A Review of Interventional Radiology Treatment Approaches for Unique Arterial Causes of Gastrointestinal Hemorrhage

**Participants**
- Ahmed Fadl MD (Presenter): Nothing to Disclose
- Amanjit S. Baadh MD: Nothing to Disclose
- Nicholas A. Georgiou MD: Nothing to Disclose
- Man Hon MD: Nothing to Disclose
- Obaib Shoaib: Nothing to Disclose
- Jason C. Hoffmann MD: Consultant, Merit Medical Systems, Inc
- Dipan Danda BS: Nothing to Disclose

**TEACHING POINTS**
1. Highlight the critical role of cross-sectional imaging and interventional radiology (IR) in diagnosing and managing acute arterial gastrointestinal hemorrhage. 2. Review indications for IR intervention in cases of acute arterial gastrointestinal hemorrhage. 3. Multiple transcatheter embolization options exist for management of acute gastrointestinal hemorrhage, including coil embolization, glue embolization, covered stent deployment, and thrombin injection. Sometimes, utilizing a combination of techniques is needed for appropriate treatment in complex cases.

**TABLE OF CONTENTS/OUTLINE**
Discuss indications for IR intervention in cases of acute arterial gastrointestinal hemorrhage. Review of imaging findings with focus on CT scan and conventional angiography: -Contrast extravasation -Pseudoaneurysm Review transarterial techniques for managing unique causes of acute arterial gastrointestinal hemorrhage: -Coil embolization -Glue embolization -Stent graft deployment -Thrombin injection Clinical examples provided: -Standard embolization techniques -Unique combinations of therapies to manage complex arterial causes of gastrointestinal hemorrhage -Correlation with cross-sectional imaging will be provided

Chronic Mesenteric Ischemia and its Treatment: A Pictorial Essay

**Participants**
- Sadia Choudhery MD (Presenter): Nothing to Disclose
- Adam Wayne Jaster MD: Nothing to Disclose
- Richard William Ahn MD, PhD: Cofounder, ViXa LLC Stockholder, Vixa LLC
- Patrick D. Sutphin MD, PhD: Nothing to Disclose
- Sanjeeva P. Kalva MD: Consultant, CeloNova Biosciences, Inc
- Anil Kumar Pillai MD: Nothing to Disclose
- Matthew Eric Anderson MD: Nothing to Disclose

**TEACHING POINTS**
Discuss the normal anatomy of the mesenteric arterial supply and collateral pathways involved in chronic mesenteric ischemia using pictorial illustrations. Discuss the pathophysiology, clinical presentation, and imaging findings in chronic mesenteric ischemia. Review the indications and strategies for endovascular treatment of chronic mesenteric ischemia along with current literature review of outcomes and complications associated with such treatment in comparison to surgical revascularization.

**TABLE OF CONTENTS/OUTLINE**
Pictorial and multimodality imaging review of normal mesenteric vascular supply and collateral pathways seen in chronic mesenteric ischemia. Clinical consequences of mesenteric ischemia. Diagnostic imaging in chronic mesenteric ischemia. Indications and contraindications for endovascular treatment. Strategies for endovascular treatment (both stent placement and angioplasty). Outcomes and complications associated with endovascular treatment in comparison to surgical revascularization.

Endovascular Treatment of Active Bleeding due to Iatrogenic Injury

**Participants**
- Hyedoo Jung MD (Presenter): Nothing to Disclose

**TEACHING POINTS**
Active bleeding due to iatrogenic injury that occurs after variable medical procedure or surgery can be required emergency hemostasis. In the past, surgical hemostasis was preferred, but now the endovascular treatment is preferred, because it is easy
to implement and also excellent treatment result. The purpose of this exhibit is to show endovascular treatment for active bleeding due to iatrogenic injury after variable medical procedure or surgery.

TABLE OF CONTENTS/OUTLINE


VIE004-b
Bariatric Effects of Decreased Serum Ghrelin Levels: Literature Review and Future Applications

Education Exhibits
Location: VI Community, Learning Center

Participants
Monzer A. Chehab MD (Presenter): Nothing to Disclose
Wendy Miller MD: Nothing to Disclose
Kerstyn Zalesin MD: Nothing to Disclose
Purushottam Krishna Dixit MD: Nothing to Disclose

TEACHING POINTS
1. The role of Ghrelin as a hunger stimulating hormone has gained significant notoriety as a potential target for weight loss therapy. 2. Familiarity with the published physiologic, surgical and interventional literature on the bariatric effects of Ghrelin may help guide future therapies directed at decreasing serum Ghrelin levels such as Left Gastric Artery Embolization (LGAE).

TABLE OF CONTENTS/OUTLINE

1. Physiology of Ghrelin as an orexigenic (hunger stimulating hormone)
2. Relationship between Gastric Fundus resection and decreased serum Ghrelin levels in humans
3. Relationship between decreased serum Ghrelin levels and weight loss in humans
4. Effect of Left Gastric Artery Embolization on decreasing Ghrelin producing cells in the gastric fundus and serum Ghrelin levels in mammals
5. Future role of Left Gastric Artery Embolization as a novel therapy for weight loss in humans.

VIE005-b
Pictorial Overview Of Aortic Endovascular Graft Endoleaks With Correlation To Stent Graft Neck Length

Education Exhibits
Location: VI Community, Learning Center

Participants
Firas Ramahi (Presenter): Nothing to Disclose
Maria Habib: Nothing to Disclose
Michael Henderson Hamblin MD: Nothing to Disclose

TEACHING POINTS
1 - Provide a detailed pictorial review of various aortic graft endoleaks with special focus on stent graft neck length. 2- Discuss the applicable clinical relevance and management of aortic graft endoleaks.

TABLE OF CONTENTS/OUTLINE

- Review abdominal aortic aneurysm (AAA) endovascular stent graft repair cases performed at our institution since 1/1/2007. - Identify cases with aortic stent graft endoleaks with special attention to their corresponding stent graft neck length and possible correlation. - Provide a pictorial review of the various types of endovascular stent endoleaks (type 1 - 5 endoleaks). - Discuss management of the endoleaks and clinical relevance.

VIE006-b
Endovascular Management of Arterioportal Fistulas

Education Exhibits
Location: VI Community, Learning Center

Participants
Gregory Ramsey MD: Nothing to Disclose
Scott G. Smith DO: Nothing to Disclose
Justin Muhlenberg MD, MBA (Presenter): Nothing to Disclose
Rajeev Suri MD: Nothing to Disclose

TEACHING POINTS
At the end of this presentation the learner should have knowledge of the: Common causes and clinical manifestations of arterioportal fistulas (APFs) Diagnostic imaging findings and classifications of APFs Recommended treatments and followup of APFs Endovascular management of APFs including angiographic findings, embolization techniques, materials, contraindications,
Clinical Application of Color-coded DSA in Lower Extremity Vascular Disease Treatment: A Preliminary Study

Education Exhibits
Location: VI Community, Learning Center

Participants
Wei Qiu (Presenter): Nothing to Disclose
XI GUO: Nothing to Disclose

TEACHING POINTS
Purpose: To evaluate the feasibility of applying color-coded DSA to quantitatively assess the clinical outcome of angioplasty for lower extremity vascular disease. Material and Methods: 12 patients with lower extremity vascular disease were treated with endovascular angioplasty (11 male, 1 female, mean age 72.55±7.46). Both DSA series before and after stent implantation were analyzed with a color-coded DSA tool (syngo iFlow, Siemens Healthcare, Forchheim, Germany) which quantitatively calculates the time intensity curve of each pixel on the DSA image. A reference region of interest (ROI) was set at the outflow the pigtail catheter while several other ROIs were set at distal end of the treated vessel segment. Various parameters such as ROI area, time-to-peak (TTP) value was derived to determine the vessel patency. Ankle Brachial Pressure Index(ABI) examination was conducted pre- and postoperatively with doppler ultrasound as a verification of the result from color-coded DSA technique.

TABLE OF CONTENTS/OUTLINE
- priciple
- methord
- prognosis
- conclusion

Vascular Findings in Ehlers Danlos, Marfan and Loeys Dietz Syndrome: A Pictorial Review

Education Exhibits
Location: VI Community, Learning Center

Participants
Arman Yaghoubian MD (Presenter): Nothing to Disclose
Daniel Sheeran MD: Nothing to Disclose
Patrick T. Norton MD: Nothing to Disclose
Klaus D. Hagspiel MD: Research Grant, Siemens AG

TEACHING POINTS
1. To review the imaging spectrum of vascular findings in patients with EDS type IV, Marfan and Loeys-Dietz Syndromes. 2. To review the basic genetics and pathophysiology behind EDS type IV, Marfan and Loeys-Dietz Syndromes.

TABLE OF CONTENTS/OUTLINE
- Ehlers-Danlos Syndrome type IV (EDS type IV): Autosomal dominant inheritance caused by a number of identified mutations within the COL3A1. - Multiple arterial aneurysms (especially visceral aneurysms), short segment dissections, vessel occlusion, arteriovenous fistula and/or frank rupture. Marfan Syndrome: Autosomal dominant inheritance caused by a number of identified mutations within the FBN1 gene. - Common involvement of the aortic root with annuloaortic ectasia and aortic dissection. Loeys-Dietz Syndrome (LDS): Autosomal dominant inheritance caused by mutations of the TGF-β receptor genes. - Clinical course is more aggressive than EDS type IV and Marfan syndrome with earlier presentation and considerably worse survival though there is phenotypic overlap between the syndromes. - Almost all patients (>98%) will have aortic root aneurysms and aortic dissection is the leading cause of death. - Distinct arterial aneurysms and tortuosity. - Distinguishing features including hypertelorism, cervical instability, craniosynostosis, and Chiari malformation.

Vascular Imaging of Toxic Vasculopathies

Education Exhibits
Location: VI Community, Learning Center

Participants
Jed Alan Hummel MD (Presenter): Nothing to Disclose
Ikponmwosa Iyamu MD: Nothing to Disclose
Samir Kulkarni MD: Nothing to Disclose
Joseph Stephen Zerr MD: Nothing to Disclose
Anil Kumar Pillai MD: Nothing to Disclose
Sanjeeva P. Kalva MD: Consultant, CeloNova BioSciences, Inc

TEACHING POINTS
To discuss toxic vasculopathies with illustrative case examples The presentation will cover etiologies including cocaine,
amphetaphetamine, and heroin related vasculopathies, ergotism, chemotherapy, and thromboangiitis obliterans To briefly review the basic underlying pathophysiology of vasculitides, utilizing graphic illustration and case examples aimed at allowing the reader to better understand the mechanisms that produce angiographic characteristics To review grading and classification of vasculitides based on diagnostic features including location, vessel size, and morphological appearance To review differential diagnoses and distinguishing features To discuss most appropriate imaging modalities To discuss catheter-directed therapy considerations

**TABLE OF CONTENTS/OUTLINE**

Introduction: Review of features and basic pathophysiology of vasculitides with illustrative case examples Diagnostic clues regarding vessel size and location Angiographic appearances with case examples Grading and classification Discussion: Toxic Vasculopathies Etiologies Common and distinguishing imaging characteristics with discussion of differential diagnoses and potential mimics Clinical presentations Selection of best imaging modalities Catheter directed therapy considerations

**VIE012-b**

**Dual-energy CT: Vascular Applications, Basic Physical Principles and limitations**

*Education Exhibits*

*Location: VI Community, Learning Center*

**Participants**

- Shima Aran MD (Presenter): Nothing to Disclose
- Khalid Walid Shaqdan MD: Nothing to Disclose
- Elmira Hassanzead MD: Nothing to Disclose
- Efren Jesus Flores MD: Nothing to Disclose
- Hani H. Abujudeh MD, MBA: Research Grant, Bracco Group Consultant, RCG HealthCare Consulting Author, Oxford University Press

**TEACHING POINTS**

Dual-energy CT (DECT) enhances the capability of single energy CT with several new applications for advanced imaging of vascular pathologies. With low kVp dataset vascular attenuation is increased and therefore it is helpful in assessment of smaller or more poorly opacified vessels. This results in reduction of contrast utilization and radiation exposure. The availability of virtual noncontrast images help in detection of vascular calcifications and endoleaks. The other key advantages of DECT for vascular imaging are the availability of advanced postprocessing application, bone subtraction and calcification removal techniques. Appropriate use of DECT techniques can save radiation dose, decrease interpretation time, or improve diagnostic accuracy.

**TABLE OF CONTENTS/OUTLINE**

1. Physical principles of DE or spectral CT on basis of photoelectric and Compton interactions as well as material decomposition.
2. Available techniques of DE data acquisition, for example, dual source CT scanners, fast kilovoltage switching and sandwich detector techniques. 3. Image processing and reconstruction of DECT data. 4. Clinical application of DECT for diagnosis of vascular pathologies. 5. Sample cases. 6. Limitations of DECT such as the effects on image quality, artifacts and radiation dose.

**VIE013-b**

**CT Angiography of Spontaneous Visceral Artery Dissection: A Pictorial Review**

*Education Exhibits*

*Location: VI Community, Learning Center*

**Participants**

- Kevin Ching MD (Presenter): Nothing to Disclose
- Anil Kumar Dasyam MD: Nothing to Disclose
- Mitchell E. Tublin MD: Nothing to Disclose
- Matthew Thomas Heller MD: Nothing to Disclose
- Biatta Sholosh MD: Nothing to Disclose
- Amir Borhani MD: Nothing to Disclose

**TEACHING POINTS**

1. Spontaneous visceral artery dissection is an uncommon cause of abdominal pain that may involve the celiac trunk, superior mesenteric, renal, and inferior mesenteric arteries. Extension into more distal branches is also common. 2. Because the diagnosis is rarely suspected initially, visceral artery dissection is often suggested from subtle findings on portal venous phase CT. Subsequent CT angiography confirms dissection and better characterizes the extent of vascular involvement. 3. The management of spontaneous visceral artery dissection is determined by the organ involved and extent of distal malperfusion.

**TABLE OF CONTENTS/OUTLINE**

1. Overview of spontaneous visceral artery dissection a. Clinical presentation b. Etiologies of spontaneous visceral artery dissection. c. Association with inherited connective tissue diseases. 2. Discuss imaging work-up, CTA protocol, and pertinent findings. 3. Quality images of visceral artery dissection evaluated with 64-slice CT and 3D reconstructions: examples include the celiac axis, superior mesenteric, renal, common hepatic, and splenic arteries. 4. Complications of distal malperfusion. 5. Treatment and recommendations for follow up imaging and multi-disciplinary care.

**VIE014-b**

**Imaging Beyond the Lumen: Vessel Wall Imaging in Large-Vessel Vasculitis Utilizing Black-Blood MRI**

*Education Exhibits*

*Location: VI Community, Learning Center*

**Participants**

- Mahmud Mossa-Basha MD (Presenter): Nothing to Disclose
- Wen Lin MD: Nothing to Disclose
- Myriam Guevera: Nothing to Disclose
- Tal Gazitt: Nothing to Disclose

**TEACHING POINTS**

1. Overview of spontaneous visceral artery dissection a. Clinical presentation b. Etiologies of spontaneous visceral artery dissection. c. Association with inherited connective tissue diseases. 2. Discuss imaging work-up, CTA protocol, and pertinent findings. 3. Quality images of visceral artery dissection evaluated with 64-slice CT and 3D reconstructions: examples include the celiac axis, superior mesenteric, renal, common hepatic, and splenic arteries. 4. Complications of distal malperfusion. 5. Treatment and recommendations for follow up imaging and multi-disciplinary care.
**Grant Hughes MD**: Nothing to Disclose

**TEACHING POINTS**

Takayasu arteritis (TA) and Giant-cell arteritis (GCA) are relatively uncommon vasculitides which may present with nonspecific clinical symptoms. Delayed diagnosis of these entities can lead to a high degree of morbidity. The purposes of this exhibit are: To review conventional imaging methods used for diagnosis and monitoring of TA and GCA To demonstrate the value of vessel wall imaging (VWI) in both the diagnosis and monitoring of TA and GCA To show how VWI can be used as a problem-solving tool when assessing clinically equivocal cases of TA and GCA

**TABLE OF CONTENTS/OUTLINE**

- Background Clinical symptomatology and pathophysiology of TA and GCA
- Imaging Overview Review conventional imaging modalities used in diagnosis of TA and GCA
- VWI Demonstrate classic imaging findings of TA and GCA using Black Blood MRI
- VWI Advantages Discuss ability to track response to treatment using VWI Identify ways in which VWI can be used as problem-solving tool in clinically equivocal cases
- Potential Pitfalls

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**VIE015-b**

**Small But Volatile: Review of Indications, Technical Considerations and Complications of Percutaneous Ablation of Adrenal Tumors**

*Education Exhibits*

*Location: VI Community, Learning Center*

Certificate of Merit

**Participants**

- **Zoe Anne Miller MD (Presenter):** Nothing to Disclose
- **Bradley Bryan Pua MD:** Nothing to Disclose
- **Jonathan Jo:** Nothing to Disclose
- **Daisy Qinjun Huang MD:** Nothing to Disclose
- **Kyungmouk Steve Lee MD:** Nothing to Disclose
- **David Craig Madoff MD:** Nothing to Disclose

**TEACHING POINTS**

Percutaneous ablation in the adrenal gland is less well-studied compared to the liver and lung. Ablation techniques in these organs are not always applicable because of the unique anatomy and physiology of the adrenal gland. The purpose of this exhibit will review: Indications for adrenal ablation from primary neoplasms to pheochromocytomas Pre-ablation planning appropriate for various adrenal lesions Ablation techniques and complications unique to adrenal gland anatomy and physiology

**TABLE OF CONTENTS/OUTLINE**

1) Anatomy and physiology of adrenal gland
2) Indications for adrenal ablation Adrenal neoplasms Adrenal metastases Pheochromocytoma
3) Pre-Ablation Planning pre-ablation biopsy urine/serum hormone assays premedication protocol with alpha-adrenergic blocking drugs
4) Ablation types of ablation: RF, cryoablation, microwave appropriate intraprocedural monitoring (central and arterial lines) thermal protection of surrounding organs avoiding hypertensive crisis using a 'stepwise RF ablation protocol' (incremental RF current)
5) Post-Ablation Imaging

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**VIE017-b**

**US-guided Percutaneous Radiofrequency Ablation of Liver Tumors; Tips and Tricks to Ensure Safe and Successful Procedure**

*Education Exhibits*

*Location: VI Community, Learning Center*

Certificate of Merit

**Participants**

- **Jin Woong Kim MD (Presenter):** Nothing to Disclose
- **Sang Soo Shin MD:** Nothing to Disclose
- **Suk Hee Heo MD:** Nothing to Disclose
- **Hyo Soon Lim MD:** Nothing to Disclose
- **Yong-Yeon Jeong MD:** Nothing to Disclose
- **Heoung-Keun Kang MD:** Nothing to Disclose

**TEACHING POINTS**

1. To overview the current principles of US-guided radiofrequency ablation (RFA) of liver tumors including indications and how to do procedure 2. To illustrate various technical tips to ensure effective and successful procedure 3. To demonstrate how to minimize collateral damage during RFA

**TABLE OF CONTENTS/OUTLINE**

A. Overview of the current status of US-guided RFA of liver tumors
   1. Indications
   2. How to do procedure
   3. Possible complications related with RFA
   4. Various technical tips to ensure effective and successful procedure
   5. How to select RFA electrode
   6. Optimal targeting route of electrode according to the location of liver tumors
   7. "No-touch" technique
   8. "Cutting edge" technique
   9. How to minimize possible complications during RFA
   10. The role of artificial ascites when performing RFA
   11. How to decide infusion route of artificial ascites according to the location of liver tumors
      a. Perihepatic
      b. Sub-hepatic
      c. Sub-xiphoid (left subphrenic)
      d. Gastrohepatic (lesser sac)
   12. How to effectively handle electrodes under the ultrasound
      a. Key factors for safe and successful placement of electrodes
      b. Training on how to breathe
      c. Securing of safe route
      d. "Bypass" targeting
      e. Several measures to reduce risk of tumoral seeding
   13. Leverage (lifting) technique

**VIE018-b**

**Comparison of Gadolinium- versus Iron-based MRA Blood Pool Contrast Agents used in Assessment of Peripheral Vascular Disease**

*Education Exhibits*

*Location: VI Community, Learning Center*
Participants

Vignesh Amal Arasu MD (Presenter): Nothing to Disclose
Warren J Gasper: Nothing to Disclose
Ryan Thomas Downey MD: Nothing to Disclose
Stefanie Weinstein MD: Nothing to Disclose
Rizwan Aslam MBBCh: Research support, Bayer AG
Thomas A. Hope MD: Speaker, Guerbet SA Research Grant, General Electric Company

TEACHING POINTS

1. Understand indications of gadolinium- versus iron-based blood pool contrast agents for MRA vascular examinations.
2. Understand strengths/limitations of different blood pool contrast agents in evaluation of peripheral vascular disease.

TABLE OF CONTENTS/OUTLINE

1. Background
   a. Overview of peripheral vascular disease and imaging techniques
   b. Pharmacology of agents
      i. Conventional extracellular fluid gadolinium-based agents
      ii. Blood pool gadolinium-based: Gadofosveset Trisodium
      iii. Blood pool iron-based: Ferumoxytol
   c. Indications
   d. Review of literature on safety and efficacy with respect to kidney function
2. Technique
   a. Administration
   b. Bolus timing
      i. Test bolus
      ii. Bolus tracking
      iii. Time resolved acquisition
      iv. Dual bolus technique
   c. MRA acquisition parameters
3. Imaging appearance
   a. Normal
      i. Conventional MRA
      ii. TRICKs
      iii. High resolution steady state imaging
      iv. Low resolution dynamic imaging
   b. Proximal lower extremity disease
   c. Distal lower extremity disease
   d. Upper extremity disease
4. Advantages/Disadvantages
   a. Safety profile
   b. Bolus timing
   c. Dose
   d. Image resolution

VIE019-b

Bridging the Gap: The Role of Interventional Radiology in the Management of Patients with End-Stage Liver Disease Awaiting Liver Transplantation

Participants

Nazanin Hajarol Asvadi MD (Presenter): Nothing to Disclose
Priyanush Kandakatla MD : Nothing to Disclose
Colin J. McCarthy MD : Nothing to Disclose
Arash Anvari MD : Nothing to Disclose
Raul Nirmal Uppot MD : Nothing to Disclose
Ronald Steven Arellano MD : Nothing to Disclose

TEACHING POINTS

1. To discuss the selection criteria utilized by several national organization for patients awaiting liver transplantation.
2. To describe the multifaceted role interventional radiology (IR) in the management of patients with end-stage liver disease awaiting liver transplantation.

TABLE OF CONTENTS/OUTLINE

1. Review of incidence of end-stage liver disease worldwide and liver transplantation as a definite therapy for these patients.
2. Review of Milan criteria and survival rate in HCC patients.
3. Describe United Network for Organ Sharing (UNOS) and its transplant allocation policies regarding waiting period in different regions and drop off rate while awaiting liver transplantation.
4. Discuss the role of interventional radiology (biopsy, thermal ablation, embolization, imaging) in the management of patients awaiting liver transplantation.

VIE020-b

Do the Differences Make any Difference? A Worldwide Comparison of Society Guidelines for FNA of Thyroid Nodules Seen On Ultrasound

Participants

Priyanush Kandakatla MD (Presenter): Nothing to Disclose
Anthony Edward Samir MD : Nothing to Disclose

TEACHING POINTS

1. To review the indications for FNA of thyroid nodule seen on ultrasound based on current society guidelines throughout the World.
2. Comparing the similarities and differences between these guidelines.

TABLE OF CONTENTS/OUTLINE

1. Description of the following guidelines for FNA of thyroid nodules seen on ultrasound:
   1.1. ATA (American Thyroid Association)
   1.2. AACE (American Association of Clinical Endocrinologists)
   1.3. ETA (European Thyroid Association)
   1.4. SRU (Society of Radiologists in Ultrasound)
   1.5. KSTR (Korean Society of Thyroid Radiology)
2. A comparison of society guidelines:
   quoted sensitivity and specificity, similarities and differences, pros and cons.
3. Examples of cases where different guidelines may result in discordant actions.

VIE022-b

Dissection of the Cervical Internal Carotid Artery—The Role of Doppler Ultrasonography:
**Pictorial Essay**

**Education Exhibits**

Location: VI Community, Learning Center

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### Participants

- Lelivaldo Antonio de Britto Neto MD : Nothing to Disclose
- Carlos A P Ventura PhD : Nothing to Disclose
- Thiago De Vasconcelos Sáriava : Nothing to Disclose
- Diego Bortolazzi Bezerra Nunes MD : Nothing to Disclose
- Priscila Pimentel Collier MD : Nothing to Disclose
- Miguel Jose Francisco Neto MD (Presenter): Nothing to Disclose
- Marcelo Buarque Gusmão Funari MD : Nothing to Disclose

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### TEACHING POINTS

To demonstrate the major findings in carotid artery dissection on the Doppler ultrasonography. To review and illustrate role of Doppler ultrasonography in carotid artery dissection and their complications. What cannot miss in the ultrasonography report of carotid dissection?

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### TABLE OF CONTENTS/OUTLINE

- Cervical artery dissections (CAD) are more common in the internal carotid arteries (ICA), 70% in the cervical and petrous segments, mainly 2-3 cm distal to the carotid bulb. These segments are easily accessible by ultrasound. The Doppler ultrasound (Doppler US) can make initial screening, diagnosis and monitoring of dissection in the proximal segments of the ICA. Computed tomography (CT) and magnetic resonance imaging (MRI) are the best methods in the evaluation of CAD. The present study aims to describe by practical cases the role and major abnormalities in the Doppler US of ICA dissections. Doppler US is a low cost exam that can assist in the diagnosis and monitoring of CAD. That can demonstrate the tapering column flow with abnormal pulsed wave Doppler up to 90% of cases of dissection. Moreover, it is able to determine the flow dynamics of the dissection. CT and MRI do not allow determining the flow dynamics. It is important for all radiologist know the majors abnormalities in carotid artery dissection on the Doppler US.

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**VIE023-b**

**Radiology and Interventional Radiology in Complex Pelvic Trauma: Suggesting a Trauma Pathway**

**Education Exhibits**

Location: VI Community, Learning Center

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### Participants

- Yaron J. Berkowitz MBChir, MRCS (Presenter): Nothing to Disclose
- Joel Dunn FRCR, MBBS : Nothing to Disclose
- Elizabeth Ann Dick MD, FRCR : Nothing to Disclose
- Jasvinder Daurka : Nothing to Disclose
- Angus Lewis : Nothing to Disclose
- An Thanh Ngo BMBS, MRCP : Nothing to Disclose
- Elika Kashef FRCR : Consultant, W. L. Gore & Associates, Inc

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### TEACHING POINTS

The viewer will be able to answer the following questions after viewing the exhibit: 1. Identify injury patterns in complex pelvic fractures. 2. What imaging modalities are appropriate in pelvic trauma? 3. When should dual phase (arterial and PV) or combined single phase 'combi' CT protocolling be used? 4. When to perform a cystogram? 5. Who need vessels embolisation and/or IVC Filter insertion? We suggest the adoption of an intelligent, step wise, one stop ,multidisciplinary approach to imaging and intervention in this often multiply injured patient group.

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### TABLE OF CONTENTS/OUTLINE

- Characterising pelvic trauma injury patterns - Dual phase versus Combined Phase CT - Cystograms, urethrograms and delayed phase CTs - Intervention (Embolisation and IVF filters) - A suggested simplified, one-stop pathway

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**VIE024-b**

**Endovascular Management for the Non-Matured Arteriovenous Fistula**

**Education Exhibits**

Location: VI Community, Learning Center

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### Participants

- Brandon Michael Shearer DO (Presenter): Nothing to Disclose
- Alexander Edward Trebelev MD : Nothing to Disclose
- Brian Anthony Bianco DO, MBA : Nothing to Disclose

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### TEACHING POINTS

Nationwide measures continue to encourage the creation of arteriovenous fistulas (AVF) in patients requiring long-term dialysis. However, AVFs are plagued with high primary failure rates due to multiple causes. Salvage techniques of the non-maturing fistula are vital not only for patient care but for health-care cost containment reasons. The purpose of this educational exhibit is to provide a review of the pathophysiology of the non-matured AVF, its diagnosis, and salvage techniques with a focus on endovascular management. A pictorial case based review utilizing retrospectively identified patients with a non-maturing AVF will be presented.

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### TABLE OF CONTENTS/OUTLINE

**VIE025-b**

**Transradial Access for Dialysis Interventions: A Pictorial Review**

*Education Exhibits*

*Location: VI Community, Learning Center*

**Participants**

Shaun Jeffrey Gonda MD (Presenter): Nothing to Disclose  
James Bret Winblad MD: Nothing to Disclose  
Travis McKenzie DO: Nothing to Disclose

**TEACHING POINTS**

1. To review transradial access, technical tips and patient selection.  
2. To depict different dialysis access interventions that can be performed from a transradial approach.

**TABLE OF CONTENTS/OUTLINE**

1. Clinical findings for patient selection  
2. Technique and tip for obtaining radial artery access  
3. Evaluation of dialysis access from transradial approach  
4. Endovascular treatment of dialysis access from transradial approach

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**VIE026-b**

**How to Make the 'Snip' Easy**

*Education Exhibits*

*Location: VI Community, Learning Center*

**Participants**

Zubin Irani MD (Presenter): Nothing to Disclose  
Rahmi Oklu MD, PhD: Nothing to Disclose

**TEACHING POINTS**

This pictorial exhibit aims to educate about Port catheter problems encountered and solutions for addressing these; in particular focusing on Port catheters being too long.

1. Problems long chest Port catheters may create / present with.  
2. Present author's step by step technique for Port catheter revisions.

**TABLE OF CONTENTS/OUTLINE**

1. Chest Port placement demographics  
2. Complication of chest port placements  
3. Pictorial technique of chest Port revision for catheters that are too long  
4. Outcomes using the presented author's technique

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**VIE028-b**

**Increasing Interventional Radiology Exposure in Medical Schools**

*Education Exhibits*

*Location: VI Community, Learning Center*

**Participants**

Rahul Nayyar MD (Presenter): Nothing to Disclose  
Nicole A. Keefe MD: Nothing to Disclose  
Nicholson Stephen Chadwick MD: Nothing to Disclose  
Krishna K. Das MD: Nothing to Disclose  
Alok Bharat Bhatt MD: Nothing to Disclose  
Venkatesh Perumal Krishnasamy MD: Nothing to Disclose  
George Vatakencherry MD: Nothing to Disclose  
Chadi Zeinati MD: Nothing to Disclose

**TEACHING POINTS**

A main goal for the SIR Medical Student Council (MSC) was to increase IR awareness and education. This has been done by completing a dedicated Medical Student Lecture Series. The lectures will be accessible by anyone who requests their use for educational purposes. They can be used in the basic science or clinical years of medical school. Topics include: Intro to IR, Peripheral Arterial Disease, Interventional oncology, Carotid Disease, Thoracic/Abdominal Aortic, Chronic liver disease, Leg Ulcers, DVT, IR Frontiers, GI bleeding, Varicose Veins, and Trauma IR. Members of the MSC volunteered for the different topics. A template for content organization was provided. Upon completion of the presentation, the lectures were reviewed by 2 IR physicians.

**TABLE OF CONTENTS/OUTLINE**

The medical student lecture series, created by the SIR MSC, will expose medical students to IR throughout medical school, which will be critical with the dual certificate. This should draw more medical students to IR by exposing them to the different modalities within IR. The series stresses the clinical aspect of IR, which is something most medical students are not aware of. We will debut this lecture series with this educational exhibit and also show step by step instructions how to obtain these lectures for your institution.
Approaching Quality Improvement in Interventional Radiology

Education Exhibits
Location: VI Community, Learning Center

Participants
Benjamin White MD (Presenter): Nothing to Disclose
Stephen Phillips Reis MD: Nothing to Disclose
Seth Toomay MD: Nothing to Disclose
Patrick D. Sulphin MD, PhD: Nothing to Disclose
Anil Kumar Pillai MD: Nothing to Disclose
Sanjeeva P. Kalva MD: Consultant, CeloNova BioSciences, Inc

TEACHING POINTS
- Recognize the difference between quality improvement and quality assurance
- Understand the DMAIC (Define, Measure, Analyze, Improve and Control) model, Six Sigma process, and Driver Diagram project mapping
- Understand the criteria that determine a strong and meaningful QI project

TABLE OF CONTENTS/OUTLINE
Quality assurance (QA) versus quality improvement (QI) Define QA and QI Goals of QA vs QI Situations in which QA is important Benefits of QI over QA Using ongoing QA to help identify possible QI projects Goals of a QI Project Better outcomes Safer care Lower cost Faster service Criteria for a Successful QI Project Important to patient Meaningful to you Needs improvement Feasible (start small, definable, achievable) Reproducible metrics Examples of Quality Improvement Projects in IR Reducing Mediport infection rates Increasing inferior vena cava filter retrieval rates Reducing radiation dose during angiography procedures First case start time Time to intervention for trauma Arteriovenous fistula/graft patency and flow rates at dialysis after maintenance therapy Automated case tracking of interventional procedures

VIE031-b
CT-guided Autologous Blood Patch for the Post Lung Intervention Pneumothorax

Education Exhibits
Location: VI Community, Learning Center

Participants
Anshuman Kumar Bansal MD (Presenter): Nothing to Disclose
Scott J. Genshaft MD: Nothing to Disclose
William T. Derry MD: Nothing to Disclose
Fereidoun G. Abtin MD: Nothing to Disclose
Antonio Joel Gutierrez MD: Nothing to Disclose
Robert D. Suh MD: Nothing to Disclose

TEACHING POINTS
Pneumothorax is a common complication of percutaneous thoracic interventions, complicating up to 50% of procedures. Pneumothoraces with persistent air leak can be difficult to treat, and at times require thoracic surgery for definitive management. Blood patching uses clot formation to seal persistent air leaks from the lung parenchyma. We present the use of a two-catheter image-guided blood patch technique to seal the persistent air leak, drain the intrapleural air, and oppose the pleural surfaces.

TABLE OF CONTENTS/OUTLINE

VIE032-b
Implications of Lipiodol Deposition Pattern on Non-contrast CT Immediately After TACE: Correlation with Pathological Findings

Education Exhibits
Location: VI Community, Learning Center

Participants
Nicholas Ralph Turman MD (Presenter): Nothing to Disclose
Shiliang Sun MD: Nothing to Disclose
Fadi Mohamad Youness MD: Nothing to Disclose
Sandeep T. Laroia MD: Nothing to Disclose
Mark Karwal: Nothing to Disclose
Leana A. Guerin MD: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is to: 1. To demonstrate types of lipiodol deposition pattern on noncontrast CT performed one day after TACE and its predicting value for tumor destruction - correlated with pathology and imaging findings 2. Comparing the outcomes of the groups of patients with/without subsequent particle embolization

TABLE OF CONTENTS/OUTLINE
To demonstrate types of lipiodol deposition pattern on noncontrast CT performed one day after TACE and its predicting value for tumor destruction - correlated with pathology and imaging findings Full homogeneous deposition pattern within target tumor Full heterogeneous deposition pattern within target lesion Partial geographic deposition defect pattern Also comparing the outcomes of the groups of patients with/without subsequent particle embolization
VIE033-b

Pictorial Review of the Re-intervention Techniques after TIPS Placement (Transjugular Intrahepatic Portosystemic Shunt) According to Clinical Manifestations

Education Exhibits
Location: VI Community, Learning Center

Certificate of Merit

Participants
- Bryan G. Belikoff MD, PhD (Presenter): Nothing to Disclose
- Seung Kwon Kim MD: Nothing to Disclose
- Carlos Javier Guevara MD: Nothing to Disclose
- Kristen Alexa Lee MD: Nothing to Disclose
- Guillermo Gonzalez-Araiza MD: Nothing to Disclose

TEACHING POINTS
Recognize the clinical manifestations after TIPS placement and know the various TIPS re-intervention techniques including basic and advanced TIPS revisions, TIPS reduction, parallel TIPS, and additional procedures such as Denver shunt and BRTO procedure according to clinical manifestations.

TABLE OF CONTENTS/OUTLINE
Background: Transjugular intrahepatic portosystemic shunt (TIPS) is an established and effective treatment for the complications of portal hypertension. Herein, we present a pictorial review of the basic to advanced re-intervention techniques after TIPS placement according to clinical manifestations. Clinical manifestations/Procedure details: 1. Initial poor clinical response - TIPS revision, parallel TIPS, Denver shunt for intractable ascites 2. Hepatic encephalopathy or hepatic failure - TIPS reduction 3. Stenosis on Doppler US with/without symptom - TIPS venogram with/without revision 4. Total occlusion of TIPS stent on Doppler US or TIPS venogram Parallel TIPS Transhepatic or Transplenic approach Thrombolysis - mechanical or catheter directed 5. Recurrent symptoms after initial clinical response TIPS revision with possible variceal embolization for bleeding Recurrent bleeding after TIPS revision with variceal embolization ↔ Parallel TIPS or BRTO for gastric varices

VIE034-b

Assessment of Mesocaval Shunts and Associated Complications: The Diagnostic and Therapeutic Role of Radiologists

Education Exhibits
Location: VI Community, Learning Center

Participants
- Jad Zouheir Chokr MD: Nothing to Disclose
- Bedros Taslakian MD (Presenter): Nothing to Disclose
- Karim Jean Rebeiz MD: Nothing to Disclose
- Sahar Semaan MD: Nothing to Disclose
- Aghiad Al-Kutoubi MD: Nothing to Disclose
- Walid Faraj: Nothing to Disclose
- Charbel Saade MS: Nothing to Disclose
- Mohammad Khalife MD: Nothing to Disclose
- Fadi M. El-Merhi MD: Nothing to Disclose
- Ali A. Haydar MD, FRCC: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: To understand the anatomy and pathophysiology of mesocaval shunts. To illustrate the pearls and pitfalls of computed tomography, Doppler ultrasound and digital subtraction angiography in the assessment of mesocaval shunts. To demonstrate the role of the radiologist in diagnostic and interventional management of complications.

TABLE OF CONTENTS/OUTLINE
- Anatomy and pathophysiology
- Clinical indications
- Imaging findings
- Complications
- Interventional techniques and applications
- Pearls and Pitfalls

VIE035-b

Renal Arteriovenous Shunts: Clinical features, Imaging Appearance and Transcatheter Embolization Based on its Angioarchitectures

Education Exhibits
Location: VI Community, Learning Center

Selected for RadioGraphics

Participants
- Miyuki Maruno MD (Presenter): Nothing to Disclose
- Hiro Kiyosue MD: Nothing to Disclose
- Shuichi Tanoue MD: Nothing to Disclose
- Yoshiko Sagara MD: Nothing to Disclose
- Junji Kashiwagi MD: Nothing to Disclose
- Norio Hongo: Nothing to Disclose
- Shunro Matsumoto MD: Nothing to Disclose
- Hiromu Mor MD: Nothing to Disclose

TEACHING POINTS
The teaching points of these exhibits are: 1. Etiology and clinical features of various types of renal arteriovenous shunts (rAVSs) 2. The imaging features of rAVSs 3. The classifications of rAVSs 4. The endovascular treatments for rAVSs based on its etiology and angioarchitectures.

**TABLE OF CONTENTS/OUTLINE**

A. Etiology and clinical features of rAVSs  
B. Imaging features of rAVSs  
   • Normal anatomy of renal arteries and veins  
   • Imaging features of rAVSs on CT, MRI and angiography  
C. Classifications of rAVSs  
   • rAVMs; cirsoid type, angiomatous type, aneurysmal type  
   • Traumatic rAVFs  
D. Endovascular treatment  
   • Treatment techniques of transcatheter embolization, including selection of embolic materials, catheters, and other adjunctive techniques, based on their types and angioarchitectures.  

**VIE036-b**

**Inferior Vena Cava Embryogenesis: What Every Interventionalist Must Know before Placing an IVC Filter**

*Education Exhibits*

*Location: VI Community, Learning Center*

**Participants**

- **Dominic Semaan MD, JD** (Presenter): Nothing to Disclose
- **Matthew Osher MD**: Nothing to Disclose
- **Mehran Salari MD**: Nothing to Disclose

**TEACHING POINTS**

- The various congenital anomalies in the development of the Inferior Vena Cava. - IVC Filter placement options when a congenital variant arises.

**TABLE OF CONTENTS/OUTLINE**

1. Embryologic development of the IVC  
2. Most commonly presenting IVC variants  
   - Review fluoroscopic presentations  
3. Review of the literature and options in IVC filter placement when a congenital variant is presented  
4. Presentation of some slightly less common variants and suggestions on IVC filter placement  
5. Conclusion

**VIE037-b**

**Through the Looking Glass: Alice in Wond-IR-Land—Potential Use of Google Glass in the World of IR**

*Education Exhibits*

*Location: VI Community, Learning Center*

**Participants**

- **Raul Nirmal Uppot MD** (Presenter): Nothing to Disclose
- **Synho Do PhD**: Research Grant, Koninklijke Philips NV
- **Debra Ann Gervais MD**: Research Grant, Covidien AG
- **Anthony Edward Samir MD**: Nothing to Disclose
- **Robert L. Sheridan**: Nothing to Disclose
- **Florian J. Fintelmann MD, FRCPC**: Nothing to Disclose
- **Peter Raff Mueller MD**: Consultant, Cook Group Incorporated
- **Ronald Steven Arellano MD**: Nothing to Disclose
- **Raymond W. Liu MD**: Nothing to Disclose
- **Alvin Yiu Chun Yu MD**: Nothing to Disclose

**TEACHING POINTS**

1. Google Glass is a wearable computer with a optical head mounted display which has many potential uses in Interventional Radiology 2. It can potentially be used for interventional procedures, interventional rounds, education, and monitoring. 3. Current limitations include ensuring patient privacy, HIPPA compliance, and maintaining sterility during procedures.

**TABLE OF CONTENTS/OUTLINE**

A. Background in Development and Use of Google Glass  
B. Review of Google Glass in Medicine  
C. Review of Google Glass During Image-guided Interventional Procedures  
D. Review of Google Glass For Real Time remote consultation/Education  
E. Review of Google Glass for Interventional Rounds  
F. Review of Google Glass in monitoring IR procedure rooms  
G. Limitations in use of Google Glass

**VIE038-b**

**Prevention and Management of Air Embolism during Vascular Interventional Procedures—Everything you Wanted to Know, but Were Afraid to Ask**

*Education Exhibits*

*Location: VI Community, Learning Center*

**Participants**

- **Colin J. McCarthy MD** (Presenter): Nothing to Disclose
- **Mohammad Ghasemi-rad MD**: Nothing to Disclose
- **Thabele Mbuso Leslie-Mazwi MD**: Nothing to Disclose
- **Rahmi Oklu MD, PhD**: Nothing to Disclose
TEACHING POINTS
1. To discuss the risk and prevention of air embolus during endovascular procedures. 2. Review the physiological effects of venous and arterial air embolism. 3. Outline the initial and advanced management of air embolism.

TABLE OF CONTENTS/OUTLINE
1. Review the estimated incidence of air embolus and identify high-risk procedures in interventional radiology. 2. Discuss imaging findings and clinical presentation following air embolus, including the hemodynamic effects such as elevated pulmonary arterial pressure and resultant right heart failure. 3. Important steps to reduce the risk of air embolus. 4. Outline management techniques including supportive therapy, positioning, aspiration and hyperbaric oxygen treatment (HBOT).

VIE039-b
Liver-on-a-chip: Personalization in Interventional Oncology?

Education Exhibits
Location: VI Community, Learning Center

Participants
Sidhartha Tavri MBBS (Presenter): Nothing to Disclose
Mohammad Ghasemi-rad MD : Nothing to Disclose
Rahul Anil Sheth MD : Nothing to Disclose
Richard L. Hesketh : Nothing to Disclose
Berk Usta PhD : Nothing to Disclose
David S. Kong PhD : Nothing to Disclose
Rahmi Oklu MD, PhD : Nothing to Disclose

TEACHING POINTS
i) to address the limitations of the current in vitro tools and animal models in the drug discovery process ii) to review recent advances in the microfluidics technology towards the development of the organ-on-a-chip platform. We will use liver-on-a-chip as the primary example. iii) to review the liver tumor-on-a-chip platform for testing anti-cancer drugs and interventions, highlighting relevance to interventional oncology.

TABLE OF CONTENTS/OUTLINE
1) Overview of the traditional drug discovery process, highlighting the current lack of predictive in vitro tools and animal models for translation from bench to bedside. 2) Organ-on-a-chip: describe advances in microfluidics and microfabrication platforms and development of 3D cell culture models to mimic in vivo human environment. 3) Discuss liver-on-a-chip devices to mimic healthy liver physiology, investigate liver diseases, and test the toxicity of potential therapeutic drugs. 4) Compare and contrast the complimentary role of tumor-on-a-chip technology in interventional oncology for biomarker discovery, chemotherapeutic sensitivity and specificity analysis, developing targeted therapy, and monitoring treatment. Novel microfluidic designs containing microscopic probes can enable the study of IRE, microwave, cryo- and RFA on tumor tissue on a chip in real-time video microscopy will be discussed.

VIE040-b
IR Targeted Liver Decellularization and Cell Therapy: Fantasy or Reality to Improve Liver Function?

Education Exhibits
Location: VI Community, Learning Center

Participants
Sidhartha Tavri MBBS (Presenter): Nothing to Disclose
Mohammad Ghasemi-rad MD : Nothing to Disclose
Rahul Anil Sheth MD : Nothing to Disclose
Richard L. Hesketh : Nothing to Disclose
Basak Uygun PhD : Nothing to Disclose
Berk Usta PhD : Nothing to Disclose
David S. Kong PhD : Nothing to Disclose
Rahmi Oklu MD, PhD : Nothing to Disclose

TEACHING POINTS
1) Review various methods of ‘decellularization’ technologies in general and specifically in liver. 2) Review the current status of stem cell therapy in regenerative medicine specifically focusing on hepatocyte derivation from pluripotent cells and fibroblasts.

TABLE OF CONTENTS/OUTLINE
1. List the current challenges in the definitive management of liver failure with orthotopic transplantation by a brief review of UNOS/OPTN data. 2. Decellularization - definition - overview of various methods of decellularizing tissue/organs including physical, chemical and enzymatic methods with their limitations, with focus on liver - briefly illustrate role of irreversible electroporation as an alternative method with literature review 3. Stem cell therapy - review the various autologous and allogeneic cell sources i.e., embryonic, fetal, inducible pluripotent stem cells, adult derived stem cells, primary tissue or organ-derived cells - review seeding techniques and list the endpoints of tissue engineered organs - describe advantages of a decellularized scaffold for stem cell therapy 4. The role of interventional radiologists in targeted decellularization of tissues, targeted stem cell therapy and monitoring its fate by imaging in vivo.

VIE041-b
Time-Driven Activity Based Costing in Interventional Radiology

Education Exhibits
Location: VI Community, Learning Center

Participants
Katelyn Brinegar (Presenter): Nothing to Disclose
**Table of Contents/Outline**

**TEACHING POINTS**

1. Demonstrate need for accurate costing in radiology operations as the healthcare environment changes. 2. Introduce Time-Driven Activity Based Costing (TDABC) as a valuable new tool to develop accurate costing processes in interventional radiology 3. Provide potential applications of TDABC in multiple imaging care processes

**TABLE OF CONTENTS/OUTLINE**

Healthcare costs in the US total 20% of gross domestic product and focus has turned to reducing these costs. Payors are placing increasing importance on delivering value, quality care at the lowest cost and are changing payment models to support high value services in healthcare. In contrast to traditional fee-for-service models, where a specific event is reimbursed, new bundled payment models are being initiated to cover a full episode of care. With these new reimbursement models, radiologists must know their costs to ensure services provided are reimbursed fairly. Until now, costs have been allocated to services based on reimbursement, leaving physicians without an accurate assessment of what it actually takes to provide healthcare. TDABC provides a flexible and versatile method to assess the costs of delivering quality services. Without accurate costing methods IR may leave the table with a smaller share of the pie, unable to demonstrate their value throughout the patient care cycle.

**VIE042-b**

**How Low Can You Go: A Pictorial Primer to Radiation Dose Reduction in Interventional Radiology**

*Location: VI Community, Learning Center*

**Participants**

Michelle Morgan RT (Presenter): Nothing to Disclose  
Ram Kishore Reddy Gurala MBBS, FRCR: Nothing to Disclose  
Kevin Wunderle: Nothing to Disclose  
Charles Martin MD: Nothing to Disclose  
Karunakaravel Karuppasamy MBBS, FRCR: Nothing to Disclose

**TEACHING POINTS**

- To list dose reducing methods in an Interventional Radiology (IR) system
- To demonstrate simple steps that should be taken routinely
- To display advanced methods and warnings systems available

**TABLE OF CONTENTS/OUTLINE**


**VIE043-b**

**The Microenvironment in Hepatocellular Carcinoma: Mind the Gap!**

*Location: VI Community, Learning Center*

**Participants**

Richard L. Hesketh (Presenter): Nothing to Disclose  
Berk Usta PhD: Nothing to Disclose  
Mohammad Ghasemi-rad MD: Nothing to Disclose  
Rahul Anil Sheth MD: Nothing to Disclose  
Rahmi Oklu MD, PhD: Nothing to Disclose

**TEACHING POINTS**

1. Tumor microenvironment in HCC is unique both in composition, its interaction with the surrounding chronically inflamed liver and inhibits drug delivery to intracelular targets. 2. Gap junctions control intercellular communication and tumor homeostasis and are down regulated in HCC. 3. Combination of drugs and therapeutic interventions has potential to overcome the intrinsic barriers to drug delivery. 4. Regulation of gap junctions could potentially lead to enhanced effects of anti-tumor drugs.

**TABLE OF CONTENTS/OUTLINE**

Significant advances in our understanding of the drivers of HCC have been possible with the advent of the 'omic age. Despite the increasing number of possible targets, drug treatment fails to induce long term remission. Specific mutations that lead to drug resistance occur but recently the role of the tumor microenvironment has been increasingly implicated in determining drug resistance. This exhibit will describe the characteristics of the tumor microenvironment that impede drug delivery and the role of gap junctions in tumorigenesis. It will emphasise future chemotherapeutic and interventional tools that have the potential to overcome these barriers and promote drug delivery and efficacy, ultimately improving survival for this silent killer.

The value of microfluidic technology including liver-on-a-chip will be discussed.

**VIE044-b**

**Interventional Radiology in Palliative Management of Intractable Pain in the Abdomen**

*Location: VI Community, Learning Center*
Participants

Naveen Kulkarni MD (Presenter): Nothing to Disclose
Ashraf Thabet MD : Nothing to Disclose
Raul Nirmal Uppot MD : Nothing to Disclose
Mihir M. Kamdar MD : Nothing to Disclose
Peter Raff Mueller MD : Consultant, Cook Group Incorporated
Avinash Ranesh Kambadakone MD, FRCR : Nothing to Disclose

TEACHING POINTS

The purpose of this educational exhibit is: 1) to review the various image guided palliative procedures for management of intractable pain in the abdomen and 2) to discuss the indications, technique and patient management principles of the image guided techniques for palliative pain management.

TABLE OF CONTENTS/OUTLINE

1. Review the various image guided palliative care procedures for pain relief in the abdomen including celiac plexus neurolysis, hypogastric neurolysis and cryoablation. 2. Discuss basic principles and anatomic considerations for interventional palliative pain procedures. 3. Discuss step-by-step technique for the image guided procedures. 4. Illustrate the interventional techniques with tips for successful treatment using a pictorial review. 5. Discuss the patient care issues before, during and after procedure including management of complications. 6. Summary and Conclusions

VIE100

Radiologists as Pain Relievers: Ultrasound Guided Truncal Nerve Blocks for Pelvic Cancer Pain Management

Education Exhibits
Location: VI Community, Learning Center

Participants

Nayha Handa MBBS (Presenter): Nothing to Disclose
Krithika Rangarajan MBBS : Nothing to Disclose
Sanjay Thulkar : Nothing to Disclose
S. Bhatnagar : Nothing to Disclose

TEACHING POINTS

Nerve block or neurolysis is a procedure in which a chemical is injected under image guidance to ablate nerves and thus block pain. They are used to treat intractable pain in cancer patients. 1) To enlist the sites of nerve blocks with their relevant anatomy in patients with pelvic cancers. 2) To review the utility of ultrasound as a guiding modality for these procedures. 3) To review their indications, contraindications and potential complications.

TABLE OF CONTENTS/OUTLINE

Outline -Sites Superior Hypogastric plexus Ganglion impar Caudal epidural block -Anatomy -Indications -Technique -Role of imaging guidance :Ultrasound, CT, Fluoroscopy -Post Procedure care -Complications -Follow up

VIE102

A Radioembolization Quiz: What the Radiologist Needs to Know

Education Exhibits
Location: VI Community, Learning Center

Participants

Jason C. Hoffmann MD : Consultant, Merit Medical Systems, Inc
Amanjit S. Baadh MD (Presenter): Nothing to Disclose
Obaib Shoaib : Nothing to Disclose
Ahmed Fadl MD : Nothing to Disclose

TEACHING POINTS

Radioembolization is an extremely valuable interventional oncology tool in treatment of primary and metastatic hepatic malignancy. This procedure allows interventional radiologists to target liver tumors with lethal radiation dose while minimizing normal hepatic parenchymal exposure. In most patients, this is extremely well-tolerated and can be performed as an outpatient. Non-target embolization (radiation-induced lung, liver, or bowel injury) is a rare, but potentially serious and life-threatening complication. It is important for radiologists to understand critical information about the procedure, including patient selection, mechanism of action, risks, and imaging that routinely is obtained before and after the procedure.

TABLE OF CONTENTS/OUTLINE

Presentation will be in quiz format. Major teaching points about indications and contraindications of radioembolization will be reviewed. Differences between the two radioembolization products will be covered. Eight cases will be utilized to cover this points as well as highlight outcomes from major research studies. Cases will include: -Primary liver tumors -Metastatic disease to the liver -Highlight normal anatomy as well as key anatomical variants -Importance of mapping angiography and nuclear medicine scintigraphy -Adjunctive techniques that may aid in uptake of dose into the tumors and/or improve safety.

VIE103

Acute Lower Gastrointestinal Bleeding: Evaluation, Management, and Pitfalls

Education Exhibits
Location: VI Community, Learning Center
## TEACHING POINTS
Overview: Acute lower gastrointestinal bleeding can lead to significant morbidity and mortality without appropriate treatment. The role of interventional radiology is crucial in patients that have persistent bleeding despite medical and endoscopic treatment. In this educational exhibit we will review the following: • ACR Appropriateness Criteria for the radiologic management of lower gastrointestinal tract bleeding • The practical utilization of radiologic modalities (CT/Nuclear medicine) • Underlying etiologies that can lead to lower GI bleeding • The role of Interventional Radiology in the therapeutic management with endovascular angiography and transcatheter embolization • Provides insight into the essential role of Interventional Radiology in the management of acute GI bleeding.

## TABLE OF CONTENTS/OUTLINE
- Introduction
- Clinical evaluation and patient management
- Review ACR appropriateness criteria
- The utilization of CTA and Nuclear Medicine
- Angiographic evaluation and management
- Use of gelfoam, PVA, coils, onyx, plus in the management of lower GI bleeding
- Review technical approach to lower GI bleeding specifically using a case-based approach
- Conclusions and Future Directions

## VIE104
### Aortic Arch: Posttherapy Imaging Evaluation of Congenital and Acquired Diseases

**Participants**
- Mariana Santos Ferreira Horta (Presenter): Nothing to Disclose
- Carla Rodrigues Saraiva MD: Nothing to Disclose
- Marcio Ferreira Madeira MD: Nothing to Disclose
- Ines Carmo Mendes MD: Nothing to Disclose

**TEACHING POINTS**
To describe and illustrate the pre- and posttherapy MDCTA and MRA imaging findings of congenital and acquired aortic arch diseases. To detail MDCTA and MRA imaging strategies for the repaired aortic arch. To explain the surgical and endovascular approaches of the congenital and acquired condition involving the aortic arch, including procedures involving the ascending and descending aorta and the supra-aortic trunks. To display possible complications after surgical and endovascular aortic arch repair.

**TABLE OF CONTENTS/OUTLINE**
1. Description of CTA and MRA imaging advantages and disadvantages for the evaluation of the repaired aortic arch. 2. Spectrum of congenital (vascular rings, aortic hypoplasia, aortic coarctation, interrupted aortic arch) and acquired diseases (atherosclerotic, inflammatory and post-dissection aneurysms, type A dissections, penetrating ulcers) that often require surgical and endovascular interventions. 3. Description and review of the imaging findings of surgical and endovascular techniques, TEVAR, hybrid surgeries, elephant trunk procedure and its variants, “arch first” technique, surgical reimplantation techniques and stenting of the supra-aortic vessels. 4. Post-treatment normal aspects and complications of surgical and endovascular approaches. 5. Final considerations

## VIE105
### Arterial Upper Extremity Run Off: Technique and Imaging Findings

**Participants**
- Prashant Nagpal MD (Presenter): Nothing to Disclose
- Ashish Rajendra Khandelwal MD: Nothing to Disclose
- Sandeep Subhash Hedgire MD: Nothing to Disclose
- Sachin Shyamsunder Saboo FRCR, MD: Nothing to Disclose
- Ayaz Aghayev MD: Nothing to Disclose
- Frank John Rybicki MD, PhD: Research Grant, Toshiba Corporation
- Michael Lally Steigner MD: Speaker, Toshiba Corporation

**TEACHING POINTS**
1. Understand the role of CT Angiography (CTA) and MR Angiography (MRA) of the upper extremity run for the diagnosis of acute arterial pathologies. 2. Identify the technical factors for optimal upper extremity angiography. 3. Review imaging appearance of various common pathologies involving the upper extremity arteries.

**TABLE OF CONTENTS/OUTLINE**
1. Role of the CT and MR upper extremity run off, especially in appropriate clinical setting. 2. Technical parameters for optimal imaging evaluation of upper extremity arteries. 3. Case based review of various pathologies involving the upper extremity arteries with emphasis on use of CT angiography in emergency setting. 4. Summary

## VIE106
### Carotid Artery Stenting: Avoiding a Surgical Pain in the Neck
Participiants

Hebah Taufik MBBS (Presenter): Nothing to Disclose
Alexander Theodore Chapman MBBS, BSc: Nothing to Disclose
Allan Irvine: Nothing to Disclose

TEACHING POINTS

Our centre has a relatively small volume of carotid artery stenting cases. A robust pathway is essential for the selection and follow-up of cases. Rigorous audit ensures that the outcomes in smaller hospitals are comparable to national figures.

TABLE OF CONTENTS/OUTLINE

Carotid artery stenting (CAS) is recommended as a second-line treatment for symptomatic patients unsuitable for endarterectomy. The British Society of Interventional Radiologists (BSIR) developed the United Kingdom Carotid Artery Stent Registry (UKCASR) to monitor short and long-term outcomes of CAS. Recently published outcomes for 953 symptomatic and 201 asymptomatic cases undergoing CAS in UK hospitals between 1998-2010. 30-day outcomes for stroke/myocardial infarction/death rate was 5.5% and death rate was 1.7% for symptomatic cases. For asymptomatic cases, 2.8% and 0.6%, respectively. At our district general hospital, we analysed 44 cases. 30-day outcome of stroke/myocardial infarction/death rate for both symptomatic and asymptomatic cases was 0%. Post-procedure duplex scans at our institute was suboptimal. 34.8% of symptomatic cases and 15.4% of asymptomatic cases were followed up within the recommended 6 week period. Using ECST, NASCET, NICE guidelines, along with the report published by UKCASR and our own experiences, we have proposed a CAS Patient Pathway.

VIE107

CRUSHING the NIDUS Management Strategies of Non-CNS High Flow AVMs

Participiants

Donald J. Perry MD (Presenter): Nothing to Disclose
Gregor Martin Dunham MD: Nothing to Disclose
Sandeep Vaidya MD: Nothing to Disclose

TEACHING POINTS

1. Arteriovenous malformation (AVM) management variables include location, nidus size and complexity, feeding vessel size, flow speed, and patient comorbidities. 2. AVM nidus elimination is the goal of embolization. Various techniques and agents utilized to optimally permeate and obliterate the nidus. 3. Surgical resection of limited utility due to high rate of recurrence. Utilized in small and very large lesions when AVM fully resectable or too bulky for adequate embolization.

TABLE OF CONTENTS/OUTLINE

1. Approach to the Non-CNS AVM: peripheral vs. visceral, nidus size and complexity, feeding vessel, flow speed, patient co-morbidities. Depicted by illustrations, videos, 3-D reconstructions, imaging, and gross pathology
2. Characterization and indications of embolic agents: absolute ethanol, cyanoacrylate adhesives (‘glue’), ethylene vinyl alcohol copolymer (Onyx). Depicted with illustrations
3. Post-treatment response and follow-up
4. Complications: Infection, bleeding, embolism, infarction, nerve injury (permanent vs. transient), acute renal failure, skin necrosis

VIE108

Deep Inferior Epigastric Artery: Often Overlooked but with Clinical Significance

Participiants

Anthony Dennis Mohabir MD (Presenter): Nothing to Disclose
Gregory Michael Grimaldi MD: Nothing to Disclose
Priya Kumer Shah MD: Nothing to Disclose
Eric John Gandras MD: Nothing to Disclose
Daniel Mark Putterman MD: Nothing to Disclose

TEACHING POINTS

1. To review the anatomy and embryology of the deep inferior epigastric artery.
2. To explain the significance of the deep inferior epigastric artery as it pertains to breast flap reconstruction surgery.
3. To demonstrate pathology involving the deep inferior epigastric artery which can be easily overlooked.

TABLE OF CONTENTS/OUTLINE

1. Anatomy and Embryology of the Deep Inferior Epigastric Artery
2. Use in Breast Flap Reconstructive Surgery
3. Pathology involving the Deep Inferior Epigastric Artery with subsequent intervention
   a. Pseudoaneurysm
   b. Hematoma
   c. Association with Aortic endoleak following Endovascular Aneurysm Repair
4. Summary

VIE109

Detecting Aortic Graft Complications: A Spectrum of CT Findings
Participants

Khalid Walid Shaqdan MD (Presenter): Nothing to Disclose
Shima Aran MD: Nothing to Disclose
Ajay K. Singh MD: Nothing to Disclose
Elmira Hassanzadeh MD: Nothing to Disclose
Anand K. H. Singh MD: Nothing to Disclose
Hosam Nabil Attaya MD: Nothing to Disclose
Hani H. AbuJudeh MD, MBA: Research Grant, Bracco Group Consultant, RCG HealthCare Consulting Author, Oxford University Press

TEACHING POINTS

• Aortic graft complications greatly influence long-term morbidity and mortality rates of abdominal aortic aneurysm (AAA) repair.
• Increased detection of graft-related complications are achieved with a better understanding of imaging characteristics • The aim of this exhibit is to describe aortic graft complications and illustrate key imaging findings

TABLE OF CONTENTS/OUTLINE

• Background/Literature review
  o Types of stent grafts
    Vanguard
    Endologix
    Zenith
  o Imaging techniques for graft surveillance:
    Plain radiograph
    CT
    MRI
    Digital subtraction angiography
    Ultrasound
    Nuclear medicine studies
  o Protocol in Post–Endovascular Aneurysm Repair Surveillance
    • Radiographic features of complications:
      o Endoleaks
      o Para-anastomotic aneurysm
      True
      False
      o Graft-enteric erosion/fistula
      o Graft Infection
      o Colon Ischemia
      o Graft Thrombosis
      o Device migration
      • Alternative to imaging for post-EVAR surveillance
      o Pressure monitoring sensors

VIE110

Embolotherapy: Identifying Risks and Choosing the Right Agent

Participants

Khalid Walid Shaqdan MD (Presenter): Nothing to Disclose
Shima Aran MD: Nothing to Disclose
Ajay K. Singh MD: Nothing to Disclose
Elmira Hassanzadeh MD: Nothing to Disclose
Hani H. AbuJudeh MD, MBA: Research Grant, Bracco Group Consultant, RCG HealthCare Consulting Author, Oxford University Press

TEACHING POINTS

• Embolotherapy has become an increasingly popular procedure in the field of interventional radiology.
• There are numerous embolic agents, each with its own characteristics that makes it ideal for certain situations.
• Familiarity with these characteristics can help in selecting the appropriate agent depending on the goal of embolization. • The aim of this exhibit is to describe the several types of commonly used embolizing agents, and a systematic method to determine when to use each agent.

TABLE OF CONTENTS/OUTLINE

• Background
  o Embolic agents
    Important physical and biological properties
    Large vessel embolic agents
    • Coils
    • Balloons
    • Amplatzer vascular plug
    • Guide wires
    • Suture material
    • Autologous clot
    Small vessel embolic agents
    • Particulate embolic agents
    • Liquid agents
    • Powder substances
  • Determining embolization agent according to:
    o Size of vessel
    o How long should the vessel stay occluded
    o Should embolized tissue remain viable
    • Advantages and disadvantages of embolization
    • Methods to decrease certain adverse effects
Endoleaks: The Achilles’ Heel of Endovascular Aortic Aneurysm Repair (An image-based Review of the Diagnosis and Management of Endoleaks)

Education Exhibits
Location: VI Community, Learning Center

Participants
Ekow A. Mills-Robertson MD (Presenter): Nothing to Disclose

TEACHING POINTS
1. Discuss the different imaging options utilized for aortic aneurysm surveillance after EVAR. 2. Review the detection and characterization of different endoleak types. 3. Explain the general approach to endoleak management based on imaging findings.

TABLE OF CONTENTS/OUTLINE
1. Introduction of EVAR and its advantages/disadvantages 2. Different imaging modalities used for aneurysm size surveillance (US, CT, MRI, DSA) 3. Classification scheme for types of endoleaks 4. Case examples of different endoleak types 5. Endoleak management strategy based on imaging findings

Endovascular Treatment of Hemoptysis, Our Experience Over a 13 year Period

Education Exhibits
Location: VI Community, Learning Center

Participants
Alex Roberto Ramirez MD (Presenter): Nothing to Disclose
Paula Hernandez Mateo MD: Nothing to Disclose
Juan Pablo Gibbs MD: Nothing to Disclose
Jose Mendez Montero: Nothing to Disclose
Javier Armijo: Nothing to Disclose
Marco Leyva Vasquez Caicedo MD, MSc: Nothing to Disclose

TEACHING POINTS
- To know the importance of hemoptysis as a life-threatening condition, with a variety of underlying causes, that deserves urgent investigation and intervention.
- To discuss the use of computed tomographic angiography (CTA) in the detection of the site and cause of hemoptysis.
- To review the relevant anatomy, interventional techniques, success rate, complications and long term results of bronchial artery embolization (BAE) as endovascular treatment of hemoptysis.
- To present our experience in the endovascular treatment of hemoptysis, along with the results of a 13-years period.

TABLE OF CONTENTS/OUTLINE
We will review the major features of the diagnostic and endovascular treatment of hemoptysis, with emphasis in our institutional experience, including:
- Relevant anatomy
- Causes
- Role of the Computed Tomography Angiography (CTA) and Digital Subtraction Angiography (DSA) in the diagnosis of hemoptysis with radiological findings
- Indications for treatment
- Bronchial artery embolization technique
- Outcomes including complications
- Short and long term follow-up

Evaluating and Managing Endoleaks

Education Exhibits
Location: VI Community, Learning Center

Participants
Joanna Kee-Sampson MD (Presenter): Nothing to Disclose
Aaron Himchak MD: Nothing to Disclose

TEACHING POINTS
At the conclusion of this exhibit, the viewer will:
1) Be able to detect and differentiate the various types of endoleaks on CT angiography and conventional angiography.
2) Have a basic understanding of the procedural aspects of endoleak repair and be familiarized with post-repair results.
3) Have an understanding of the surveillance of endoleaks.

TABLE OF CONTENTS/OUTLINE
This will be presented in a quiz format:
1) Brief background on endovascular aneurysm repair (EVAR).
2) Introduction of the diagnosis and treatment of endoleaks.
3) The role of imaging in the evaluation and management of endoleaks.
4) Case examples of different types of endoleaks.
5) The importance of surveillance and follow-up in endoleaks.
6) Late complications of endoleaks and their management.
This will be presented in a quiz format: 1) Brief background on endovascular aneurysm repair (EVAR). 2) Introduction of endoleaks (clinical significance, natural history, risk factors) 3) Diagnosis and clinical surveillance of endoleaks (CT, CTA, duplex ultrasound) 4) Types I-V endoleaks will each be discussed in terms of: a. Definition b. Specific imaging findings (CTA, angiography) c. Repair of each type of endoleak i. Type I and III (balloon dilatation, relayering endograft, extending endograft, endoanchors) ii. Type II (embolization) iii. Type IV (self-limited) iv. Type V (treatment controversial, will present literature review) 5) Follow-up of endoleaks post repair

VIE115

Finding the NIDUS: Detection and Work-up of Non-CNS AVMs

Education Exhibits
Location: VI Community, Learning Center

Participants
Gregor Martin Dunham MD (Presenter): Nothing to Disclose
Donald J. Perry MD: Nothing to Disclose
Jeffrey Harold Maki MD, PhD: Research Consultant, Merge Healthcare Incorporated Research support, Bracco Group Research support, Bayer AG Speakers Bureau, Lantheus Medical Imaging, Inc
Sandeep Vaidya MD: Nothing to Disclose

TEACHING POINTS
1. Non-CNS lesions can occur anywhere, most commonly in the limbs and pelvis. Radiology plays a crucial role in detection, work-up, and management.
2. Complex tortuous anatomy must be delineated for proper management.
3. Ultrasound provides easy confirmation of suspected AVM and quantitative analysis.
4. Appropriate MR sequencing and proper CT and MR contrast timing vary based on location and size of AVM.
5. Angiography historically gold-standard for diagnosis, however currently reserved for management.

TABLE OF CONTENTS/OUTLINE
1. Initial presentation: patient characteristics; symptoms; dermatologic findings; syndromes- von Klippel- Trenaunay-Weber and Osler-Weber-Rendu. 2. Definition and classification: AVM vs. hemangioma vs. venous angioma vs. other vascular anomalies; Hamburg classification. Depicted with imaging and illustrations. 3. Diagnosis and Work-up: ultrasound including velocity waveform analysis and duplex doppler; MRA and CTA including sequencing, contrast timing, and 3-D reconstructions; Angiography; Radionucliotide-labeled microsphere shunt study; work-up algorithm. Depicted with imaging, video, 3-D reconstructions, and illustrations.

VIE116

Flow-Diverter Devices for Intracranial Aneurysm Treatment: How, When and Why

Education Exhibits
Location: VI Community, Learning Center

Participants
Teresa Gonzalez De La Huebra Labrador (Presenter): Nothing to Disclose
Roberto Correa Soto: Nothing to Disclose
Ricardo Corrales Pinzon: Nothing to Disclose
Aurymar Fraino: Nothing to Disclose
Jesus Garcia Alonso: Nothing to Disclose
Jose Antonio de las Heras Garcia: Nothing to Disclose
Luis Velasco Pelayo: Nothing to Disclose

TEACHING POINTS
To review the indications of endovascular treatment of intracranial aneurysms, with special emphasis on the use of flow-diverter devices.
To become familiar with the procedure and potential complications.

TABLE OF CONTENTS/OUTLINE
- Intracranial aneurysm
- Diagnostic imaging
- Endovascular treatment
- Flow-diverter devices:
  - Indications
  - Contraindications
  - Procedure
  - Complications

VIE117

Gastrointestinal Bleeding in Patients with Left Ventricular Assist Devices— Interventional Radiology’s Role in Diagnosis and Management

Education Exhibits
Location: VI Community, Learning Center
Certificate of Merit

Participants
Ashley Elizabeth Prosper MD (Presenter): Nothing to Disclose
Michael David Katz MD: Nothing to Disclose

TEACHING POINTS
• Review the mechanics of Left Ventricular Assist Devices (LVADs) and their effects on cardiovascular physiology • Discuss the multiple risk factors for bleeding in patients with LVADs • Review the most likely sites of gastrointestinal bleeding in patients with LVADs • Discuss an approach to the evaluation of gastrointestinal bleeding in LVAD patients and how IR plays a role

TABLE OF CONTENTS/OUTLINE
• Schematic review of LVADs and their mechanics • Discussion of altered perfusion in patients with LVADs including continuous flow and decreased pulse pressure • An explanation of coagulopathy in the LVAD patient: anticoagulation, decreased vWF, platelet destruction and angiodysplasia • A stepwise approach to evaluating GI bleeding in LVAD patients • Selected angiographic case review from our institution • When to consider empiric embolization

VIE118
How We Do It: Evaluation and Management of Acute Upper Gastrointestinal Bleeding

Education Exhibits
Location: VI Community, Learning Center

Participants
Jennifer Frances Feneis MD (Presenter): Nothing to Disclose
Raja Ramaswamy MD: Nothing to Disclose
Kevin Charles McCammack MD: Nothing to Disclose
Gerant M. Rivera-Sanfeliz MD: Nothing to Disclose

TEACHING POINTS
Overview: Acute upper gastrointestinal bleeding can lead to significant morbidity and mortality without appropriate treatment. The role of interventional radiology is crucial in patients that have persistent bleeding despite medical and endoscopic treatment. In this educational exhibit we will review the following: • ACR Appropriateness Criteria for the radiologic management of upper gastrointestinal tract bleeding. • The practical utilization of radiologic modalities (CT/Nuclear medicine) • Underlying etiologies that can lead to acute upper GI bleeding • The role of Interventional Radiology in the therapeutic management with endovascular angiography and transcatheter embolization • Provide insight into the essential role of Interventional Radiology in the management of acute upper GI bleeding.

TABLE OF CONTENTS/OUTLINE
• Introduction • Clinical evaluation and patient management • Review ACR appropriateness criteria • The utilization of CTA and Nuclear Medicine • Angiographic evaluation and management • Use of gelfoam, PVA, coils, onyx, glue in the management of upper GI bleeding • Review technical approach to upper GI bleeding specifically using a case-based approach • Conclusions and Future Directions

VIE119
Interventional Radiology (IR) in the Management of Visceral Artery Pseudoaneurysms: A Review of Techniques and Embolizing Agents

Education Exhibits
Location: VI Community, Learning Center

Participants
Madhusudhan Kumble Seetharama MD, FRCR (Presenter): Nothing to Disclose
Shivanand Ramachandra Gamanagatti MBBS, MD: Nothing to Disclose
Deepnarayan Srivastava: Nothing to Disclose
Arun Kumar Gupta MBBS, MD: Nothing to Disclose

TEACHING POINTS
1. To illustrate various techniques and embolizing agents used in the management of visceral artery pseudoaneurysms. 2. To discuss and review the performance of each technique and / or embolizing agent.

TABLE OF CONTENTS/OUTLINE
1. Brief review of pathophysiology of visceral artery pseudoaneurysms. 2. Various techniques (endovascular, percutaneous and endoscopic) and embolizing agents used in the management of visceral artery pseudoaneurysms. 3. Advantages and disadvantages or risks of each technique and / or embolizing agent.

VIE120
Introduction of Occlusion Balloons in Anterior Division of the Hipogastric Artery as a Prophylaxis Measure for Intraoperative Blood Loss in Cases of Placenta Accreta

Education Exhibits
Location: VI Community, Learning Center

Participants
Neus Rus Calafell (Presenter): Nothing to Disclose
Mercedes Perez-Lafuente: Nothing to Disclose
Carla Gonzalez Junyent MD: Nothing to Disclose
Maria Pardo-Antunez: Nothing to Disclose
TEACHING POINTS

- Imaging findings in the diagnosis of placenta accreta during the gestation using ultrasound and MRI.
- The placement of angioplasty occlusive balloons can reduce the risk of bleeding in cases of placenta accreta

TABLE OF CONTENTS/OUTLINE

The main objective is describe our experience in placement of angioplasty occlusive balloons into the anterior trunk of hypogastric arteries in order to reduce the intraoperative bleeding in patients with placenta accreta. Thus, a descriptive analysis of the procedure will be shown. Firstly, angioplasty balloons are placed into the anterior division of hypogastric arteries through bilateral catheterization of common femoral artery. Secondly, the balloons are inflated in order to check the arteries are totally occluded and, subsequently, they are attached to the arterial sheaths and these are then set to the patient’s skin. Patients undergo caesarean delivery and, if necessary, the balloons are inflated in order to get intraoperative proper hemostasy. Finally, the balloons are removed immediately after the caesarean procedure but arterial sheaths are removed 24h later depending on patient’s evolution. The intraoperative blood loss can be reduced by using angioplasty balloons in patients suffering from placenta accreta. This may improve the prognosis of these patients.

VIE121

It’s Not Always Only Medical! Type B Aortic Dissection: What the Vascular Surgeon Wants to Know before and after the Intervention

Education Exhibits
Location: VI Community, Learning Center

Participants

Mickael Ohana MD, MSc (Presenter): Nothing to Disclose
Aissam Labani MD : Nothing to Disclose
Mi-Young Jeung MD : Nothing to Disclose
Yannick Georg MD, MSc : Nothing to Disclose
Fabien Thaveau : Nothing to Disclose
Christof Karmonik PhD : Nothing to Disclose
Jean Bismuth : Nothing to Disclose
Nabil Chakfe MD, PhD : Nothing to Disclose
Catherine Roy MD : Nothing to Disclose

TEACHING POINTS

Become familiar with CT and MRI acquisitions protocols used in type B aortic dissection. Be able to radiologically define a complicated acute type B aortic dissection. Exploit information from CTA and 4D-angioMRI to locate entry/reentry tears and achieve precise sizing before endovascular treatment. Learn how to follow-up type B dissections in the acute and the chronic settings, according to whether they were treated surgically or medically.

TABLE OF CONTENTS/OUTLINE

1. Introduction 1.1 Definition and physiopathology 1.2 Prevalence and prognosis 1.3 Current therapeutic management 2. Imaging protocols 2.1 CTA 2.2 MRA 3. Surgical indications 3.1 Malperfusion 3.2 Pertoaortic hematoma / hemorrhagic pleural effusion 3.3 Aneurysmal evolution 4. What to look for before endovascular or open surgery 4.1 Entry/reentry tears 4.2 Sizing 5. How to follow-up these patients 5.1 Recommended CTA/MRA intervals 5.1 What to look for after open or endovascular surgery 5.2 What to look for after initial medical treatment 6. Conclusion

VIE122

Minimally-Invasive Interventions in the Treatment of Non-Traumatic Splenic Disorders—A Whirlwind Tour of Splenic Vascular Anomalies, Gastric Varices Secondary to Sinistral Hypertension, and Hypersplenic Thrombocytopenia

Education Exhibits
Location: VI Community, Learning Center

Certificate of Merit

Participants

John J. Park MD, PhD (Presenter): Nothing to Disclose
Jinha Park MD, PhD : Speakers Bureau, Bayer AG Advisory Board, Guerbet SA Advisory Board, Koninklijke Philips NV
Jonathan M. Kessler MD : Nothing to Disclose

TEACHING POINTS

Although trauma remains a key indication for many minimally-invasive splenic interventions, other non-traumatic indications are becoming more common as advances in transcatheter techniques offer novel and viable alternatives to surgery. As a result, it is important to have a firm understanding of splenic anatomy and the pathophysiology behind these other treatable types of splenic disorders. 1. Review the anatomy and pathophysiology involved in selected non-traumatic splenic disorders, including splenic vascular anomalies, gastric varices due to sinistral portal hypertension, and hypersplenic thrombocytopenia 2. Provide the reader with the various indications, diagnostic imaging, interventions, contraindications, and potential complications related to non-trauma related splenic interventions. 3. Study real case examples of different splenic interventions in order to showcase various imaging and interventional techniques in the treatment of various spleen-related disorders.

TABLE OF CONTENTS/OUTLINE

A. Splenic anatomy B. Pathophysiology of selected disorders related to the spleen. C. Current indications for splenic interventions in the non-trauma setting. D. Highlight minimally-invasive techniques employed in the treatment of disorders related to the spleen. E. Key imaging and interventional points related to splenic interventions.

VIE123

Nellix Endograft Repair of Aortic Aneurysm: Pictorial Review of the Normal and Abnormal CT
TEACHING POINTS

Nellix endoprosthesis is a novel and increasingly utilised device for aorto-iliac aneurysm repair, with unique CT appearances that alter with time and are prone to misinterpretation. We present a pictorial review based on our institutional experience of more than 60 Nellix cases.

1. Review the NELLIX device: principles, materials and procedure of deployment.
2. Understand early and long term CT features following stent insertion.
3. Outline surveillance, including CT protocols and the roles of Duplex and angiography.
4. Review device related complications.

TABLE OF CONTENTS/OUTLINE

1. NELLIX device- composition, indications, contraindications
2. NELLIX deployment technique.
3. Short and long term post insertion device appearances.
4. CT surveillance protocol and the role of ancillary imaging modalities.
5. Potential complications and their remedies.
6. Unrecognised pitfalls and future challenges.

VIE124

Novel Techniques for Catheterizing the Excluded Aneurysm Sac for the Purpose of Embolization of Endoleaks Associated with Endovascular Repair of AAAs

TEACHING POINTS

1. To review the pathophysiology and prognosis of endoleaks after AAA repair.
2. Discuss the benefits of Onyx (EV3 Inc., Plymouth, MN) as a liquid embolic agent, as compared to coils.
3. Pictorial description of the different approaches to endoleak repair using Onyx, while focusing on type II endoleaks.

TABLE OF CONTENTS/OUTLINE

A. Short review of the 5 types of endoleaks. B. Focused review of the pathophysiology, prevalence, complications and prognosis of untreated type II endoleaks. C. Current indications for treatment of endoleaks. a. Follow-up protocols; CT and/or ultrasound b. Size criteria D. Short description of Onyx and its properties. E. Describing the different techniques of accessing the aneurysmal sac, when using onyx: a. Endovascular: i. Accessing the inferior mesenteric artery through the marginal artery of Drummond. ii. Catheterizing lumbar arteries via the internal iliac and iliolumbar arteries. b. Direct sac access: i. CT or fluoroscopic guided translumbar ii. Ultrasound guided transabdominal c. Combined endovascular/direct approach; a novel method of accessing the aneurysm sac by perigraft catheterization between the endograft and the vascular wall at an anastomotic site. F. Comparing and contrasting the different repair techniques in regards to indications, efficacy, and complications.

VIE126

Postpancreatectomy Hemorrhage: Case Review of Radiologic Imaging and Intervention

TEACHING POINTS

1. To review the pathophysiology and diagnosis of endoleaks after AAA repair.
2. Discuss the benefits of Onyx (EV3 Inc., Plymouth, MN) as a liquid embolic agent, as compared to coils.
3. Pictorial description of the different approaches to endoleak repair using Onyx, while focusing on type II endoleaks.

TABLE OF CONTENTS/OUTLINE

A. Short review of the 5 types of endoleaks. B. Focused review of the pathophysiology, prevalence, complications and prognosis of untreated type II endoleaks. C. Current indications for treatment of endoleaks. a. Follow-up protocols; CT and/or ultrasound b. Size criteria D. Short description of Onyx and its properties. E. Describing the different techniques of accessing the aneurysmal sac, when using onyx: a. Endovascular: i. Accessing the inferior mesenteric artery through the marginal artery of Drummond. ii. Catheterizing lumbar arteries via the internal iliac and iliolumbar arteries. b. Direct sac access: i. CT or fluoroscopic guided translumbar ii. Ultrasound guided transabdominal c. Combined endovascular/direct approach; a novel method of accessing the aneurysm sac by perigraft catheterization between the endograft and the vascular wall at an anastomotic site. F. Comparing and contrasting the different repair techniques in regards to indications, efficacy, and complications.
1. Whipple pancreatoduodenectomy has up to 50% post-operative morbidity rate. Postpancreatectomy hemorrhage is seen in 24 hours. Early hemorrhage is often caused by technical failure to achieve hemostasis. Late hemorrhage is often caused by ulcers, vascular erosions, pseudoaneurysms, fistulas or anastomotic dehiscence. 3. CT angiography may help identify the bleeding site in hemodynamically stable patients. DSA delineates vascular anatomy and also guides endovascular treatment. 4. GDA stump is the most common location of hemorrhage. Less common locations include the hepatic artery, celiac axis, splenic artery, and inferior pancreaticoduodenal artery. Bleeding from an anastomotic ulcer is rare. 5. Endovascular treatments include embolization and stent grafting. If bleeding occurs from a pseudoaneurysm, packing of the pseudoaneurysm should be avoided since the weak wall is associated with a high risk of rebleeding.

**TABLE OF CONTENTS/OUTLINE**

1. Review of post-Whipple anatomical considerations
2. Review of common etiologies of post-Whipple hemorrhage
3. Case review of endovascular treatment of post-Whipple hemorrhage

**VIE128**

**Recanalization of Chronic Total Occlusions Using the Crosser™ Vibrational Atherectomy Catheter**

**Education Exhibits**

**Location:** VI Community, Learning Center

**Participants**

Alex C. Penn MD (Presenter): Nothing to Disclose  
Jeffrey Chil-jek Sung MD, MBA: Stockholder, Pfizer Inc Stockholder, Gilead Sciences, Inc

**TEACHING POINTS**

- To understand the indications, method of use and factors which may affect technical success of the Crosser™ (Bard Peripheral Vascular, Tempe, AZ) high-frequency vibrational catheter for traversal of chronic total occlusions.

**TABLE OF CONTENTS/OUTLINE**

- A. Anatomy (Vascular anatomy and anatomy of occlusive lesions)  
- B. Diagnostic Imaging (US, CTA, diagnostic angiography)  
- C. Review of Indications, Contraindications  
- D. Treatment (Use of the Crosser™ device for traversal of CTOs)  
- E. Follow-up Management  
- F. Outcomes (include complications)

**VIE129**

**Segmental Arterial Mediolysis (SAM): A Pictorial Review**

**Education Exhibits**

**Location:** VI Community, Learning Center

**Cum Laude**

**Participants**

Jay Patel MD (Presenter): Nothing to Disclose  
Joanna Kee-Sampson MD: Nothing to Disclose  
Nishith Patel MD: Nothing to Disclose  
Thaddeus M. Yablonsky MD: Nothing to Disclose  
Sean Keith Calhoun DO: Nothing to Disclose

**TEACHING POINTS**

1. Review the history, pathophysiology and clinical presentation of SAM  
2. Learn imaging features of SAM on a variety of modalities  
3. Discuss the differential diagnosis and treatment options for SAM

**TABLE OF CONTENTS/OUTLINE**

- History  
- Pathophysiology  
- Clinical presentation  
- CTA and MRA findings  
- Angiographic findings  
- Complications - thrombosis, arterial wall hemorrhage, dissection, ischemia, aneurysm rupture  
- Differential diagnosis - vasculitis, fibromuscular dysplasia, atherosclerotic disease, arterial trauma, inflammatory pseudoaneurysm  
- Treatment - medical/conservative therapy, angioplasty, embolization  
- Conclusion

**VIE130**

**Slow the Flow: The Role of Interventional Radiology in Managing Obstetrical Emergencies**

**Education Exhibits**

**Location:** VI Community, Learning Center

**Participants**

Rebecca Zener MD (Presenter): Nothing to Disclose  
Daniele Patrice Wiseman MD, FRCP: Nothing to Disclose  
Amol Mujoomdar MD: Speaker, Cook Group Incorporated Speaker, Covidien AG

**TEACHING POINTS**

The purpose of this exhibit is: 1. To review the clinical problem and diagnosis of invasive placenta 2. To discuss the role of interventional radiology in the management of invasive placenta 3. To review the role of interventional radiology in the management of post-partum hemorrhage from both invasive placenta, and other causes

**TABLE OF CONTENTS/OUTLINE**

- Clinical and diagnostic overview of the invasive placenta spectrum (placenta accreta, increta and percreta)  
- Review of the
Some of Peritoneal and Retroperitoneal Bleedings Could be SAM!

**Education Exhibits**

**Location:** VI Community, Learning Center

**Participants**
- Hiroshi Kondo MD: Nothing to Disclose
- Yukichi Tanahashi MD (Presenter): Nothing to Disclose
- Hiroshi Kawada MD: Nothing to Disclose
- Yoshifumi Noda MD: Nothing to Disclose
- Satoshi Goshima MD, PhD: Nothing to Disclose
- Masayuki Kanematsu MD: Nothing to Disclose

**TEACHING POINTS**

Segmental arterial mediolysis (SAM) is a rare condition and presents with intra-abdominal bleeding which may result in a life-threatening situation. Unruptured aneurysms were rarely exacerbated and could be followed-up by contrast-enhanced CT. Understanding and recognizing radiologic features of SAM is critical for an accurate diagnosis and determination of appropriate treatments.

**TABLE OF CONTENTS/OUTLINE**

Review the various clinical manifestations of SAM. Presentation of characteristic imaging findings of SAM including string of beads, fusiform and saccular formation of aneurysms, and arterial wall thickening and dissection. Review the clinical indications and treatment options of transcatheter arterial embolization. Discussion of the diagnostic problems and the treatment strategies.

Takayasu Arteritis: Current Status of Imaging Diagnosis

**Education Exhibits**

**Location:** VI Community, Learning Center

**Participants**
- Kenichi Yokoyama MD (Presenter): Nothing to Disclose
- Toshiaki Nitatori MD: Nothing to Disclose
- Masanichi Imai: Nothing to Disclose
- Toshiya Kariyasu: Nothing to Disclose
- Maiko Yoshida MD: Nothing to Disclose
- Mitsuteru Tsuchiya: Nothing to Disclose
- Makiko Nishikawa: Nothing to Disclose
- Yusuke Kinoshita: Nothing to Disclose
- Yayoi Tsukahara: Nothing to Disclose
- Masanaka Watanabe: Nothing to Disclose

**TEACHING POINTS**

1. Recent advances in imaging modalities allow not only early diagnosis but also detailed assessment of localization and activity of vascular lesions of Takayasu arteritis (TA) including aorta and its branches, coronary artery, and pulmonary artery. 2. These imaging modalities also provide the information of fatal or serious arterial complication of TA and may be helpful for planning and modifying treatment.

**TABLE OF CONTENTS/OUTLINE**

The pictorial review of the imaging findings of TA and its differential diagnosis - Aorta and its branches - Coronary artery - Pulmonary artery - Iliac and femoral artery - Others Recent advances in imaging modalities for evaluating vascular lesions of TA - Multidetector-row CT or CT angiography - MRI or MR angiography - FDG-PET/CT - Others The characteristics and the role of imaging for the fatal or serious arterial complication of TA - Aortic regurgitation - Aortic aneurysm, dissection, atypical coaractation of aorta - Renal arterial stenosis - Others

Technical Recommendations for Intra-arterial Therapy in Rat Liver Tumor Model

**Education Exhibits**

**Location:** VI Community, Learning Center

**Participants**
- Hideyuki Nishiofuku (Presenter): Nothing to Disclose
- Toshihiro Tanaka MD: Nothing to Disclose
- Yasushi Fukukawa: Nothing to Disclose
- Takeshi Sato: Nothing to Disclose
- Hiroshi Anai MD, PhD: Nothing to Disclose
- Kimihiko Kichikawa MD: Nothing to Disclose
- Shinzaku Maeda: Nothing to Disclose
- Tetsuya Masada: Nothing to Disclose

**TEACHING POINTS**

Rat liver tumor models have been improved and are widely used for various preclinical studies in interventional oncology. Most of the previous studies of intra-arterial therapy were performed under laparotomy, with the insertion of catheter via gastroduodenal artery. Recently, image-guided angiographic techniques have been developed. The purpose of this exhibit is: (1)
To learn about the techniques of preparation of rat liver tumor models. (2) To learn about the interventional techniques for intra-arterial therapy in rat. (3) To learn about the anatomical variations of hepatic artery in rat.

**TABLE OF CONTENTS/OVERVIEW**

Contents (1) Cell culture methodologies and tumor implantation procedures, e.g. direct injection, portal vein injection and splenic parenchymal injection. (2) Tumor cell lines and animal models in terms of hepatocellular carcinoma and colorectal cancer, e.g. McA-RH7777 in SD rat and RCN-9 in F344 rat. (3) Transcatheter arteriography techniques, carotid artery approach and femoral approach with/without the combination of laparotomy. (4) Type and frequency of the anatomical variations of hepatic artery. (5) Applications for clinical studies. Summary

Image-guided intra-arterial therapy in rat liver tumor model is feasible and useful for preclinical studies in interventional oncology.

**VIE134**

The Role of Diagnostic and Interventional Radiology in the Management of Visceral and Renal Artery Pseudoaneurysms

**Education Exhibits**

Location: VI Community, Learning Center

**Participants**

Anthony Cox MBBS: Nothing to Disclose
Priti Dutta MD (Presenter): Nothing to Disclose
Antjie Maria Papadopoulou MBBS: Nothing to Disclose
Anthony Goode: Nothing to Disclose
Nick Woodward MBBS: Nothing to Disclose
Kate Steiner MBBS: Nothing to Disclose
Neil Hunter Davies MBBS: Nothing to Disclose

**TEACHING POINTS**

Pseudoaneurysms arising from visceral and renal arteries are potentially life-threatening entities frequently requiring urgent or emergent treatment. State-of-the-art cross-sectional imaging with increased sensitivity in the detection of small or clinically silent lesions enables early diagnosis and prompt therapeutic intervention. Endovascular techniques now have an established role in their treatment. This poster aims to review the aetiology, clinical presentation, cross-sectional and angiographic imaging appearances of visceral and renal pseudoaneurysms according to anatomic location and to illustrate the endovascular treatment options.

**TABLE OF CONTENTS/OVERVIEW**

Visceral and renal artery pseudoaneurysms are presented according to anatomic location reviewing their aetiology and natural history, clinical presentation, cross-sectional imaging appearances and angiographic findings. Particular considerations with regards to planning endovascular treatment are reviewed and the endovascular method employed for definitive treatment is illustrated.

**VIE135**

Transcatheter Embolization Techniques with N-Butyl Cyanoacrylate (NBCA)

**Education Exhibits**

Location: VI Community, Learning Center

**Participants**

Hiro Kiyosue MD (Presenter): Nothing to Disclose
Shuichi Tanoue MD: Nothing to Disclose
Miyuki Maruno MD: Nothing to Disclose
Norio Hongo: Nothing to Disclose
Hiromu Mori MD: Nothing to Disclose

**TEACHING POINTS**

The teaching points of this exhibit are: 1. General property of N-Butyl Cyanoacrylate (NBCA) 2. Basic technique of transcatheter embolization with NBCA 3. Specific and additional techniques for effective embolization for various vascular lesions

**TABLE OF CONTENTS/OVERVIEW**

A. General property of NBCA • Adhesive liquid • Anionic polymerization (affected by temperature, concentration, flow velocity, and concentration of anion) B. Basic technique of transarterial embolization with NBCA • preparation of NBCA-lipiodol mixture • selection of concentration of NBCA • flushing catheter lumen with glucose • injection of NBCA C. Specific and additional techniques for various vascular lesions • Target vascular lesions: (Pseudo)aneurysms/extravasation, multiple arteriovenous fistulas, arteriovenous malformations with nidus, a high-flow large arteriovenous fistula, and gastroesophageal varices • Injection techniques: sandwich injection/continuous injection, wedged catheter/free flow, low-concentration/high-concentration • Additional techniques: devasculization of non-target feeder, flow control with coils or balloon, dual injection, warming NBCA

**VIE136**

Vascular Complications of Pancreaticoduodenectomy (The Whipple Procedure): Diagnosis and Treatment

**Education Exhibits**

Location: VI Community, Learning Center

Magna Cum Laude

**Participants**

Steven Li-Wen Hsu MD: Nothing to Disclose
Anil Kumar Pillai MD: Nothing to Disclose
Stephen Phillips Reis MD: Nothing to Disclose
Clayton K. Trimmer DO: Nothing to Disclose
TEACHING POINTS

TABLE OF CONTENTS/OUTLINE
Pancreaticoduodenectomy procedure and its indications Vascular complications of pancreaticoduodenectomy Review of International Study Group for Pancreatic Surgery definitions for post-pancreatectomy hemorrhage Diagnostic imaging in the characterization of vascular complications Indications and contraindications for endovascular treatment of vascular complications associated with pancreaticoduodenectomy

VIE137
Vascular Complications Related to Arteriotomy Access and Closure: A Pictorial Review

Education Exhibits
Location: VI Community, Learning Center

Participants
Rakesh Khubchand Varma MBBS, MD (Presenter): Nothing to Disclose
Naganathan Bhagvathy Subra, Mani MD: Nothing to Disclose
Joshua David Pinter MD: Nothing to Disclose
Christopher John Friend MD: Nothing to Disclose

TEACHING POINTS
To review various techniques and approach for percutaneous arterial access. To review the vascular complications associated with arterial access and closure and their imaging features. To review management of vascular complications related to percutaneous arterial access and closure. Briefly discuss techniques to minimise vascular complications related to arterial access and closure with emphasis on noninvasive imaging.

TABLE OF CONTENTS/OUTLINE

VIE138
Vascular Compression Syndromes Seen in Athletes

Education Exhibits
Location: VI Community, Learning Center

Participants
Jordan Gold MD: Nothing to Disclose
Danielle Toussie BS: Nothing to Disclose
Adam C. Zoga MD: Nothing to Disclose
Christopher Geordie Roth MD: Author, Reed Elsevier
Sandeep Prakash Deshmukh MD (Presenter): Nothing to Disclose

TEACHING POINTS
After reviewing this exhibit, participants will be able to: 1. Recognize the multimodality imaging findings associated with various vascular compression syndromes seen in athletes. 2. Describe the anatomic abnormality associated with each syndrome.

TABLE OF CONTENTS/OUTLINE
Each of the following areas will be discussed in regards to each disease entity: Anatomy Pathophysiology Multimodality imaging evaluation Management Disease entities will include the following: Upper extremity: Thoracic outlet syndrome Effort thrombosis Quadrilateral Space Syndrome Lower extremity: May-Thurner Illiac endofibrosis Popliteal artery entrapment

VIE139
Vascular Emergency!: Mycotic Aneurysms of the Aorta and Its Branches: Multimodality Imaging Findings with Clinical Correlation and Post Treatment Follow-up

Education Exhibits
Location: VI Community, Learning Center

Participants
Ignacio Beddings MD (Presenter): Nothing to Disclose
Alvaro Huete Garm MD: Nothing to Disclose
Sanjeev Bhalla MD: Nothing to Disclose
Pablo Bachler MD: Nothing to Disclose
Maria Jose Baladron MD: Nothing to Disclose
Eugenio Zalaquett MD: Nothing to Disclose
Matias Gustavo Vargas Araya MD: Nothing to Disclose
Christine O. Menias MD: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To describe the normal arterial structure and pathophysiology of mycotic aneurysms. 2. To
review the clinical manifestations of mycotic aneurysms located in different parts of the aorta and its branches. 3. To depict the usual imaging findings with different modalities: ultrasound, CT, MRI and PET-CT. 4. To discuss prognosis and different treatment options. 5. To illustrate post imaging findings.

**TABLE OF CONTENTS/OULLINE**


**VIE140**

**Vascular Steal Syndromes: Angiographic Imaging Spectrum and Endovascular Management**

*Location: VI Community, Learning Center*

**Participants**

Justin Muhlenberg MD, MBA (Presenter): Nothing to Disclose

Rajeev Suri MD : Nothing to Disclose

**TEACHING POINTS**

Define vascular steal syndromes as distinct clinical entities resulting from preferential shunting of blood away from a target circulation resulting in clinical symptoms. Highlight imaging features and endovascular management of steal syndromes with a brief comment on surgical management. Intended for radiology residents, fellows and practicing radiologists, this exhibit aims to create awareness and highlight treatment options for vascular steal syndromes.

**TABLE OF CONTENTS/OULLINE**

Introduction and Teaching Points Pathophysiology of Vascular Steal Syndromes Common Etiologies for Vascular Steal Syndromes Discussion of Various Vascular Steal Syndromes and Endovascular Management Dialysis associated steal syndromes Subclavian steal syndrome TIPS and/or portosystemic collateral steal resulting in hepatic encephalopathy Splenic artery steal resulting in liver ischemia post liver transplant Vascular malformation associated steal causing distal tissue ischemia AAA Type II Endoleak Conclusion and Reiteration of Teaching Points

**VIE141**

**Where Is the Leak? Case Based Review of Standard Classification of Endoleaks in Patients with Endovascular AAA Repair and Diagnosing a New Variant of Endoleak**

*Location: VI Community, Learning Center*

**Participants**

Nishith Patel MD (Presenter): Nothing to Disclose

Jay Patel MD : Nothing to Disclose

Thaddeus M. Yablonsky MD : Nothing to Disclose

Sean Keith Calhoun DO : Nothing to Disclose

**TEACHING POINTS**

1. Review the indications, patient preparation, and common approaches for various AAA repair. 2. Learn the imaging features of conventional endoleaks with pathophysiology of complications 3. Describe a new endoleak entity that has not been previously described in the literature. 4. Discuss possible treatment options. After completing this educational exhibit, the reviewer will be familiar with the indications, patient preparation and common approaches for AAA intervention. The reviewer will also be confident in their ability to diagnose, formulate treatment options and manage common complications of endovascular repair.

**TABLE OF CONTENTS/OULLINE**


**VIE142**

**Advanced Iterative Model Reconstruction in Improving Image Quality of CT Angiography**

*Location: VI Community, Learning Center*

**Participants**

Kenneth K. Lau (Presenter): Nothing to Disclose

Nicholas David Ardley : Nothing to Disclose

Kevin Buchan : Employee, Koninklijke Philips NV

Theodore Lau : Nothing to Disclose

**TEACHING POINTS**

CT abdominal angiography (CTA) plays a vital role in diagnosing and monitoring conditions such as stenosis, occlusion, thrombus-embolism, aneurysm, dissection, endoleak and gastrointestinal bleed. Its advantages in comparison to digital subtraction angiography (DSA) are shorter acquisition time, non-invasive nature and less procedural complications. Vessel wall calcification may cause beam-hardening artifact that obscures the vessel lumen. The latest Iterative model reconstruction (IMR) is a knowledge-based algorithm that improves low contrast resolution, reduces image noise and artifact. The aim of this exhibit is to assess the diagnostic utility of IMR in CTA.

**TABLE OF CONTENTS/OULLINE**
The data sets of CTA of thoracic and abdominal aorta, pulmonary, renal, mesenteric arteries, carotid and cerebral arteries of 156 patients were reconstructed using IMR and iDose IRs. 1. The vessel contours and definitions were better visualized down to small vessel with IMR than iDose due to image noise reduction. 2. Less beam-hardening artifacts from vessel wall calcified plaques allow accurate luminal assessment. 3. The presence of embolism and dissection were better depicted on IMR CTA. IMR is superior to conventional iterative reconstruction and aids more accurate vascular pathology assessment.

VIE143

Aortic Endoprosthesis Follow-up: How, When and Why CT Angiography?

Education Exhibits
Location: VI Community, Learning Center

Participants
Maria Eugenia Maccarone MD : Nothing to Disclose
Carlos Capunay MD : Nothing to Disclose
Javier Vallejos MD, MBA (Presenter) : Nothing to Disclose
Patricia M. Carrascosa MD : Research Consultant, General Electric Company

TEACHING POINTS
To describe the multiphasic CT angiography protocol study To define the follow up imaging after stent graft placement To recognize the multiphasic CT angiography as the best choice of non-invasive method to detect and classify endoleaks and other complications

TABLE OF CONTENTS/OUTLINE
Complications after aortic endoprosthesis placement Classification of Endoleaks Imaging techniques: Digital angiography MR angiography Ultrasound CT angiography Follow up imaging after stent graft placement: When CT angiography?

VIE144

Breast Reconstruction with DIEP and SGAP Flaps – Role of Pre-Operative CT Angiogram

Education Exhibits
Location: VI Community, Learning Center

Participants
Gregory Aaron Bonci MD (Presenter): Nothing to Disclose
Bohdan Pomahac MD : Nothing to Disclose
Dimitris Mitsouras PhD : Nothing to Disclose
Stephanie A. Caterson MD : Nothing to Disclose
Amir Imanzadeh MD : Nothing to Disclose
Meaghan Mackesy MD : Nothing to Disclose
Edward J. Caterson MD, PhD : Nothing to Disclose
Frank John Rybicki MD, PhD : Research Grant, Toshiba Corporation

TEACHING POINTS
Perforator flaps offer cosmetically superior results with significantly less morbidity than TRAM flaps. Choice of flap is dependent on patient anatomy and quality of vasculature. Pre-operative CTA effectively maps perforators, decreases operative time, and decreases morbidity/complications. Post-processing may also help to determine exact tissue volume to be harvested for more targeted reconstruction.

TABLE OF CONTENTS/OUTLINE
1. Autologous breast reconstruction basics (patient selection, aim, timing of surgery, advantages over breast implants). 2. Overview and evolution of flap options with focus on deep inferior epigastric perforator (DIEP) and superior gluteal artery perforator (SGAP) flaps. 3. Overview of pre-operative imaging including Doppler ultrasound, CTA, and MRA. Brief review of literature demonstrating the advantages of CTA with regard to duration of surgery, length of hospitalization, and complication rates. 4. Importance of angiosomes in perforator flap surgery. Alteration of imaging protocols to better determine flap vascular supply and reduce likelihood of fat necrosis. 5. Future directions include 3D printing of perforator flaps for more customized pre-operative planning.

VIE145

Clinical Applications of Single-source Dual-energy CT with Fast kVp Switching in CT Angiography: What the Radiologist Needs to Know

Education Exhibits
Location: VI Community, Learning Center

Participants
Haruhiko Machida MD (Presenter): Nothing to Disclose
Isao Tanaka : Nothing to Disclose
Rika Fukui : Nothing to Disclose
Yun Shen PhD : Employee, General Electric Company Researcher, General Electric Company
Takuya Ishikawa : Nothing to Disclose
Eiko Ueno MD : Nothing to Disclose
He Qing Wang MSc : Nothing to Disclose

TEACHING POINTS
To review limitations of conventional CT angiography (CTA) To describe basic principles and various techniques in single-source
dual-energy CT (DECT) with fast kVp switching to overcome these limitations. To illustrate various clinical applications and advantages using these techniques by presenting clinical images.

TABLE OF CONTENTS/OUTLINE

- Limitations of conventional CTA
  - Iodine contrast medium (CM)/radiation dose
  - Insufficient vessel contrast enhancement (CE)
- Severe calcification
- Limited tissue characterization/perfusion assessment
- Metallic/beam-hardening (BH) artifacts

Basic principles and various techniques in DECT:

- BH correction
- Monochromatic imaging (MI)
- Material density imaging (MDI)
- Energy level (keV)-CT value (HU)
- Curve
- Effective atomic number (Z) histogram
- Iterative reconstruction (IR)

Various clinical applications and advantages:

- CM dose reduction/improved vessel CE: low-keV MI/iodine (water) MDI
- Radiation dose reduction: water (iodine) MDI replacing non-CE CT/IR
- Calcium reduction: iodine (calcium/hydroxyapatite) MDI
- Lipid-rich plaque detection: fat (water) MDI/keV-HU curve/effective Z histogram
- Differentiation among CM, calcification, fresh hematoma: MDI
- Tissue perfusion assessment: iodine (water) MDI

VIE146

Contrast Medium Delivery Strategies and Radiation Dose Parameters Affecting CT Angiography

Education Exhibits

Location: VI Community, Learning Center

Participants

Charbel Saade MS (Presenter): Nothing to Disclose
Fadi M. El-Merhi MD: Nothing to Disclose
Ali A. Haydar MD, FRCP: Nothing to Disclose
Ghaleb Ghusayni: Nothing to Disclose
Salam Al-Hamra: Nothing to Disclose
Mukbil H. Hourani MD: Nothing to Disclose
Bedros Taslakian MD: Nothing to Disclose
Hussain Al-Mohiy: Nothing to Disclose

TEACHING POINTS

- Optimal opacification of the arteries is essential for CTA
- Matching timing with vessel dynamics significantly improves vessel opacification
- This leads to increased arterial opacification and reduced venous opacification
- This can also lead to a reduced volume of contrast agent.
- This can also lead to reduced radiation dose

TABLE OF CONTENTS/OUTLINE

A. Vascular Anatomy
B. Contrast media parameters that affect bolus shaping
C. Scanner parameters that affect vascular opacification
D. Scanner and contrast parameters affect radiation dose
E. Stenosis and aneurysm effects on blood/contrast circulation
F. Pearls and Pitfalls
G. Outcomes

VIE147

Dual Energy CT Angiography with Reduced Iodine Load: A Comprehensive and Practical Approach

Education Exhibits

Location: VI Community, Learning Center

Certificate of Merit

Participants

Patricia M. Carrascosa MD: Research Consultant, General Electric Company
Carlos Capunay MD (Presenter): Nothing to Disclose
Javier Vallejos MD, MBA: Nothing to Disclose
Alejandro Deviggiano MD: Nothing to Disclose
Gaston Rodriguez Granillo: Nothing to Disclose

TEACHING POINTS

1. To review the indications, diagnostic imaging, potential benefits and limitations of performing a dual-energy CT angiography with reduced iodine contrast volume.
2. To understand the advantages of dual energy CT in vascular imaging.

TABLE OF CONTENTS/OUTLINE

A. Introduction to dual energy CT
B. Physics
C. Image analysis
D. Spectral imaging
E. Material decomposition
F. Calcium and bone subtraction
G. CT image acquisition
H. Technical parameters
I. Radiation issues
J. Contrast injection protocol
K. Diagnostic Imaging
L. Potential indications:

VIE148

Eyes Wide Open: Impending Death Signs in Cardiovascular Disease; What Every Radiologist Should Fear

Education Exhibits

Location: VI Community, Learning Center

Participants

Alvaro Acosta Bustillos (Presenter): Nothing to Disclose
**TEACHING POINTS**

1. There are some MDCT findings of impending death in cardiovascular disease that the radiologist should be aware in order to communicate immediately to the medical and surgical team.

2. This signs are aortic rupture, collapse of the true lumen in aortic dissection, contrast-fluid levels in the vena cava, cardiac tamponade, intramural haematoma more than 3 cm, and others.

3. To provide relevant information to the medical team which might be crucial for the appropriate treatment.

**TABLE OF CONTENTS/OUTLINE**

PURPOSE/AIM Review the most common signs of impending death in cardiovascular disease. Describe imaging findings in Multidetector Computed Tomography (MDCT) of impending death in cardiovascular disease. Describe relevant information for clinicians and surgeons provided by MDCT. CONTENT ORGANIZATION (Introduction) common signs of impending death in cardiovascular disease and its clinical relevance. MDCT technique requirements and special considerations. MDCT findings of impending death: of coronary arteries, heart chambers, pericardium, thoracic and abdominal aorta, supraaortic and mesenteric vessels, and IVC. Relevant information for the clinicians and surgeons that might aid in treatment planning.

**VIE149**

**Nitroglycerin Sprays Benefit the Vessel Depiction Performance Improvement in Abdominal CTA**

*Education Exhibits*

*Location: VI Community, Learning Center*

**Participants**

Ryusuke Kujirai RT (Presenter): Nothing to Disclose
Susumu Sato RT : Nothing to Disclose
Ryohei Horisawa RT : Nothing to Disclose
Yutaka Suzuki RT : Nothing to Disclose
Kenichi Ando RT : Nothing to Disclose

**TEACHING POINTS**

Our facility is using nitroglycerin spray in for the purpose of widening the coronary artery in coronary CTA. There is work to dilate the blood vessels throughout the body as well as expand the coronary arteries to nitroglycerin. We have investigated whether also useful in abdominal CTA to use this effect. It was studied in 15 patients taken at 120kV and 80kV. Without nitroglycerin (80kV/120kV) with nitroglycerin (80kV/120kV) Compared patient is 70.4 years average age. Each image was visually evaluated according to the fifth rated of image quality and vascular depiction performance displays in VR. Quality and vascular depiction performance is improved easily by using nitroglycerin. It is possible to be used for different parts and integrated tube voltage.

**TABLE OF CONTENTS/OUTLINE**

Nitroglycerin Spray is possible to enhance the depiction performance while still ensuring the quality of the CTA.

**VIE150**

**Novel Contrast-Injection Protocol for High Resolution Abdominal CT-Angiography: Vascular Visualization Improvement with Vasodilator**

*Education Exhibits*

*Location: VI Community, Learning Center*

Certificate of Merit

**Participants**

Minori Hoshika (Presenter): Nothing to Disclose
Norimi Nishiyama : Nothing to Disclose
Yuki Kobayashi : Nothing to Disclose
Yoshihiro Takeda MD : Nothing to Disclose

**TEACHING POINTS**

To review the advantages and limitations of CT-Angiography(CTA). To provide an explanation of the new examination method and conventional examination methods. Review the usefulness of abdominal CTA with vasodilator (nitroglycerin).

**TABLE OF CONTENTS/OUTLINE**

- Method and characteristic of vascular visualization in CTA. · Description of the high resolution in CTA method: Comparison of GroupA (with nitroglycerin/n=23) and GroupB (without nitroglycerin/n=26) during abdominal CTA. The usefulness of CTA as an operation tool is reported. There is a limitation to the spatial resolution in comparison with Angiography, as rendering the peripheral blood vessels is difficult. In CTA with vasodilator as an operation tool, made available in nearly all cases in Group A, visualization of the pancreaticoduodenal artery and inferior pancreatic artery. Visualization in Group B (without nitroglycerin group) was only about 30% capability. We had same result in case we describe the inferior pancreatic artery. We conclude it is useful to use nitroglycerin for better describing image. Vascular depiction performance is enhanced by the use of the vasodilator. In this new method, without iodine content, flow rate was also increased, and blood vessel depiction performance is possible.

**VIE151**
Optimal Protocol of Scanning Mode for Reducing Contrast Medium Dose and Radiation Dose in Carotid CT Angiography: Low kVp or Low keV Scan

Education Exhibits
Location: VI Community, Learning Center

Participants
Yunjing Xue MD (Presenter): Nothing to Disclose
Qing Duan MD: Nothing to Disclose
Lihong Chen: Nothing to Disclose
Bin Sun: Nothing to Disclose

TEACHING POINTS
1. To describe the basic principles and feasibility of low-tube-voltage carotid CT angiography and Spectral Imaging using ASiR reconstruction in combination with a lower contrast medium dose with clinical data and images. 2. Illustrate optimization of low dose CT scan and low dose contrast medium injection protocol.

TABLE OF CONTENTS/OUTLINE
1. Basic principle and clinical value of low-tube-voltage and GSI monochromatic carotid CT angiography. 2. Optimization of low dose contrast medium injection protocol. 3. Carotid artery image quality evaluation and ASiR optimization. 100-kVp protocol had significantly higher carotid enhancement and sharpness of the artery compared with the 120-kVp protocol. GSI protocol could provide similar image quality of carotid artery to 120-kVp protocol. 4. Both GSI and 100-kVp protocol could significantly reduce the noise of carotid and main branches of thoracic aorta images compared with that of 120-kVp protocol. 5. The GSI (60kev) scan with 50% ASiR and 3 ml/s injection velocity has lowest CM dose and can provide more information of plaque and tissue differentiation. 6. We can balance the image quality, useful information (vessel, plaque, stent, tumor), radiation dose and contrast medium dose all kinds of CT scans parameters to choose the optimized CTA protocol to achieve the best clinical effect.

VIE152
Subtraction CT Angiography for Peripheral Arterial Occlusive Disease Using Semi-automated Position Matching Method

Education Exhibits
Location: VI Community, Learning Center

Participants
Ryoichi Tanaka MD (Presenter): Nothing to Disclose
Kunihiro Yoshioka MD: Nothing to Disclose
Kenta Muranaka: Nothing to Disclose
Akihiko Abiko: Nothing to Disclose
Shigeru Ebara MD: Nothing to Disclose

TEACHING POINTS
The aims of this exhibit are to 1) understand basic concept of subtraction CT angiography. 2) get to know the difference between manual position matching technique and semi-automated position matching technique. 3) come to know the diagnostic accuracy of subtraction CT angiography in comparison with invasive angiography.

TABLE OF CONTENTS/OUTLINE
A. Back ground: the limitations in current imaging procedures for peripheral arterial occlusive disease - including invasiveness in conventional angiography, radiation dose, renal dysfunction due to arteriosclerosis, and time consuming post processing and evaluation.
B. Advantage of subtraction CT angiography: its accuracy in comparison with digital subtraction angiography.
C. Position matching technique for subtraction CT angiography: the basic technique required in scanning and post-processing techniques
D. Clinical application: Presentation in case with severe arterial calcification including cases who underwent hemodialysis

VIE153
The Application Value of Quantitative Iodine-based Substance Mappings in Diagnosing Pulmonary Embolism (PE)

Education Exhibits
Location: VI Community, Learning Center

Participants
Tingting Lin (Presenter): Nothing to Disclose
Jiang Ning Dong: Nothing to Disclose

TEACHING POINTS
1. To assess the value of ration-based iodine substance mappings of CT imaging in diagnosing 2. To reflect the effects of different types of PE and diameters of emboli 3. To provide more morphological and functional information for the diagnosis of PE

TABLE OF CONTENTS/OUTLINE
Relationship of perfusion changes of ration iodine-based substance mappings with embolized locations of conventional CTPA, Perfusion changes of ration iodine-based substance mappings - different types of PE - diameters of emboli Future directions and summary
**VIE154**

**Upper Extremity CTA: Clinical Applications in the Subacute Setting**

**Education Exhibits**

Location: VI Community, Learning Center

**Participants**

Radhika B. Dave MD (Presenter): Nothing to Disclose  
Dominik Fleischmann MD: Research support, Siemens AG

**TEACHING POINTS**

1. Arterial phase images are crucial for the evaluation of aneurysm, stenosis, and occlusion in vasculitis. Delayed venous phase images are helpful to evaluate for wall enhancement. 2. Vasculitis demonstrates smoothly tapered luminal narrowing compared to irregular luminal contour seen in stenosis secondary to atherosclerotic disease. 3. Imaging with the extremity in both the adducted and abducted positions can facilitate the diagnosis of thoracic outlet syndrome. 4. Warming of the hand prior to CTA can be helpful to differentiate true arterial stenoses from vasospasm.

**TABLE OF CONTENTS/OUTLINE**

Upper extremity CTA has found a niche in the assessment of acute vascular injury. However, its less well known subacute applications involve evaluation of vasculitis, vascular malformations, overuse syndromes, and connective tissue diseases.  
- Vasculitis: Aneurysms, stenosis, and wall thickening  
- Arteriovenous malformations: Delineation of arterial and venous supply  
- Evaluation of subfacial and intramuscular components  
- Relationships to neurovascular bundles  
- Compression syndromes such as thoracic outlet syndrome: Variations of patient positioning to facilitate diagnosis  
- Imaging findings  
- Connective tissue disorders: Vascular and extravascular imaging findings  
- Imaging techniques to facilitate diagnosis of true arterial stenoses

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**VIE155**

**Arteriovenous (AV) Grafts and Fistulas for Hemodialysis Access—The Role of MDCT with CT Angiography and 3-D Reconstructions in Delineating Anatomy and Identifying Complications**

**Education Exhibits**

Location: VI Community, Learning Center

**Participants**

Sameer Ahmed MD (Presenter): Nothing to Disclose  
Siva P. Raman MD: Nothing to Disclose  

**TEACHING POINTS**

1. Understand different available options for hemodialysis, including arteriovenous (AV) grafts, AV fistulas, hemodialysis catheters, and peritoneal dialysis, including the benefits and downsides of each method.  
2. Understand the normal imaging appearance on MDCT of AV grafts and fistulas, including different potential locations for their placement and their relationship to adjacent vasculature.  
3. Understand proper construction of a CT protocol designed to evaluate a graft or fistula.  
4. Recognize a number of complications of grafts and fistulas that may be visible on MDCT.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction  
   - Different types of hemodialysis access options available and their appropriateness in different situations  
   - Detailed discussion of grafts and fistulas, including the manner in which they are placed and the difference between grafts and fistulas  
2. Anatomy  
   - Locations in which grafts and fistulas can be placed  
   - Different possible vascular communications which can be created  
   - Original artwork illustrating both fistulas and grafts from our in-house medical illustrator  
3. MDCT appearance of normal grafts and fistulas.  
4. Complications which can be recognized on MDCT, with case examples  
   - Stenosis  
   - Thrombosis  
   - Aneurysms/Pseudoaneurysms  
   - Ischemia/Steal syndrome  
   - Infection

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**VIE156**

**Dialysis Access in a Nutshell**

**Education Exhibits**

Location: VI Community, Learning Center

**Participants**

Aparna Srinivasa Babu MD (Presenter): Nothing to Disclose  
Salmi Simmons MD: Nothing to Disclose

**TEACHING POINTS**

- Routes of dialysis access  
- Relevant anatomy and physiology  
- Pictorial illustration based instruction on types of dialysis access
• Recognition of different types of dialysis access routes on imaging studies • "Fistula first" initiative • Novel approaches and anticipated developments

TABLE OF CONTENTS/OUTLINE

After establishing the magnitude of the problem that renal disease poses in today’s society, we will introduce the readers to the historical perspective of dialysis. Subsequently, we will explore the anatomical and physiological principles involved in obtaining and maintaining an access route for dialysis. The "Fistula first" initiative will be discussed in this section. This will be followed by a discussion of types of dialysis access, including HD catheters, grafts, fistulas and PD catheters. Potential complications and their management will be examined. We will demonstrate multimodality imaging appearances of catheters, grafts and fistulas, with pictorial illustration of imaging findings to provide a better understanding. This section will also focus on imaging characteristics that enable recognition of different types of catheters, grafts and fistulas. Finally, we will summarize our presentation and take a brief peek into future trends and emerging innovations.

VIE157

To Stent or Not to Stent? Comprehensive Review of Endovascular Stent Indications, Complications, and Controversies in Dialysis Access

Education Exhibits
Location: VI Community, Learning Center

Participants
Michael Ginsburg MD (Presenter): Nothing to Disclose
Jonathan Matthew Lorenz MD : Nothing to Disclose
Sean P. Zivin MD : Nothing to Disclose

TEACHING POINTS

1. To review the common categories of endovascular stents 2. To describe the indications for endovascular stent placement in hemodialysis access with an up-to-date literature review 3. To learn about potential stent complications and become familiar with management of fractured, misplaced and migrated endovascular stents

TABLE OF CONTENTS/OUTLINE

Dialysis Access Endovascular Stent Categories - Self-expandable stents (Bare metal stents) • Stainless steel • Nitinol alloys - Stent grafts (Covered Stents) - Balloon expandable stent (Mostly unsuitable for central and peripheral venous interventions) - Drug-eluting stents (Not yet evaluated clinically) Indications for Stent Placement in Dialysis Vascular Access Abnormalities, Up-To-Date Literature Review and Case Based Examples - Recurrent stenosis - Elastic lesion - Vein rupture - Venous anastomosis stenosis - Extrinsic compression - Pseudoaneurysm formation - In-stent retenosis Endovascular Stent Complications, Controversies and Case Based Illustration of Management Options - Stent Fracture - Stent Misplacement - Stent Migration

VIE158

Totally Implantable Venous Access Systems (Ports): Post-procedural Complications and Management

Education Exhibits
Location: VI Community, Learning Center

Participants
Katsuhiro Kobayashi MD (Presenter): Nothing to Disclose
Rahul Nayyar MD : Nothing to Disclose
Mohammed Jawed MD : Nothing to Disclose
Dianbo Zhang MD : Nothing to Disclose
Mark Alfred Sultenfuss MD : Nothing to Disclose
Mitchell Ira Karmel MD : Nothing to Disclose

TEACHING POINTS

1. Review venous anatomy relevant to proper port placement 2. Describe patient-related and port placement technique-related reisk factors for postprocedural port complications. 3. Discuss port-related postprocedural complications and their management.

TABLE OF CONTENTS/OUTLINE

1) Central venous anatomy relevant to proper port placement 2) Proper port placement technique with emphasis on patient-related and port placement technique-related risk factors for postprocedural port complications 3) Postprocedudural port complications and their management - infectious (port site infection, catheter-related blood stream infection) - mechanical (catheter migration/kink/fracture, catheter fragment embolization, Twiddler's syndrome, etc.) - thrombotic (fibrin sheath formation, venous stenotic/thrombotic) 4) Diagnostic algorithm for malfunctioning ports 5) Conclusions

VIE159

Magnetic Resonance Angiography Applications in Reconstructive Plastic Surgery

Education Exhibits
Location: VI Community, Learning Center

Participants
Ana Fernandez (Presenter): Nothing to Disclose
Ana Alvarez Vazquez : Nothing to Disclose
Chawar Hayoun : Nothing to Disclose
Mar Jimenez De La Pena : Nothing to Disclose
Vicente Martinez de Vega : Nothing to Disclose

TEACHING POINTS

- to know the several techniques that are available for the preoperative mapping of perforating vessels: Doppler ultrasound, computed tomography-angiography (CTA), and, more recently, magnetic resonance angiography (MRA). - to emphasize the role
of MRA for being a technique free of ionizing radiation and provides accurate anatomical information. Despite being a minority issue in the field of radiology, advances in reconstructive surgery perforator flaps make it necessary to deep in the knowledge of this technique. - to know different techniques MRA and advances in non contrast enhanced MRA.

TABLE OF CONTENTS/OUTLINE
- Review of MRA techniques used in mapping perforators.
- MRA applications in DIEP, gluteal, thigh and lower limb flaps.

**VIE160**

**A Resident-Driven How-To Guide for the Creation of Low-Cost Gelatin Phantoms for Training in Ultrasound and Fluoroscopically Guided Percutaneous Procedures**

*Education Exhibits*

*Location: VI Community, Learning Center*

**Participants**

- Stephen Aaron Balfour MD (Presenter): Nothing to Disclose
- Pratik S. Patel DO: Nothing to Disclose
- David Scott Pryluck MD: Nothing to Disclose

**TEACHING POINTS**

The construction of gelatin-based phantoms for teaching radiology residents and medical students to perform ultrasound and fluoroscopically-guided procedures can be easily accomplished with readily available materials and little cost. By viewing this exhibit, learners will gain the fundamental knowledge to assemble a variety of phantom models, including solid visceral organs and vascular structures, for laboratory training of residents and medical students at their home institutions. This exhibit will also demonstrate a proposed curriculum for formally implementing phantom models in resident and medical student education.

**TABLE OF CONTENTS/OUTLINE**

1) Brief review of medical literature regarding the construction of gelatin-based phantoms for resident and medical student education.
2) Pictorial guide with detailed descriptions for assembling gelatin-based phantoms of visceral organs including liver and kidney for simulation of percutaneous procedures.
3) Pictorial guide with detailed descriptions for assembling gelatin-based phantoms of vascular structures for simulation of venous and arterial access.
4) A review of suggested training curriculum incorporating gelatin-based phantoms in radiology resident and medical student education.

**VIE161**

**Advanced Image Guided Percutaneous Technique for the Placement of Peritoneal Dialysis Catheters**

*Education Exhibits*

*Location: VI Community, Learning Center*

Certificate of Merit

**Participants**

- Todd Ellis Drasin MD, MPH (Presenter): Nothing to Disclose
- Paul Erik Dybbro MD: Nothing to Disclose

**TEACHING POINTS**

1. Importance of peritoneal dialysis in renal replacement therapy armamentarium 2. Advantages/disadvantages of image guided percutaneous catheter placement vs gold standard advanced laparoscopic catheter placement.
3. The pre-procedure considerations, procedural technique, and post procedure protocols that make up our advanced image guided percutaneous technique for the placement of peritoneal dialysis catheters.
4. Data supports that, in selected patients, the advanced percutaneous and laparoscopic techniques are comparable with respect to technical success, catheter survival, and complications.

**TABLE OF CONTENTS/OUTLINE**

A. Role of peritoneal dialysis in renal replacement therapy 1) What is peritoneal dialysis? 2) Advantages/disadvantages versus hemodialysis B. Current peritoneal dialysis catheter placement gold standard - advanced laparoscopic technique 1) Critical technical components that define the 'advanced laparoscopic' technique C. Advanced image guided percutaneous technique for the placement of peritoneal dialysis catheters 1) Pros and cons relative to surgical gold standard 2) Pre-procedure considerations 3) Procedural steps with imaging correlation 4) Post procedure care D. Outcomes 1) Technical success, catheter survival, complications

**VIE162**

**Billing and Coding for Procedures: A Necessary Primer for Interventional Radiologists**

*Education Exhibits*

*Location: VI Community, Learning Center*

Certificate of Merit

**Participants**

- Kevin Ching MD (Presenter): Nothing to Disclose
- Christopher John Friend MD: Nothing to Disclose
- Ernesto Santos MD: Nothing to Disclose
- Rakesh Khubchand Varma MBBS, MD: Nothing to Disclose
TEACHING POINTS
1. An astute knowledge of billing and coding is essential for interventional radiologists as under billing may jeopardize the finances of a practice while overbilling constitutes medical fraud. 2. Physicians must be informed of specific terminology, the break down of physician reimbursement, and importance of accurate billing and coding. 3. Our exhibit reviews need to know information on this topic in a straightforward and understandable format.

TABLE OF CONTENTS/OUTLINE
1) Appropriate usage of current procedural terminology (CPT) codes and modifiers 2) Relative based relative value work scale (RBRVS), Relative value units (RVU), Conversion factors (CF) and how to calculate payment 3) What makes up a Global Payment 4) Professional fees: physician work, practice expense, and malpractice expense 5) Geographic practice cost index (GPCI): why the cost of care varies by region 6) ICD-9: an appropriate indication is essential for payment 7) Global periods: what is included after the procedure and for how long 8) Coding for multiple procedure on the same day and bundling of payments 9) Current RVU's for common interventional radiology procedures 10) Key concepts will be emphasized using case examples of everyday procedures.

VIE163
Choosing the Right Path: A Percutaneous Biopsy Quiz

Education Exhibits
Location: VI Community, Learning Center

Participants
Adam DeFoe MD (Presenter): Nothing to Disclose
Louis Morel MD: Nothing to Disclose
Adam Stibbe MD: Nothing to Disclose
Shawn Stone: Nothing to Disclose

TEACHING POINTS
- Explore the best routes for percutaneous biopsy of multiple lesions/organs via a quiz format, with emphasis on the shortest, safest path.
- Learn which modality to choose for percutaneous biopsy of different lesions.
- Learn the common risks and complications associated with percutaneous biopsies.
- Apply the above knowledge to future cases, including on board exams.

TABLE OF CONTENTS/OUTLINE
Lesions warranting biopsy will be presented as one or more CT images, followed by multiple choice quiz questions regarding percutaneous biopsy of the lesion. These questions include: Which lesion (if multiple) will you select to biopsy? What modality would you choose for biopsy guidance? Which route will you take to access the lesion? The questions will be followed by justification for the best answer to emphasize the learning objectives, including images depicting the actual biopsy. A brief discussion of risks and complications will also be included with each case.

VIE164
Endovascular Management of Complicated Aortic Dissections

Education Exhibits
Location: VI Community, Learning Center

Participants
John Bao Minh Chung MD (Presenter): Nothing to Disclose
Avnesh Sinh Thakor MBCHIR, PhD: Nothing to Disclose
Richard James Cormack MD: Nothing to Disclose
Roshni Pravin Patel MRCS, BSc: Nothing to Disclose
Darren Klass MD, PhD: Nothing to Disclose

TEACHING POINTS
1.) The reader will recognize what constitutes a complicated aortic dissection.
2.) The reader will be aware of the treatment algorithm to manage patients presenting with complicated aortic dissections.
3.) The reader will understand the methodology of treating such patients endovascularly using a combination of proximal covered stents as well as non-covered dissection stents.

TABLE OF CONTENTS/OUTLINE
Introduction: - Define what constitutes a complicated aortic dissection; - Discuss the prevalence of this condition and the population cohort it usually affects; - Discuss morbidity/mortality associated with untreated complicated aortic dissection.
Historical Treatment Algorithm: - Outline initial medical management, followed by consideration for surgery; - Discuss traditional surgical repair and outcomes from surgical treatment. Endovascular Management Algorithm: - Outline requisite steps to stabilize patient and evaluate vascular anatomy; - Discuss how to size covered stent grafts as well as non-covered stents; - Step-by-step guide to placement of a dissection endovascular prosthesis; - Discuss our center’s experience with a small patient cohort (n=6 at time of abstract submission), including clinical presentation, therapy provided, and short to medium term outcomes.

VIE165
How to Improve Teaching in Interventional Radiology: Description and Comparison of Methods for Composing and Building Vessel Models for Real Life Simulation

Education Exhibits
Location: VI Community, Learning Center
Certificate of Merit
Participants
Marcus Treitl MD (Presenter): Nothing to Disclose
Maximilian F. Reiser MD : Nothing to Disclose
Karla Maria Treitl MD : Nothing to Disclose

TEACHING POINTS
We developed different methods to build low cost silicone vessel models that allow for repeat production of custom made vessel trees that simulate real life patient anatomy and allow e.g. real life simulation of a future procedure. We compare hand made wax forms for production of silicone models to high tech 3D printing with silicone and low cost 3D printing with plastic and the behavior and realism of these models in a perfusion model. The steps for manufacturing of these models are described in detail and advise is given how to implement these procedures into the own departmental workflow.

TABLE OF CONTENTS/OUTLINE
A. Problem of teaching interventional procedures. B. Role of custom made silicone simulators in future. C. Analysis of possible ways the build low cost silicone vessel models. D. Building reproducible wax models. E. Options for 3D design of vessel models for 3D printing out of CT data sets. F. Using desktop 3D printers with PLA plastic. F. Using 3rd party 3D silicone printers. G. Description of the behavior and haptic of the available models. H. How to set up a silicone vessel production and their use for teaching in the own department. I. Future and outlook.

VIE166
Image Acquisition and Guidance Systems: An Introduction for Interventional Radiology Trainees
Education Exhibits
Location: VI Community, Learning Center

Participants
Alex Singleton MD (Presenter): Nothing to Disclose
Lulu He DO : Nothing to Disclose
Michelle Morgan RT : Nothing to Disclose
Ram Kishore Reddy Gurajala MBBS, FRCR : Nothing to Disclose
Charles Martin MD : Nothing to Disclose
Karunakaravel Karuppasamy MBBS, FRCR : Nothing to Disclose

TEACHING POINTS
The goal of this exhibit is To help radiology residents and fellows improve equipment utilization in an interventional radiology (IR) suite. To describe commonly used image acquisitions and post processing tools. To compare the relative radiation dose and image quality of acquisition methods. To exhibit cases demonstrating different acquisition methods and their application.

TABLE OF CONTENTS/OUTLINE
A. Introduction: A new user is often puzzled at the user interface in an advanced IR system. Understanding different image acquisition methods allows us to use them to our advantage. This exhibit attempts to demystify the role played by these acquisition methods. B. Digital Radiography Single digital exposure Fluoroscopy C. Digital subtraction Radiography Road-map Reference image fade D. C-Arm Cone-beam Computed Tomography (CBCT) 3D anatomical demonstration 3D-3D volumetric fusion Needle guidance system Live 2D over 3D guidance Live scheme display E. Cases F. Summary: Radiologists-in-training are often overwhelmed by the complex user interface in an interventional radiology suite. Familiarity with the basic modes of image acquisition and utilization will enhance trainee participation during procedures and their interaction within IR team.

VIE167
Modular Design of a Mobile Web-app for Clinical Decision Support, Education, Reference, and Communication for Interventional Radiology
Education Exhibits
Location: VI Community, Learning Center

Participants
Loyrirk Temiyakarn MD (Presenter): Nothing to Disclose
Neil Shah MD : Nothing to Disclose
Adeel Siddiqui MBBS : Nothing to Disclose
Asim F. Choudhri MD : Nothing to Disclose

Background
The role of the modern interventional radiologist (IR) is constantly evolving. Keeping up to date with the latest techniques and criteria can be a daunting task, especially in a busy practice. Mobile decision support tools can help overcome this barrier at all levels of training. Modular mobile web-apps have the potential to educate while lowering communication barriers and facilitating safe, timely, efficient, and effective patient care.

Evaluation
A modular mobile web-app decision support and reference tool was designed for IRs to include appropriateness criteria, grading systems, radiation dose comparison, radiation dose tracking for patients and IRs, reference material on anatomy, catheters and drugs, and patient instructions. Separate modules were optimized for different levels of training including medical students, residents, fellows, and staff physicians. Modules were also tailored for separate facilities within an academic medical center. Additional modules to aid communication included shift/call schedules, contact information, and integrated text paging.

Discussion
Although the quality improvement metrics are still being collected, initial feedback on the design has been overwhelmingly positive. Feedback will be used to improve and optimize the web-app and develop new modules as the demand arises.

Conclusion
Mobile decision support, reference, education, and communication tools have potential to benefit interventional radiologists at all levels of training in providing safe, timely, efficient, and effective patient care. A modular web-app ensures dynamic, up-to-date information customizable for all levels of training and all facilities within multi-facility academic medical centers.

VIE168

Multidisciplinary Approach of Vascular Anomalies: Classification, Diagnosis and Treatment

Education Exhibits
Location: VI Community, Learning Center

Participants
Nerea Hormaza MD (Presenter): Nothing to Disclose
Juliana Mesa : Nothing to Disclose
Beatriz Mateos-Goni : Nothing to Disclose
Ruth Gonzalez Sanchez : Nothing to Disclose
Inaki Escudero : Nothing to Disclose
Armando Gozalo Garcia : Nothing to Disclose
Xabier Tomas Izquierdo Penafiel MD : Nothing to Disclose
Maria Rosario Gonzalez-Hermosa : Nothing to Disclose

TEACHING POINTS
-To review the spectrum of vascular anomalies according to ISSVA 1996 classification, radiological diagnosis and treatment. -To recognize some misnomers for frequently seen vascular anomalies which the radiologist should be aware of. -To remark the importance of Vascular Anomalies Committees to achieve a correct diagnostic and therapeutic management of these lesions.

TABLE OF CONTENTS/OUTLINE
Vascular anomalies encompass a broad spectrum of lesions, often described using an overlapping and confusing terminology. Since 1996 there is a broadly accepted classification published by the ISSVA based on the histological characteristics. The importance of Vascular Anomalies Committees lies in the need for an unified diagnosis through the experience of multiple experts which enables a correct management. Multiple imaging techniques are available such as US-Doppler, MRI, CT, angiography, plain film: the utility of each modality is shown in this exhibit. Considering that imaging guided procedures are frequently the treatment of choice, interventional techniques are also shown. A pictorial review of vascular anomalies is made showing some complex cases that were presented in the Vascular Anomalies Committee of our institution. Imaging clues are provided to recognize and to make a proper classification of each anomaly with an appropriate terminology.

VIE169

Operator Radiation Dose Reduction during Fluoroscopic Interventional Procedures in an Academic Setting

Education Exhibits
Location: VI Community, Learning Center

Participants
Arun C. Nachiappan MD : Nothing to Disclose
Gary Lloyd Horn MD (Presenter): Nothing to Disclose
Ray C. Mayo MD : Nothing to Disclose
David Matthew Wynne MD : Nothing to Disclose
Benjamin R. Archer PhD : Nothing to Disclose
John Austin Hancock MD : Nothing to Disclose
Cliff J. Whigham DO : Nothing to Disclose

TEACHING POINTS
1) Review various sources of operator radiation dose during fluoroscopy. 2) Describe methods to decrease operator dose, which include appropriate shielding use, optimal positioning of operator and patient, collimation, lower fluoroscopic frame rate, and judicious use of digital subtraction angiography. 3) Discuss how one can institute a radiation safety educational program at one’s own institution.

TABLE OF CONTENTS/OUTLINE
1) Overview of sources of radiation to which the fluoroscopy operator is exposed. 2) Review of operator and patient dose monitoring methods 3) Review of department-wide strategies to lower operator radiation dose, including lowering fluoroscopy time, setting reference levels, encouraging vendor interaction, and hands-on orientation for new resident operators. 4) Discussion of steps to monitor and reevaluate educational program and ideas to incentivize decreased operator dose.

VIE170

Patient Anxiety before and Interventional Radiologic Procedures: Guiding the Radiologists Towards a More Patient-centered Role

Education Exhibits
Location: VI Community, Learning Center

Certificate of Merit

Participants
Khalid Walid Shaqdan MD (Presenter): Nothing to Disclose
Shima Aran MD : Nothing to Disclose
Elmira Hassanzadeh MD : Nothing to Disclose
Hani H. Abujudeh MD, MBA : Research Grant, Bracco Group Consultant, RCG HealthCare Consulting Author, Oxford University Press

TEACHING POINTS
• Minimally invasive procedures increasingly replace open surgery and reduce the need for general anesthesia. • Although
interventional radiology treatments offer less risk, pain and recovery time when compared to open surgery, patients nonetheless may be anxious about them and their outcomes. The aim of this exhibit is to explain physician etiquettes, assessment methods, environmental factors, communication techniques, and recent research findings to reduce patient anxiety and improve overall experience in the interventional practice.

### TABLE OF CONTENTS/OUTLINE

- Background/Literature review:
  - Harmful effects of patient anxiety
  - Role of radiologists in improving patient experience
  - ACR Imaging 3.0 campaign
  - "Program to enhance relational communicational skills-Radiology"
  - How other specialties deal with patient anxiety
  - How to maintain a low anxiety environment:
    - Quick patient assessment
    - Spielberger and colleagues "State–Trait Anxiety Inventory (STAI)"
    - Standardized guidelines
    - Physician etiquettes
    - Bedside manners
    - Environmental factors
    - Discussion techniques
    - Appropriate ways to deliver unexpected news to the patient
- Recent research
  - Video goggles worn by patient during IR procedure showing soothing non-violent videos

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**VIE171**

**Percutaneous Abscess and Fluid-Collection Drainage: A Primer for Every Interventional Radiology Resident/Fellow**

*Education Exhibits*

*Location: VI Community, Learning Center*

**Participants**

- Masashi Tamura (Presenter): Nothing to Disclose
- Seishi Nakatsu MD: Nothing to Disclose
- Yosuke Suyama: Nothing to Disclose
- Jitsuro Tsukada: Nothing to Disclose
- Nobutake Ito MD: Nothing to Disclose
- Sota Oguro: Nothing to Disclose
- Hideki Yashiro MD: Nothing to Disclose
- Masanori Inoue MD: Nothing to Disclose
- Masahi Jinzaki MD: Nothing to Disclose

**TEACHING POINTS**

Percutaneous drainage is an effective and safe method for treating abscess and fluid-collection. We describe and illustrate the principle and various techniques of percutaneous abscess and fluid-collection drainage. By viewing this exhibit, the readers will

1. Understand when you should perform percutaneous drainage or not.
2. Be able to choose appropriate device and imaging guidance.
3. Learn how to safely perform percutaneous drainage using basic technique and to manage the catheter.
4. Get further technique for drainage of the apparently inaccessible, challenging lesion.

### TABLE OF CONTENTS/OUTLINE

1. Introduction
2. Clinical Indication and Contraindication
3. Planning and Imaging Guidance
4. Device and Basic technique
   a. Device
   b. Puncture and Catheter Placement
      i) Seldinger Method
      ii) Modified Trocar Method
   c. Management of Catheter
      i) The Principle of Management of Catheter
      ii) Timing of Catheter Removal
      iii) Catheter-related Problems
5. Further Technique for Apparently Inaccessible Lesion
   a. Three Dimensional Puncture: Multislice CT Fluoroscopy, ISOP Method
   b. Creation of Artificial Window: Hydro- or Pneumo-dissection
   c. Traverse of Organ
   d. Tractography and Progress of Catheter by Using Hydrophilic Guide Wire and Seeking Catheter

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**VIE172**

**Percutaneous Spinal Cement Augmentation: Status Quo and Future Directions**

*Education Exhibits*

*Location: VI Community, Learning Center*

👩‍🎓 Cum Laude

**Participants**

- Uei Pua, MBBS, FRCR (Presenter): Nothing to Disclose

**TEACHING POINTS**

1) Understand the indications and contraindications for cement augmentation, namely; vertebroplasty, kyphoplasty and stentoplasty (vertebral body stenting)
2) Understand current techniques and advances in the area of cement augmentation

### TABLE OF CONTENTS/OUTLINE

By the end of the exhibit, the reader will be familiar with the following: Pre-procedural assessment for cement augmentation (case selection): 1) Imaging assessment: Conventional radiography AND MRI 2) Morphological assessment for suitability: i) AO classification of vertebral fractures ii) Tomita classification of vertebral involvement in metastatic disease 3) Clinical assessment: Visual analog scale, Oswestry Disability Index, response to conventional treatment Conventional technique and complications of cement augmentation techniques: 1) Principles fluoroscopic planes and needle trajectory 2) Tools and differences of the various techniques 3) Principles of cement filling and complications Advances and future directions in cement augmentation 1) Advances in techniques: Unipedicular approaches 2) Advances in imaging: Cone beam CT 3) Use of non-cement fillers: e.g. allogenic
### VIE173

**Peri-Procedural Anticoagulant Management**

*Education Exhibits*

*Location: VI Community, Learning Center*

**Participants**

- Brendan Patrick McMenomy MD (Presenter): Nothing to Disclose
- Anil Nicholas Kurup MD: Nothing to Disclose
- Patrick Wade Eiken MD: Nothing to Disclose
- Jonathan Michael Morris MD: Nothing to Disclose
- Robert McBane MD: Nothing to Disclose
- Thomas Duncan Atwell MD: Nothing to Disclose

**TEACHING POINTS**

1. Summary of anticoagulation medications encountered in clinical practice.
2. Suggested periprocedural guidelines for management of different anticoagulation medications when performing percutaneous imaging-guided procedures.

**TABLE OF CONTENTS/OUTLINE**

- Anti-Platelet Agents Medication List
- Suggested Periprocedural Guidelines for Antiplatelet Agents
- Vitamin K Antagonists Medication List
- Suggested Periprocedural Guidelines for Vitamin K Antagonists
- Heparins Medication List
- Suggested Periprocedural Guidelines for Heparins
- Direct Thrombin Inhibitors Medication List
- Suggested Periprocedural Guidelines for Direct Thrombin Inhibitors
- Direct Factor Xa Inhibitors Medication List
- Suggested Periprocedural Guidelines for Direct Factor Xa Inhibitors
- Glycoprotein IIb/IIIa Antagonists Medication List
- Suggested Periprocedural Guidelines for Glycoprotein IIb/IIIa Antagonists
- Suggested Periprocedural Laboratory Screening Guidelines
- Correction of Coagulation Abnormalities

### VIE177

**Vascular and Lymphatic Imaging for Plastic and Reconstructive Surgery: A Primer for the Radiologist**

*Education Exhibits*

*Location: VI Community, Learning Center*

**Certificate of Merit**

**Participants**

- Shigeyoshi Soga MD (Presenter): Nothing to Disclose
- Hiroshi Shinmoto MD: Nothing to Disclose
- Teppei Okamura MD: Nothing to Disclose
- Nobuyuki Yoshihara: Nothing to Disclose
- Tsuyoshi Soya: Nothing to Disclose
- Tsuyumi Kaji MD: Nothing to Disclose
- Fumio Ohnishi: Nothing to Disclose
- Toshiharu Minabe: Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is to detail:

1. Surgical anatomy and principles of microvascular flap reconstruction and lymphatic reconstructive surgery.
2. Role of vascular and lymphatic imaging
3. Comparison of imaging protocols and modalities, including CT, MR, US, lymphoscintigraphy, and fluorescence imaging.
4. Image post-processing for submillimeter vessels and lymphatics.

**TABLE OF CONTENTS/OUTLINE**

1. Surgical procedures
   - Microsurgical flap procedures
   - Lymphatic-venous anastomosis for the treatment of lymphedema
2. Microsurgical anatomy
3. Imaging protocols and clinical impact for plastic and reconstructive surgery
4. Vascular imaging: CT/MR angiography for reconstructive surgery, ranging from breast and head/neck reconstruction to facial transplantation
5. Lymphatic imaging: high-resolution isotropic 3D MR lymphangiography and lymphoscintigraphy
6. Imaging and surgical findings
7. Comparison of imaging modalities (CT, MR, US, lymphoscintigraphy, and near-infrared fluorescence imaging), as well as review of existing literatures
8. Future directions and summary

### VIE178

**Who Needs Glue: Exploring New Percutaneous Biological Sealants in Interventional Radiology**

*Education Exhibits*

*Location: VI Community, Learning Center*

**Certificate of Merit**

**Participants**

- Vibhor Wadhwa MBBS (Presenter): Nothing to Disclose
- Clifford Raabe Weiss MD: Research collaboration, Siemens AG
- Brian Philip Holly MD: Nothing to Disclose
- Todd Schlacltert MD: Nothing to Disclose
- Anobel Tamrazi MD, PhD: Nothing to Disclose

**TEACHING POINTS**

1. Review the biological sealants used in various surgical specialties and with potential use in IR procedures especially for bowel transplantation.
1. Review the biological sealants used in various surgical specialties and with potential use in IR procedures especially for bowel leaks and fistulae. 2. Explain with relevant case examples the utility of different biological sealants in IR.

**TABLE OF CONTENTS/OUTLINE**

1. List the new generation biological sealants used in various surgical specialities, with potential use in IR.
2. Present relevant cases showing the utility of these sealants.
3. Illustrate sealant preparation and deployment technique.

**VIE179**

*Case Based Review of Renal Interventions: From Indications to Completion. Primer for Radiology Residents and Fellows*

*Education Exhibits*

*Location: VI Community, Learning Center*

*Selected for RadioGraphics*

**Participants**

Jay Patel MD (Presenter): Nothing to Disclose
Nisshih Patel MD: Nothing to Disclose
Sean Keith Calhoun DO: Nothing to Disclose
Thaddeus M. Yablonsky MD: Nothing to Disclose

**TEACHING POINTS**

1. Review the indications, patient preparation and equipment for various renal interventions
2. Learn multimodality features of a variety of renal pathology
3. Discuss interventional treatment options, technical considerations and common complications of these interventions

**TABLE OF CONTENTS/OUTLINE**

The indications, patient preparation and equipment for each case will be reviewed, followed by a discussion of multimodality imaging features. Interventional treatment options, technical considerations and common complications will also be reviewed. Topics presented include:

**Embolization:**
- Renal arteriovenous fistula
- Renal arteriovenous malformation
- Renal angiomyolipoma
- Renal cell carcinoma
- Renal Trauma

**Drainage:**
- Renal and perinephric abscesses
- Percutaneous nephrostomy
- Ureteral stenting

**Other:**
- Percutaneous transluminal angioplasty - fibromuscular dysplasia
- Radiofrequency ablation - oncocytoma
- Stenting - renal artery stenosis
- Percutaneous nephrolithotomy

**VIE180**

*Clinical Outcome of Percutaneous Transhepatic Obliteration for Anorectal Varices*

*Education Exhibits*

*Location: VI Community, Learning Center*

**Participants**

Tetsuya Minami MD (Presenter): Nothing to Disclose
Satoshi Kobayashi MD: Nothing to Disclose
Toshifumi Gabata MD: Nothing to Disclose
Osamu Matsui MD: Research Consultant, Kowa Company, Ltd Research Consultant, Otsuka Holdings Co, Ltd Research Consultant, Eisai Co, Ltd Speakers Bureau, Bayer AG Speakers Bureau, Eisai Co, Ltd

**PURPOSE**

From anorectal varices is quite rare, but they can lead to a life-threatening hemorrhage because of their high flow rate and volume. Treatment of anorectal varices has not yet been established. We are able to control six cases of the varices by percutaneous transhepatic obliteration (PTO).

**METHOD AND MATERIALS**

From 2004 to 2013, six patients (67-80 years old) who suffered anorectal varices induced by portal hypertension were enrolled this study. All six women were treated with balloon-occluded antegrade transvenous sclerotherapy by 5% ethanolamine oleate iopamidole (EU) via percutaneous transhepatic approach.

**RESULTS**
Four patients were successfully treated after one procedure, and one patient required twice treatment. In the case of rest one patient, the varices could be controlled by twice PTO and partial splenic embolization.

CONCLUSION

This study suggests that PTO by using EOI may be good treatment for anorectal varices.

CLINICAL RELEVANCE/APPLICATION

Varices develop at any site of GI tract in patient with portal hypertension. Recently, the frequency of anorectal varices is reported as higher than before. bleeding from anorectal varices can lead to a life-threatening hemorrhage. No therapeutic strategy has yet been established. Our method using ethanolamine is effective treatment for anorectal varices.

VIE181

Cryoablation of Exophytic Neoplasms: Novel Minimally Invasive Approach to Treat Unresectable Tumors

Education Exhibits
Location: VI Community, Learning Center

Participants

Luke Gerges DO (Presenter): Nothing to Disclose
Maryam Gu : Nothing to Disclose
Ammar Ahmed Chaudhry MD: Nothing to Disclose
Jung Hwoon Edward Yoon MD: Nothing to Disclose
David Schulsinger: Nothing to Disclose
John Alexander Ferretti MD: Nothing to Disclose

TEACHING POINTS

1. Review indications, interventional methods, contraindications, complications, pearls and pitfalls of percutaneous cryoablation.
2. Cryoablation was previously not recommended for perivascular and pericolonic neoplasms due to heat sink effects and potential damage to adjacent organs. We will discuss novel approach to treat these previously ‘do NOT cryoablate’ lesions and how to minimize potential risks while obtaining an appropriate size ablation zone. 3. Algorithm to help determine the best treatment modality in managing renal masses.

TABLE OF CONTENTS/OUTLINE

A. Anatomy- Effect of cryoablation on vessels, small and large intestines, abdominal wall, etc. B. Clinical Findings secondary to mass effect, obstruction, vessel invasion, etc. C. Highlight imaging findings (e.g. significance of fat planes) that serve as key to patient inclusion and exclusion criteria. D. Pathophysiology: Cryobiology: Intra- and extracellular mechanisms that promote tumor cell death E. Procedure Technique: discuss key do’s and don’ts e.g. not crossing peritoneal reflections, not ablating needle tract, etc. F. Follow-up: Immediate post-procedure management and follow-up guidelines G. Outcomes: a. Complications: Immediate (hemorrhage, recurrence, bowel perforation, etc), Delayed (recurrence, fistulas, etc) b. Survival

VIE182

How Critical is C-arm Computed Tomography(C-arm CT) for Overcoming Challenges in Patients Undergoing Trans-arterial Chemoembolization for Hepatocellular Carcinoma?

Education Exhibits
Location: VI Community, Learning Center

Participants

Chinmay Bhimaji Kulkarni MBBS, MD (Presenter): Nothing to Disclose
Srikanth Moorthy MD: Nothing to Disclose
Sreekumar K P MBBS, MD: Nothing to Disclose
Rajesh Ramaih Kannan MD: Nothing to Disclose
Nirmalkumar Prabhu: Nothing to Disclose

TEACHING POINTS

Basics of C-arm Computed Tomography (C-arm CT). How is C-arm CT performed ? Application in patients undergoing Trans-arterial chemoembolization (TACE) for Hepatocellular carcinoma (HCC).

TABLE OF CONTENTS/OUTLINE


VIE183

Managing Complicated Acute Pancreatitis: Interventional Radiology to the Rescue

Education Exhibits
Location: VI Community, Learning Center

Participants

Rory O’Donohoe MBCh (Presenter): Nothing to Disclose
Sinead Helena McEvoy MBCh, FFR(RCSI): Nothing to Disclose
Lisa P. Lavelle MBCh, FFR(RCSI): Nothing to Disclose
David Paul Brophy MBCh: Research Consultant, Marvao Medical Limited Shareholder, Marvao Medical Limited
Colin Patrick Cantwell MD: Nothing to Disclose

TEACHING POINTS

JEFFREY WILLIAM McCANN MBBCh, MSc : Nothing to Disclose
EDMUND RONAN RYAN MBBCh : Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To review the complications of acute pancreatitis including the various types of vascular and non-vascular complications. 2. To discuss the indications for image guided interventions with an emphasis on clinical evaluation. 3. To review the role of MRI in the assessment of fistulae and of phlegmonous peri-pancreatic collections. 4. To illustrate the IR techniques for treatment of both vascular and non-vascular complications.

TABLE OF CONTENTS/OUTLINE
1. Overview of the complications of acute pancreatitis. 2. The types of collections associated with acute pancreatitis (using the revised Atlanta classification of pancreatitis: acute peripancreatic fluid collections, acute necrotic collections, pseudocysts, walled off necrosis), and indications for their drainage. 3. Drainage approaches and techniques, including retroperitoneal, transhepatic and transgastric drainage. 4. Fistulae and their management, including pancreaticojejunal fistulae. 5. The diagnosis and treatment of arterial and venous complications, with an emphasis on endovascular therapy for pseudoaneurysms of the gastroduodenal artery, inferior pancreaticoduodenal artery and splenic artery. 6. Summary.

VIE184
Non-Surgical Management for Hepatocellular Carcinoma with Vascular Tumor Thrombus

Education Exhibits
Location: VI Community, Learning Center

Participants
Masakatsu Tsurusaki MD, PhD (Presenter): Nothing to Disclose
Takamichi Murakami MD, PhD: Nothing to Disclose
Nobuyuki Asato MD: Nothing to Disclose
Yukinobu Yagyu MD: Nothing to Disclose
Seishi Kuma MD: Nothing to Disclose
Mitsuru Matsuki: Nothing to Disclose

TEACHING POINTS
1. To discuss the various forms of non-surgical management for unresectable hepatocellular carcinoma (HCC) with vascular tumor thrombus (VTT).
2. To present HCC with VTT cases demonstrating various treatment techniques, complications, responses and survival.

TABLE OF CONTENTS/OUTLINE
A. Epidemiology of HCC with VTT
B. Various non-surgical treatments for HCC with VTT, including transcatheter arterial chemoembolization (TACE), transcatheter arterial embolization (TAE) using gelatin sponge cubes only, radiotherapy combined with TACE or TAE, hepatic arterial infusion (HAI), and systemic chemotherapy
C. Interventional management of complications caused by VTT, such as portal obstruction and portal hypertension
D. Cases
E. SUMMARY Our results of both HAI and radiotherapy combined with TACE for HCC with VTT suggest that are tolerable and increase tumor response rate. This exhibit reviews a. The methods of non-surgical treatments of HCC with VTT. b. The outcomes of non-surgical treatments of HCC with VTT. c. The methods of management and outcomes by interventional procedure for complications caused by VTT.

VIE185
Role of Interventional Radiology in the Management of Renal Artery Aneurysm: A Pictorial Review

Education Exhibits
Location: VI Community, Learning Center

Participants
Christelle Chedrawy MD (Presenter): Nothing to Disclose
Pedram Rezaie MD: Nothing to Disclose
Daniel Joseph Kay MD: Stockholder, General Electric Company
Anupam Basu MD: Nothing to Disclose
Daniel Anthony Falco DO: Nothing to Disclose

TEACHING POINTS
Visceral arterial aneurysms are rare entities with a described incidence of 0.2%. Renal artery aneurysms account for 15-22% of the visceral arterial aneurysms and are generally discovered incidentally. Most of the aneurysms are less than 2 cm and are asymptomatic. Symptoms may result from rupture and thromboembolic events. A size greater than 2 cm warrants intervention. Multiple approaches have been described in the management of visceral arterial aneurysms. The primary intent of covered stent placement is to exclude the aneurysmal sac while maintaining distal perfusion. The described approach offers an alternative to treat high risk patients, as well as patients with aneurysms whose size or location would make a surgical approach problematic.

TABLE OF CONTENTS/OUTLINE
1. Introduction
2. Overview of Renal Artery Aneurysms
3. Case presentation
4. Preprocedure preparation and diagnostic imaging
5. Imaging features on CT scan of the abdomen
6. Diagnostic Angiogram
7. Procedure: Placement of covered stents
8. Postprocedure Management and follow up
9. Complications

VIE186
The Role of Hypersplenism in Complicated Portal Hypertension

Education Exhibits
Location: VI Community, Learning Center

Certificate of Merit
Participants
Joseph Wilson Owen MD (Presenter): Nothing to Disclose
Kathryn Jane Fowler MD : Research support, Bracco Group
Nael El Said Saad MBCh : Research Consultant, Veran Medical Technologies, Inc Proctor, Siertex Medical Ltd

TEACHING POINTS
Increased splenic flow may be a compensatory mechanism to maintain portal flow in the face of increasing hepatic resistance/portal hypertension. Hypersplenism can be due to marrow disorders, resulting in increased splenic capacity and blood flow. These high flow states can exacerbate the complications of portal hypertension.

Treatment of hypersplenism may reduce overflow phenomenon in patients at risk for variceal bleeding.

TABLE OF CONTENTS/OUTLINE
Associations Myelo/Lymphoproliferative Disorders Portal Hypertension (PHTN) Pathophysiology Hypertrophy Arterial Recruitment Splenic Outflow Sequelae Leukop/Thrombocytopenia Hemorrhage - Splenic portal flow ratio may correlate with varical bleeding Post Transplant PHTN - Increased splenic flow persists, so PHTN persists despite normal hepatic resistance Treatments Partial/Complete Splenic Embolization Splenectomy TIPS/BRTO Case 1 17 y/o h/o liver transplant with post transplant PHTN Esophageal varices biopsy- Noncirrhotic PHTN Elevated splenic flow Splenectomy vs splenic embolization Case 2 34 y/o with noncirrhotic PHTN and splenomegally Variceal hemorrhage PHTN treated with TIPS Recurrent variceal bleeding Splenectomy with resolution of PHTN

VIE187
Comparison between Cross-sectional and Angiographic Imaging features in Locoregional Management of Hepatocellular Carcinoma: A Pictorial Review

Education Exhibits
Location: VI Community, Learning Center

Participants
Nirmal Kakani MD : Nothing to Disclose
Hamid Reza Sadeghi Neshat MSc (Presenter): Nothing to Disclose
Derek William Cool MD, PhD : Patent agreement, Eigen
Aaron Fenster PhD : License agreement, Eigen

TEACHING POINTS

TABLE OF CONTENTS/OUTLINE
As incidence of HCC continues to increase, multi-modality imaging protocols have allowed us to understand their vital role in its detection, treatment and follow up. The unique vascular properties of primary liver cancer allows the treatment of these tumors with trans-arterial chemo- and radio-embolization (TACE/TARE), as well as percutaneous ablation. Accurate and reliable understanding of the angiographic appearance with concurrent interpretation of the follow up scans is paramount for the success of Loco-regional therapy. This educational exhibit aims to compare the angiographic findings of the lesions with the CT, 2D/3D ultrasound, and contrast ultrasound changes pre- and post treatment. This will help the reader to understand the relation between location, vascularity and the response of the tumor to treatment across modalities. Images are selected from 50 patients recruited in an IRB approved study who underwent (DEB)TACE/TARE or microwave/radiofrequency ablation between 2011-2014 to study role of multi-modality imaging in interventional management of focal liver tumors.

VIE188
CT-guided Radiofrequency Ablation of Lung Tumors: How to Do It

Education Exhibits
Location: VI Community, Learning Center

Participants
Tomohisa Okuma MD, PhD (Presenter): Nothing to Disclose
Toshiyuki Matsuoka MD : Nothing to Disclose
Shinichi Hamamoto MD, PhD : Nothing to Disclose
Yukio Miki MD, PhD : Nothing to Disclose

TEACHING POINTS
To review the indications, contraindications, imaging for treatment response, clinical outcome and potential complications of percutaneous CT-guided radiofrequency ablation.

TABLE OF CONTENTS/OUTLINE
A. Review of Indications, Contraindications B. Technique C. Evaluation of therapeutic effects (CT, FDG-PET, and MR imaging) D. Outcomes E. Contributing factors to local progression F. Complications (including management)

VIE189
How We Do It: MRI Analysis of Tissue Imaging Outcomes Following Percutaneous Ablation of Hepatic Tumors

Education Exhibits
Location: VI Community, Learning Center

Participants
Gregory John Woodhead MD, PhD (Presenter): Nothing to Disclose
TEACHING POINTS
The purposes of this exhibit are: 1. To review irreversible electroporation (IRE), an evolving technique for the percutaneous ablation of malignant hepatic tumors. 2. To gain an awareness of how recent advances in abdominal MRI facilitate analysis of tissue imaging outcomes following percutaneous ablation. 3. To outline the systematic methodology employed at our institution for the characterization of post-IRE tissue outcomes.

TABLE OF CONTENTS/OUTLINE
I. Overview of percutaneous ablation of hepatic tumors: IRE, RFA, microwave ablation, and cryoablation. II. IRE: Applications, advantages, and technique. III. Abdominal MRI: A superior imaging modality for the characterization of hepatic tumors and evaluation of post-ablation tissue imaging outcomes: HCC and hepatic metastases. IV. "How we do it": A systematic methodology for MRI evaluation and characterization of post-ablation outcomes. V. Through case examples, interpreting physicians will be introduced to broad categories of MR imaging outcomes following IRE: (1) Devascularization, and (2) Residual enhancement. IV. Summary: Recent advances in Body MRI facilitate analysis of post-ablation tissue characteristics. This educational exhibit will outline a methodology for the systematic evaluation of MRI outcomes following IRE of malignant hepatic tumors.

VIE190
Magnetic Resonance Imaging for Guidance of Hepatic Radiofrequency Ablation

Education Exhibits
Location: VI Community, Learning Center

Participants
Stephan Claesen MD (Presenter): Nothing to Disclose
Hans-Jörg Remp : Nothing to Disclose
Rudiger Hoffmann : Nothing to Disclose
Philippe Lucien Pereira MD : Support, Terumo Corporation Support, Bayer AG Support, Siemens AG Advisory Board, Siemens AG Support, Bracco Group Speaker, Terumo Corporation Speaker, Bayer AG Advisory Board, Bayer AG Speaker, CeloNova BioSciences, Inc Consultant, CeloNova BioSciences, Inc Speaker, Biocompatibles International plc Research Grant, Biocompatibles International plc Speaker, Microsulis Medical Ltd Consultant, Microsulis Medical Ltd
Claus Detlef Claussen MD : Nothing to Disclose
Konstantin Nikolaou MD : Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG

TEACHING POINTS
Capabilities of magnetic resonance (MR) imaging for guidance of different steps during hepatic radiofrequency (RF) ablation: pre- (planning), peri- (targeting, monitoring, and controlling), and post-interventional (assessment of treatment response) imaging. Beside general advantages of MR imaging like excellent soft-tissue contrast in hepatic imaging special techniques are in particular supportive for targeting and monitoring of thermal ablation. MR-fluoroscopy offers a near real-time feedback in different planes while the RF applicator is advanced into the target tissue. In relation to thermal ablation therapy, the main advantage of MR imaging is the sensitivity to thermal effects. Strategies for monitoring thermal ablation therapy are a direct temperature mapping, e.g. the proton resonance frequency shift method, or a visualization of irreversible tissue damage caused by thermally induced coagulation. Advantages and disadvantages of MR-guided RF ablation will be discussed.

TABLE OF CONTENTS/OUTLINE

VIE191
Pulmonary Ablation: An Update on Currently Available Ablation Technologies and Their Use in the Lungs

Education Exhibits
Location: VI Community, Learning Center

Participants
Ankaj Khosla MD (Presenter): Nothing to Disclose
Stephen Phillips Reis MD : Nothing to Disclose
Ali Pirasteh MD : Nothing to Disclose
Thomas Alfred Pacicco : Nothing to Disclose
Clayton K. Trimmer DO : Nothing to Disclose
Sanjeeva P. Kalva MD : Consultant, CeloNova BioSciences, Inc

TEACHING POINTS
In a subset of patients, ablation of pulmonary nodules serves as an alternative to surgical resection of both primary and metastatic lesions in the lung. Following the results of the National Lung Cancer Screening Trial (NLCSCT), the number of both primary and secondary lung tumors is likely to increase after the implementation of low dose screening CT. In this exhibit we aim to describe the currently available pulmonary ablation technologies. There will be a review of the current literature on lung cancer, staging, pulmonary ablation techniques and a discussion on the indications for ablation. We will go over procedure details with demonstration from our institution and review the variety of probes used in pulmonary radiofrequency ablations. Finally, we will discuss upcoming techniques and their potential.

TABLE OF CONTENTS/OUTLINE

VIE192
Rare Complications after Lung Percutaneous Radio Frequency Ablation: Incidence, Risk
Factors, Prevention and Management

Education Exhibits
Location: VI Community, Learning Center

Certificate of Merit
Selected for RadioGraphics

Participants
Nicolas Alberti MD (Presenter): Nothing to Disclose
Xavier Buy MD: Proctor, Galil Medical Ltd
Nora Frullo: Nothing to Disclose
Michel Montaudon MD: Nothing to Disclose
Mathieu Canella: Nothing to Disclose
Afshin Gangi MD, PhD: Proctor, Galil Medical Ltd
Jean Palusisere MD: Travel support, Bracco Group

TEACHING POINTS
Tumor destruction by percutaneous radiofrequency ablation (PRFA) is a minimally invasive treatment proposed in the management of lung tumors, primary or secondary, especially in inoperable patients. This technique is very well tolerated in the lung, and most of the complications, which occur in up to 50% of cases, are minor. Little is known about potential rare complications after PRFA. The aim of this educational exhibit was to a) describe b) prevent c) manage rare complications after PRFA of the lung based upon our experience in a large tertiary referral centre (more than 1000 patients during 11 years).

TABLE OF CONTENTS/OUTLINE
1) Pulmonary complications: *Bronchopleural or bronchial fistula *Pulmonary artery pseudo aneurysm *Gas embolism *Aspergilloma or delayed abscess inside post RFA cavitation
2) Thoracic wall complications: *Intercostal neuroma *Intercostal artery injury *Rib necrosis
3) Mediastinal and apical complications: *Neural damage (brachial plexus, recurrent and phrenic nerves) *Diaphragmatic injury (hernia)

VIE194
How and When Do the Checks with Doppler Ultrasound to Patients Who Have Been Transplanted Pancreas—Kidney

Education Exhibits
Location: VI Community, Learning Center

Participants
Roberto Correa Soto (Presenter): Nothing to Disclose
Teresa Gonzalez De La Huebra Labrador: Nothing to Disclose
Aurymar Fraino: Nothing to Disclose
Percy Alexander Chaparro Garcia: Nothing to Disclose
Diego Sebastian Palominos Pose MD: Nothing to Disclose
Karin Daniela Muller MD: Nothing to Disclose
Cecilia Santos Monton: Nothing to Disclose
Heidy Saenz Acuna MD: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is:

- To explain the possible locations, orientations and physiology of the new transplanted organ (kidney, pancreas).
- To review the methodology and temporal protocol of doppler ultrasound of patients transplanted pancreas-kidney.
- To review the radiological findings indicating good and / or poor outcome.

TABLE OF CONTENTS/OUTLINE
- Introduction
  - Transplanted organs (pancreas-kidney) location, orientation, relationships, physiology.
  - Imaging techniques and findings.
    1. Doppler ultrasound technique: protocol review, methodology, temporal protocol.
    2. Radiological findings of good prognosis.
    3. Imaging findings of complications and poor prognosis
- Common diagnostic pitfalls.
- A useful radiological report.
- Cases to illustrate the radiologic features.

VIE195
How to Hit the Bulls Eye: Tips and Tricks for a Successful Ultrasound Guided Lymph Node Biopsy

Education Exhibits
Location: VI Community, Learning Center

Participants
Daniel Claudio Mysler MD: Nothing to Disclose
Andres Kohan MD (Presenter): Fellowship funded, Koninklijke Philips NV
TEACHING POINTS
To review clinical indications for lymph node biopsy To identify the different image guided biopsy techniques for lymph nodes To review ultrasound guided lymph node biopsy technique To review the different tips and tricks for a successful procedure and tissue sampling

TABLE OF CONTENTS/OUTLINE
- Anatomy: location of the lymph nodes, best acoustic windows to image them and best point of access for tissue sampling
- Pathophysiology: metastatic pathways and where to go look for the most probably involved lymph nodes
- Clinical Findings: tips from physical examination to help locate pathological lymph nodes
- Ultrasound guided biopsy technique: a review step by step of the appropriate biopsy procedure
- Indications and contraindications
- Tips and tricks for successful tissue sampling: experience based tips and tricks to maximize tissue sampling and obtain a representative biopsy
- Possible complications and their treatment

VIE196
Imaging the Swollen Arm with Dialysis Access: It’s Not Just DVT

Education Exhibits
Location: VI Community, Learning Center
Magna Cum Laude

Participants
- Shilpa Nagarur Reddy MD (Presenter): Nothing to Disclose
- Meghan Boros MD: Nothing to Disclose
- Mindy Meislich Horrow MD: Spouse, Director, Merck & Co, Inc

TEACHING POINTS
1. Venous US is frequently the initial study requested to evaluate acute arm swelling in patients with dialysis access 2. While important to exclude DVT, in the setting of swelling in an arm with chronic dialysis access, radiologists must consider a wide variety of other vascular and non-vascular causes for swelling, many of which can be appreciated or suggested using US 3. This exhibit will review anatomy of AV grafts and fistulas and how to evaluate them with US, demonstrate examples of alternative vascular and non-vascular diagnoses, and discuss when other modalities and interventions are necessary

TABLE OF CONTENTS/OUTLINE

VIE197
It Doesn’t Look Right but I’m Not Sure Why: Dissection of a Doppler Waveform

Education Exhibits
Location: VI Community, Learning Center
Certificate of Merit

Participants
- Amy Davis Haberman MD (Presenter): Nothing to Disclose
- Erin Horsley DO: Nothing to Disclose
- Steven David Herman MD: Nothing to Disclose

TEACHING POINTS
1. Learn the specific components of spectral waveforms and their meaning with respect to physiology.
2. Learn to maximize the ultrasound unit settings to guarantee accuracy of diagnosis.
3. Be able to recognize normal and abnormal waveforms specific to each organ and pathology.

TABLE OF CONTENTS/OUTLINE

VIE198
The Doppler Imaging Criteria for Diagnosing Stenoses in Arteries: A Comprehensive Review

Education Exhibits
Location: VI Community, Learning Center
Participants

Ganesh Moreshwar Joshi MBBS (Presenter): Nothing to Disclose
Flavius F. Guglielmo MD : Nothing to Disclose
Lauren Lown : Nothing to Disclose
Roger Lown : Nothing to Disclose
Laurence Needleman MD : Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: 1. Review all arteries outside of the brain that can be evaluated with Doppler ultrasound. 2. Learn imaging criteria for diagnosing significant stenosis in each artery. 3. Learn primary and secondary signs of arterial stenosis.

TABLE OF CONTENTS/OUTLINE

General principles 1. Waveform appearance within and adjacent to a significant stenosis 2. Optimizing color and spectral Doppler Head and neck arteries 1. Internal carotid- non-operated, post CEA, and post stenting 2. Common and external carotid 3. Subclavian- with TOS evaluation 4. Vertebral 5. Innominate Abdomen arteries 1. Abdominal aorta 2. Celiac- with MALC evaluation 3. SMA, IMA 4. Renal- native and transplant renal artery evaluation 5. Iliac Upper extremity arteries 1. Axillary, brachial, ulnar 2. Radial- with evaluation for radial artery dependence Lower extremity arteries 1. Femoral, popliteal 2. PTA, ATA, peroneal 3. Bypass grafts, stents The major teaching points of this exhibit are: 1. There are general principles to know when evaluating arteries for stenosis within and proximal and distal to the stenosis. Adhering to them improves diagnostic accuracy. 2. Several arteries have unique imaging criteria when diagnosing stenosis. 3. In some arteries maneuvers can be performed to diagnose a stenosis.

VIE199

The Role of Ultrasonography to Evaluate Complications after Endovascular Aneurysm Repair at Different Sites

Education Exhibits

Location: VI Community, Learning Center

Participants

Joao Rafael Terneira Vicentini MD (Presenter): Nothing to Disclose
Felipe Ribeiro Ferreira : Nothing to Disclose
Danilo Giorgio Oliveira Azevedo Medrado MD : Nothing to Disclose
Leina Ceravolo De Melo Zerey : Nothing to Disclose
Carlos A P Ventura PhD : Nothing to Disclose
Maria Cristina Chammas MD : Nothing to Disclose

TEACHING POINTS

- Recognize the importance of ultrasound as a diagnostic method in the evaluation of complications after endovascular aneurysm repair, particularly endoleak
- Key findings in ultrasound / Doppler examination of stents/grafts in peripheral arteries
- Discuss ways to improve Doppler ultrasound technique for better results in these patients
- Main advantages of ultrasound in the initial follow-up after aneurysm surgery over other imaging methods

TABLE OF CONTENTS/OUTLINE

- Sample of cases evaluated and monitored with Doppler ultrasound
- Special aspects of different arteries examination, such as the carotid and popliteal arteries
- Security and applicability of ultrasound following endovascular correction of aneurysms
- Correlation of sonographic findings and CT angiography (CTA)
- Literature review on use of ultrasound and CT scan for follow-up after endovascular aneurysm repair

VIE200

Ultrasound-Guided Intervention: Beyond the Guidance Tool

Education Exhibits

Location: VI Community, Learning Center

Participants

Alexander Zachary Copelan MD (Presenter): Nothing to Disclose
Anindya K. Roy MD : Nothing to Disclose
Hanh Vu Nghiem MD : Nothing to Disclose

TEACHING POINTS

Advantages of ultrasound in cross-sectional intervention have been previously described. Utilizing case-based illustrations, we will not only substantiate these traditional advantages, but will also demonstrate additional advantages, including the use of ultrasound as a diagnostic, intra-procedural problem solving tool to prevent unnecessary procedures and potential complications.

TABLE OF CONTENTS/OUTLINE

Illustrate and Depict:

Traditional advantages of US as an image guidance tool: real-time nature, vessel visualization, portability, decreased procedure time and cost, and lack of ionizing radiation and use of iodinated contrast material

Expanded advantages:

i. Biopsy of small lesions, lesions not readily accessible by CT guidance, trans-rectal, trans-vaginal, and trans-perineal approaches, and pediatric intervention

ii. Use of US-guided direct compression to displace bowel loops to facilitate biopsy of deep lesions, to treat pseudo-aneurysm with or without thrombin injection, and to help minimize potential post-procedural bleeding complications

iii. Use of US imaging as an intra-procedural problem solving tool to help prevent unnecessary procedures and potential complications, and to urge the interventionist to recognize such instances and take the appropriate steps to ensure the safety
and efficacy of image-guided intervention

VIE201

Ultrasound-Guided Thoracic Interventions: Practical Guide With Tips and Tricks

Education Exhibits
Location: VI Community, Learning Center

Participants

Jose Carmelo Albillos Merino MD (Presenter): Nothing to Disclose
Susana Hernandez Muniz MD : Nothing to Disclose
Javier Azpeitia Arman MD : Nothing to Disclose
Rosa M. Lorente-Ramos MD, PhD : Nothing to Disclose
Alvaro Paniagua MD : Nothing to Disclose

TEACHING POINTS

To describe the main thoracic interventions that can be achieved by ultrasound guidance. To propose a tailored approach with tips and tricks.

TABLE OF CONTENTS/OUTLINE

US-guided interventional procedures main advantages are that can be performed at the patient bed-side, permit a safe real-time control of the interventions without the use of ionizing radiation and are cost and time-effective. US has been considered to have a secondary role in interventions on the thorax. Nevertheless, most thoracic structures are adequately imaged by US and, as a result, interventional procedures can be safely performed with US-guidance. The main procedures that can be performed are biopsies (fine-needle and core biopsy) and drainage of fluid collections. The organs that can be reached by US are located in the chest wall, mediastinum, pericardium, pleura, pleural cavity and in the subpleural pulmonary parenchymas. We propose a guide to the interventions based on a tailored approach with real cases. Several steps must be followed: To depict the lesion with available imaging techniques . To decide the best approach to the lesion. To verify correct visualization of the lesion with US. To perform the procedure with adequate technique and material. To assess absence of complications.

VIE202

Utility of Ultrasound in Selected Cases in Interventional Radiology

Education Exhibits
Location: VI Community, Learning Center

Participants

Ayman Sawas MD (Presenter): Nothing to Disclose
Devang Butani MD : Nothing to Disclose

TEACHING POINTS

Learn indications, benefits, interventional methods, and potential complications of utilizing ultrasound in interventional radiology procedures through case based presentation. This will include cases of performing direct intrahepatic protocaval shunt (DIPS) with intravascular ultrasound guidance, treating stenosis and thrombosiss of dialysis fistulas without fluoroscopy, and percutaneous transhepatic cholangiogram (PTC).

TABLE OF CONTENTS/OUTLINE

A. Clinical scenario.
B. Indication
C. Benefits of ultrasound pertaining to the case
D. Anatomy
E. Interventional methods
F. Outcomes including complications

VIE203

CT Spectral Imaging in CT Portal Venography: Which Phase is Better, Late Arterial Phase or Portal Venous Phase

Education Exhibits
Location: VI Community, Learning Center

Participants

He Qing Wang MSc (Presenter): Nothing to Disclose
Ailian Liu MD : Nothing to Disclose
Yijun Liu : Nothing to Disclose
Haruhiko Machida MD : Nothing to Disclose
Eiko Ueno MD : Nothing to Disclose

TEACHING POINTS

To review current CT in CT portal venography (CTPV) and its limitations. The standard contrast medium injection of the multiphase contrast-enhanced in liver can be used for CTPV with spectral CT To demonstrate the improved image quality using late arterial phase as compared with that obtained using portal venous phase by presenting clinical images

TABLE OF CONTENTS/OUTLINE
1) Standard CT in CTPV and its limitations - low contrast between the portal vein and liver parenchyma results in poor depiction of the intrahepatic portal veins on CTPV images. CTPV images can be easily affected by various factors - limited effect on the portal veins to increase the contrast medium dose and/or injection rate.

2) Normal multiphase contrast enhancement in the liver can be used for CTPV with spectral CT. Optimal energy level of CTPV images in portal venous phase by presenting clinical images. Optimal energy level of CTPV images in late arterial phase is better than that obtained using portal venous phase high contrast between the portal vein and liver parenchyma in late arterial phase no hepatic veins overlapped the portal veins

VIE204
"Management of Displaced Intravascular Foreign Bodies—An Overview"

Education Exhibits
Location: VI Community, Learning Center

Participants
James Burn MBBS, BSc (Presenter): Nothing to Disclose
Antoni Aleksander Sergot MBBS, FRCP: Nothing to Disclose
Yaron J. Berkowitz MBChir, MRCS: Nothing to Disclose
Wasim Hakim MBBS: Nothing to Disclose
Steven S.M. Moser: Nothing to Disclose

TEACHING POINTS
1) Knowledge of the typical types, sites and risk factors of displaced intravascular foreign bodies.
2) An understanding of the associated morbidity and mortality.
3) Understanding of the various retrieval methods and equipment available - including advantages and disadvantages of each.
4) Tips/guidelines for improving outcome in intravascular retrieval/repositioning.

TABLE OF CONTENTS/OUTLINE
- Summary of typical displaced foreign bodies and sites of migration eg. pulmonary arteries/cardiac atria - using case examples.
- Risk factors for fracture/migration eg. emergency insertion / poor guide catheter or guide wire support / tortuous and calcified vessels etc.
- Overview of the clinical sequelae and associated mortality and morbidity of displaced/fractured intravascular foreign bodies.
- Summary of various retrieval equipment (eg snares, baskets or forceps) and techniques (proximal vs distal grab etc) using case examples.

VIE205
The Road to Success for Adrenal Venous Sampling; Can It Be Useful to Detect Adrenal Veins on Unenhanced CT with 3D Thin Slice Data Acquisition?

Education Exhibits
Location: VI Community, Learning Center

Participants
KIMEI AZAMA (Presenter): Nothing to Disclose
Masahiro Okada MD: Nothing to Disclose
Yuko Iraha: Nothing to Disclose
Joichi Heianna: Nothing to Disclose
Tomomi Koga: Nothing to Disclose
Sadayuki Murayama MD, PhD: Nothing to Disclose

TEACHING POINTS
- The teaching points of this exhibit are: 1. To explain about adrenal venous anatomy on CT and MRI and basics of adrenal signal intensities on in-phase or opposed phase of dual-phase T1 weighted image. 2. To describe the clinical impact of adrenal venous sampling for primary aldosteronism. 3. To show the technique of adrenal venous sampling and present the utility to understand the location of adrenal veins on unenhanced CT, including 3D data acquisition. 4. Pitfalls of adrenal venous sampling are also addressed.

TABLE OF CONTENTS/OUTLINE
- Anatomy of adrenal veins a. The shape of left/right adrenal vein b. Variations
- Concept of primary aldosteronism
- Definition, Frequency, Classification
- Significance of adrenal venous sampling
- For definite diagnosis
- To determine surgical indication
- Identification of left/right adrenal vein on unenhanced CT
- How to recognize the location of adrenal veins on unenhanced CT
- Optimal CT parameters of 3D data acquisition
- What shape is better to insert the catheter to adrenal veins?
- Strategies for left/right adrenal venous sampling
- Technical difficulties
- Pitfalls of adrenal venous sampling

VIE207
The Transjugular Route to Biopsies: A Practical Guide

Education Exhibits
Location: VI Community, Learning Center

Participants
Harshad Wankhedkar DMRD (Presenter): Nothing to Disclose
Diptiman Roy MD: Nothing to Disclose
Tejas Prakash Dharia MBBS: Nothing to Disclose
Charul Goyal MBBS: Nothing to Disclose
TEACHING POINTS
The Transjugular route has been used to perform biopsies of liver, kidney, intracardiac masses, pancreas and other organs. A principle indication of using a transjugular route is the presence of an uncorrected bleeding disorder, when a percutaneous approach is contraindicated. Transjugular route for biopsy is an established technique in high risk patients. Indications for transjugular renal biopsy, apart from bleeding disorders, include conditions that preclude the prone position, like voluminous ascitis, morbid obesity and mechanical ventilation. Transjugular route for intracardiac masses has the advantage of avoiding cardiac wall injury.

TABLE OF CONTENTS/OUTLINE

Benefits of using a transjugular approach for visceral biopsies

- Patient Selection
- Organ-specific Procedure technique
  - Pre-procedural work up
  - Procedure
  - Post-procedure imaging
- Procedure-specific complications
  - Major complications
  - Minor complications
  - Organ specific complications

VIE208
Where We Have Been, Where We Are, and Where We Are Going: History and State of the Art Treatment and Management of Chronic Lower Extremity Venous Insufficiency

Education Exhibits
Location: VI Community, Learning Center

Participants
Mustafa Syed DO (Presenter): Nothing to Disclose
Eli Halpern MD: Nothing to Disclose
Ronald Mark Dreifuss MD: Nothing to Disclose
Christopher John Moran MD: Nothing to Disclose

TEACHING POINTS
Describe chronic lower extremity venous insufficiency (CVI). Demonstrate a basic pathophysiologic and epidemiologic understanding. Quantifying CVI. Understanding deep/superficial/perforator venous anatomy and its importance in treatment success. Overview of older, current and novel techniques--their appropriate use in treatment and management of CVI.

TABLE OF CONTENTS/OUTLINE

- Introduction: Description of venous insufficiency and our role in management as interventional radiologists.
- Epidemiology: Who is most prone to CVI? Pathophysiology and Anatomy: What are factors that lead to venous insufficiency? What is the pathophysiology? Pertinent discussion of anatomy (with diagrams).
- Approach to Evaluation and Treatment: CEAP Classification.
- Sonography Discussion of older techniques such as surgical stripping and sclerotherapy. Discussion of newer techniques such as mechanical, chemical and thermal ablation--effectiveness, and appropriate subset of patients.
- Post-treatment follow-up: Discussion of post-treatment follow-up. Evaluating success of a therapy, Patient’s options in the event of post-treatment failure. Conclusion: Discussion emphasizing the importance of understanding CVI, anatomy, it’s morbidity, and great benefit to the patient in the setting of appropriate treatment.

SPSP01
Nuevos Horizontes en Diagnostico por Imagen Desde el CIR: Sesión del Colegio Interamericano de Radiología (CIR) en Español/New Horizons in Diagnostic Imaging from CIR: Session of the Interamerican College of Radiology (CIR) in Spanish

Special Courses
- NM
- MR
- CT
- VA
- NR
- MK
- GU
- GI
- CH
- BR

AMA PRA Category 1 Credits™: 3.75
ARRT Category A+ Credits: 4.00
Sat, Nov 29 1:00 PM - 5:00 PM Location: E451A

LEARNING OBJECTIVES
1) To review advances or new horizons in imaging in major subspecialties from experts from different CIR (Interamerican College of Radiology) countries.
2) To use a practical approach including case-based learning.
3) To seek audience participation with presentation of unknown clinical examples related to the organ system presentations.

Sub-Events
SPSP01A
Introducción/Opening Remarks
Gloria Soto Giordani MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.
Sistema Nervioso Central: Correlación Entre Marcadores Genéticos e Imágenes en Astrocitomas/Central Nervous System: Imaging-Genetic Markers Correlation in Astrocytomas

Mauricio Castillo MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To become familiar with the traditional biochemical/genetic markers of astrocytomas and how their presence or absence correlate with imaging findings. 2) To understand the biological changes, as reflected by MR advanced imaging techniques, that astrocytomas go through when malignant transformation occurs.

ABSTRACT

In this lecture we will use advanced MR imaging techniques, perfusion (both contrast enhanced and arterial spin labelled), permeability, diffusion, and spectroscopy to understand the biological behavior of astrocytomas. Low grade astrocytomas may not show high choline on MRS but show high myoinositol which correlates with low perfusion values. Anaerobic astrocytomas produce metalloproteases and thus VEGF and PDGF can stimulate angiogenesis resulting in high perfusion with gadolinium and ASL. Additionally, hypoxia induces formation of permeability factors leading to edema and contrast enhancement in glioblastomas. Necrosis, seen as lipids on MRS is a marker of glioblastoma. Presence of MGMT promoter and alterations in the IDH1 gene (present in most secondary glioblastomas) confer a better survival pattern to glioblastoma patients and these findings are seen predominantly in temporal and deep tumors and in those with little contrast enhancement and high signal on T2 and DWI images. Thus, the initial transformation in all low grade astrocytomas is ischemia that can be seen as the presence of lactate on MRs, while markers of higher grades such as angiogenesis, permeability, and necrosis can be identified with perfusion, K-trans maps, and MR spectroscopy. Lack of myoinositol on MRS indicates its consumption for production of metalloproteases and thus it is also an early marker of angiogenesis. Many of these changes occur before anatomical images may suggest them.

URL

https://sites.google.com/site/castilloneuroradiology/

Active Handout

http://media.rsna.org/media/abstract/2014/14002958/SPSP01C sec.pdf

Cardiovascular: Cambios Desde el TAC y RM Hacia la Imagen Funcional y Molecular/Cardiovascular: CT and MRI Changes towards Functional and Molecular Imaging

Antonio Luna MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Revisar las indicaciones actuales del TC y RM en el diagnóstico cardiovascular. 2) Ensalzar las nuevas aproximaciones técnicas en TC y RM del sistema cardiovascular. 3) Esbozar el papel potencial de la imagen funcional y molecular en enfermedades cardiovasculares. 1) Review the current clinical indications of CT and MRI in cardiovascular diagnosis. 2) Highlight the new technical approaches in CT and MRI of the cardiovascular system. 3) Outline the potential role of functional and molecular imaging in the management of cardiovascular diseases.

Mama: Integración de Medicina Nuclear en las Imágenes Diagnósticas de Mama/Breast: Nuclear Medicine Integration in Breast Imaging

Maria Victoria Velasquez MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Present the current indications for Molecular Breast Imaging and Positron Emission Mammography. 2) Describe imaging protocols, radiation exposure and benefits for both techniques. 3) Outline the most common findings of benign and malignant breast lesion on MBI and PEM with correlation with other breast imaging studies. 4) Navigate through the different steps of PEM guided biopsy. 5) Describe alternative management and follow up with these techniques.

ABSTRACT

Integration of Nuclear Medicine in Breast Imaging In the last decade the introduction of Nuclear medicine as
Molecular imaging of the breast had a significant development in the diagnosis of breast abnormalities. Positron Emission Mammography (PEM) and Molecular Breast Imaging (MBI) have been successful in the detection of benign, atypical and malignant breast conditions. PEM have been proven to represent a very helpful staging tool in patients with contraindications to breast MRI. MBI is a valuable technique for screening of high risk patients and as for problem solving for patients with inconclusive clinical or imaging findings. This presentation will review the main indications of these Nuclear Medicine studies and will detail the findings and the correlation with conventional breast imaging. The breast imager will have a better understanding of the anatomic, functional and molecular breast imaging techniques.

Tórax: Hallazgos de la Resonancia Magnética en Enfermedades del Parénquima/Chest: Magnetic Resonance Findings in Lung Parenchymal Disease

Arthur Soares Souza MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To show the value of thoracic MRI for assessment of parenchymal lung disease. 2) To demonstrate the value of diffusion weighted MRI (DWI) for differentiating benign from malignant lung neoplasms.

ABSTRACT

In this lecture we will show the clinical ability of thoracic MRI to depict the most common patterns of parenchymal lung diseases, and do the correlation with CT findings. MRI seems to be a valuable tool, without radiation exposure, for management of parenchymal lung disease. We will, also, address the importance of diffusion weighted MRI (DWI) for differentiating benign from malignant lung lesions.

URL

http://www.ultrax.com.br/chest

Conferencia del Colegio Interamericano de Radiología/Interamerican College of Radiology Lecture

Dante R. Casale Menier MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Segunda Parte/Part II

Moderator Miguel E. Stoopen MD: Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Musculoesqueletico: Imágenes Avanzadas del Cartílago Articular y "Chemichal Shift" de Médula Ósea/Musculoskeletal: Advanced Imaging of the Articular Cartilage and Bone Marrow Chemical Shift Imaging

Gonzalo Javier Delgado MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Abdomen e Hígado: Contrastes Hepatoespecíficos y Elastografia por Resonancia Magnética/Abdomen and Liver: Liver Specific Contrast Agents and Hepatic MR Elastography

Luis Antonio Sosa MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.
Rapid Pathologic Subtyping of Kidney Tumors after Ex Vivo Core Needle Biopsy Using Optical Spectroscopy


PURPOSE

To develop and validate an instrument to rapidly discriminate between renal cancer neoplastic subtypes and normal core biopsy tissue using elastic light scatter spectroscopy.

METHOD AND MATERIALS

We performed an Institutional Review Board approved prospective study of surgically resected kidney tumors with a clear pathologic diagnosis from 1/2013 - 2/2014. Visible tumors and surrounding normal kidney were biopsied using 18G side-notch core needles. Core biopsy specimens were analyzed using a specialized light spectroscopic scatter device that rapidly scans (less than 1 minute) core needle biopsy samples while still on the needle. Spectra were normalized and distributed against geometrical means and outliers were rejected. The spectral data was decomposed into 25 principal components and a machine learning algorithm was used to differentiate between tumor subtypes and normal tissue. Receiver operating characteristic (ROC) curves were generated using pathology as the gold standard for all samples.

RESULTS

Fifty-three kidneys were biopsied during the study period resulting in 3076 usable spectra after outlier rejection (1272 normal and 1804 tumor samples). The final pathologic diagnoses included clear cell carcinoma (1130/1804, 63%), papillary carcinoma (248/1804, 14%), chromophobe carcinoma (226/1804, 13%) and oncocytoma (200/1804, 11%). Principal component analysis using the Random Forest algorithm resulted in a
CONCLUSION

Rapid tissue-preserving optical spectroscopy analysis of core biopsy samples is feasible and can successfully differentiate renal tumor subtypes with a high degree of classification accuracy. This instrument offers the potential to improve on-site biopsy assessment.

CLINICAL RELEVANCE/APPLICATION

Automated workflow-integrated pathologic assessment of core needle biopsies using optical spectroscopy is possible and has the potential to improve on-site biopsy assessment.

Intra-procedural Low-dose 18-Fluoro-deoxyglucose PET/CT-guided Biopsy Leads to Increased Accuracy in Poorly Visualized Lesions

SSA23-02

François Cornelis MD (Presenter): Nothing to Disclose, Haruyuki Takaki MD: Nothing to Disclose, Jeremy C. Durack MD: Nothing to Disclose, Joseph Patrick Erinjeri MD, PhD: Nothing to Disclose, Constantinos Thasos Sofocleous MD, PhD: Consultant, Sirtex Medical Ltd, Robert H. Siegelbaum MD: Nothing to Disclose, Heiko Schoder MD: Nothing to Disclose, Stephen Barnett Solomon MD: Research Grant, General Electric Company Research Grant, AngioDynamics, Inc Consultant, Johnson & Johnson Consultant, Coviden AG Director, Devicor Medical Products, Inc Director, Aspire Bariatrics, Inc

PURPOSE

To report the accuracy of percutaneous biopsies performed under intra-procedural 18-Fluoro-deoxyglucose (FDG) positron emission computed tomography (PET-CT) guidance.

METHOD AND MATERIALS

The IRB approved this retrospective study with a waiver of written informed consent. We reviewed 105 consecutive patients from 2011 to 2013 who had clinically indicated percutaneous PET-CT guided biopsies of 106 masses (mean size, 3.3 cm; range, 0.7-15.9 cm; SD, 2.9 cm) in bones (n=33), liver (n = 26), soft tissues (n = 18), lung (n = 15) and abdomen (n=14). Recommendation for PET-CT guidance was based on existing image review and challenges anticipated using CT, MR or ultrasound modalities for procedural guidance. The biopsy procedures were performed following injection of 6.9mCi in mean (range, 3.9-13.2; SD, 2) of FDG. Maximal standardized uptake value (SUV) of lesions was 8.8 in mean (range, 1.9-44.4; SD, 6.3). A systematic review of the histopathological results and outcomes was performed. Descriptive statistics were used to summarize the results.

RESULTS

Biopsies were positive for malignancy in 76 (71.7%, 76/106) cases and for benign tissue in 30 cases (19.8%, 30/106). Immediate results were considered as adequate for 100 PET-CT biopsies (94.3%, 100/106), and for the 6 others (5.7%, 6/106) benign diagnoses were confirmed after surgery (n=4) or follow-up (n=2). Accuracy, sensitivity and positive predictive value (PPV) of biopsies were all 100%, with a 95% confidence interval of [95.2-100] for PPV. Complications occurred after 4 biopsies (3.7%, 4/106).

CONCLUSION

Intra-procedural PET-CT guidance appears is a safe and effective method and allows high accuracy of percutaneous biopsies for metabolically active lesions. For purposes of biopsy guidance, half of the typical FDG activity is sufficient for target visualization.

CLINICAL RELEVANCE/APPLICATION

PET-CT imaging guidance can be used to biopsy metabolically active lesions not well visualized on other modalities with an excellent specificity and positive predictive value.

Safety and Outcomes Following Percutaneous Biopsy of Hepatic Adenomas

SSA23-03

Derrick Arnold Doolittle MD (Presenter): Nothing to Disclose, Thomas Duncan Atwell MD: Nothing to Disclose, Taofic Mounajjed: Nothing to Disclose, David Maitland Hough MD: Nothing to Disclose, Grant D. Schmit MD: Nothing to Disclose, Anil Nicholas Kurup MD: Nothing to Disclose

PURPOSE

Until recently, MRI with gadoxetate disodium (Eovist) was used to distinguish benign FNH from hepatic adenoma, the latter neoplasm having a small but real propensity for both spontaneous hemorrhage and malignant degeneration. Recently, an inflammatory variant of hepatic adenoma has been described which may demonstrate MRI imaging features similar to FNH, precluding diagnostic differentiation of these tumors. Given the implications of the different pathologies, there is a resurging interest in the role of biopsy in differentiating FNH and hepatic adenoma. The purpose of this project was to determine the safety and outcomes following biopsy of hepatic adenomas.

METHOD AND MATERIALS
We performed a retrospective review of all patients at our institution over a 14 year interval with a confirmed biopsy proven diagnosis of hepatic adenoma. The biopsy procedure and complications of the biopsy were evaluated. Pathology-specific outcomes related to the diagnosis of adenoma were assessed.

RESULTS

Sixty-four patients were identified (56 females and 8 males, average age of 41.5 years) with an average follow up of 883 days after biopsy. Four (6%) patients had RF ablation the same day as the biopsy and complications were not assessed for these patients. Nine of the remaining 60 (15%) patients had a minor complication. There were no major complications. Three (5%) of our 64 biopsy-proven adenomas revealed focal nodular hyperplasia upon surgical resection. One biopsy proven adenoma was rebiopsied 3 months later, with result showing well differentiated hepatocellular carcinoma.

CONCLUSION

Complications of biopsy proven hepatic adenomas are rare. Although rare, discordant pathology results from biopsy and surgical resection may occur.

CLINICAL RELEVANCE/APPLICATION

Biopsy of hepatic adenoma is safe with rare discordant results.

Radiation Exposure of Medical Staff during Percutaneous Soft Tissue Interventions on a Phantom Using a Multi-axis Interventional C-arm CT System with 3D Laser Guidance

Nils Rathmann MD (Presenter): Nothing to Disclose, Michael Kostrzewa MD: Nothing to Disclose, Uwe Haeusler: Nothing to Disclose, Stefan Oswald Schoenberg MD, PhD: Institutional research agreement, Siemens AG, Steffen J. Diehl MD: Nothing to Disclose

PURPOSE

The purpose of this study was to investigate absolute radiation exposure values for interventional radiologists during 3D laser guided soft tissue interventions using a multi-axis interventional C-arm CT system with 3D laser guidance (Artis Zeego, Siemens Healthcare Sector, Germany).

METHOD AND MATERIALS

3D, laser supported, fluoroscopic guidance (syngo iGuide) of the Siemens Artis Zeego intervention system was used to puncture sixteen lesions at different angles with a 20G biopsy-needle. The lesions were identified in a triple modality 3D abdominal phantom (model 057A, CIRS, Norfolk, VA, USA). Two 20l water containers were placed adjacent to the phantom to increase its volume. One C-arm CT (syngo DynaCT) was performed for planning of the intervention and one DynaCT was performed for post procedural evaluation to properly identify the needlepoint within the lesion. Laser supported fluoroscopy was used for needle guidance. For each intervention three thermoluminiscent dosimeters (TLDs) placed on an i.v. pole at the level of the eyes, the umbilicus and the ankles were used to collect representative radiation exposure values of the interventionalist. The i.v. pole was placed next to the phantom analogue to the position of the interventionalist without lead shielding for the entire duration of the intervention.

RESULTS

Sixteen interventions were analyzed. For proper positioning of the needle within each target lesion mean fluoroscopy time was 4.1s and mean overall procedural duration was 904s. Mean radiation value of all TLDs was 189±59 mSv (range 100 - 423). Mean radiation value of the TLDs at the level of the eye lens was 177±44 mSv (range 118 - 290), of the umbilicus 231±29 mSv (range 100 - 189) and of the ankle 150±29 mSv (range 100 - 189).

CONCLUSION

Our results suggest that proper lead shielding during the interventions and leaving the intervention suite during DynaCT is of critical importance to minimize radiation exposure for the medical staff. Furthermore these results have to be systematically compared to CT-guided interventions for which lower values of radiation exposure have been reported for medical staff.

CLINICAL RELEVANCE/APPLICATION

These results indicate that even with modern navigation tools without lead shielding relative high radiation doses for medical staff can occur during biopsy with a clinical robot-arm assisted intervention system.

Image-guided Needle Aspiration versus Percutaneous Catheter Drainage in the Management of Complex Pyogenic Liver Abscesses Caused by Klebsiella Pneumonia

Sivasubramanian Srinivasan MD, FRCR (Presenter): Nothing to Disclose, Hui Seong Teh MBBS: Nothing to Disclose, Manickam Subramanian MD, FRCR: Nothing to Disclose

PURPOSE

Our aim was to compare the effectiveness of percutaneous needle aspiration with percutaneous catheter drainage in the management of liver abscess caused by Klebsiella pneumonia.

METHOD AND MATERIALS
64 patients (42 males, 22 females: 25-85 years, mean 74 years) with culture proven Klebsiella liver abscesses underwent either percutaneous needle aspiration or catheter drainage. The abscesses were graded into four grades according to the liquefaction and loculations (grade 1: unilocular abscess, grade 4: solid appearing complex abscess with scanty liquefaction). In grade 4 abscesses, percutaneous aspiration was performed with a 18G needle in multiple locules to aspirate the contents. For catheter drainage, 8- to 12-French catheters were inserted into the abscess cavity by the Seldinger technique under imaging guidance. Outcome was assessed with clinical and laboratory parameters and sonographic monitoring of size of the abscesses.

RESULTS
Percutaneous procedures were technically successful in all patients (64/64, 100%) and clinical success was achieved in 62 patients (62/64, 96%). Percutaneous needle aspiration was successful in first attempt in 22 (22/28, 79%) patients after one aspiration and six patients (21%) needed a second procedure where as 12 (12/36, 33%) patients in the drainage group needed a second procedure. Need for second procedure, especially in grade 4 abscesses was significantly lower in the aspiration group (p<0.05) compared the drainage group. Four patients with air forming Klebsiella liver abscesses, were hemodynamically unstable due to septic shock had to undergo catheter drainage and one (1/4, 25%) of them could not recover from the septic shock.

CONCLUSION
Rercutaneous aspiration is more effective in Klebsiella abscesses with scanty liquefaction compared to catheter drainage. However emergent catheter drainage is necessary in patients with air-forming Klebsiella abscesses who usually present with hemodynamic instability due to septic shock.

CLINICAL RELEVANCE/APPLICATION
In Klebsiella pneumonia liver abscesses, especially in cases with scanty fluid component, needle aspiration can be considered as a first line of management with antibiotic coverage. However in patients with air-containing Klebsiella pneumonia abscesses, emergent catheter drainage will be necessary because of severe sepsis.

SSA23-06

Image-guided Percutaneous Drainage for Treatment of Post-surgical Anastomotic Leak in Patients with Crohn's Disease

James Donald Byrne BS (Presenter): Nothing to Disclose, Ari Joel Isaacson MD: Nothing to Disclose, Ryan Stephens MD: Nothing to Disclose, Hyeon Yu MD: Nothing to Disclose, Charles Thomas Burke MD: Nothing to Disclose

PURPOSE
Anastomotic leaks are a common complication after bowel surgery in Crohn's patients. Image-guided percutaneous drainage is an attractive alternative to reoperation because of decreased morbidity and hospital stay. Because data for this specific population is scarce, we aimed to determine the safety and efficacy of image-guided percutaneous drainage in the management of anastomotic leak in Crohn's patients by retrospectively reviewing cases at a single academic institution.

METHOD AND MATERIALS
The medical records of 41 patients with Crohn's disease who underwent percutaneous drain placement for the treatment of anastomotic leak from September 2004 to November 2013 were reviewed. CT imaging was also reviewed to determine the number, size and locations of the drained fluid collections. Local treatment failures and complications were evaluated for all patients.

RESULTS
The mean volume of the abscesses resulting from anastomotic leak was 167.2 cm³ (median 59.5 cm³; range 1.8-1173.1 cm³), and the mean number of targeted fluid collections per patient was 1.5 (median 1; range 1-4); 15 of 41 (38.1%) patients were treated for multiple abscesses. The mean duration between surgery and percutaneous drain placement was 18.5 days (median 14 days; range 6-60 days), and the median drain size was 10 French, with a range of 8-16 French. Overall, the mean duration of drainage was 70.4 days (median 29 days; range 2-732 days). The mean number of drain manipulations/exchanges was 1.2 (median 0; range 0-14). One of 41 (2.4%) patients experienced minor complications from drain placement, injury to a superficial abdominal artery, and no major complications occurred. Two of 41 (4.9%) patients required repeat surgeries.

CONCLUSION
Image-guided percutaneous drainage for the treatment of post-surgical anastomotic leaks in Crohn's patients is effective and safe with low rates of complications and reoperations.

CLINICAL RELEVANCE/APPLICATION
Image-guided percutaneous drainage of anastomotic leaks after bowel surgery in Crohn's patients is a safe and effective alternative to surgical intervention, reducing morbidity and hospital stay.

SSA23-07

Comparison of Unilateral versus Bilateral Biliary Drainage in Patients with Malignant Biliary Obstruction: A Prospective Study

Tezbir Singh MBBS (Presenter): Nothing to Disclose, Shivandan Ramachandra Gamanagatti MBBS, MD: Nothing to Disclose, Raju Sharma MD: Nothing to Disclose, Deepnarayan Srivastava: Nothing to Disclose

PURPOSE
This study evaluated the efficacy of unilateral versus bilateral percutaneous transhepatic biliary drainage in the palliation of these patients in terms of improvement of quality of life and reduction of serum bilirubin levels.
METHOD AND MATERIALS

A prospective, single-center study was conducted in a cohort of 49 patients with malignant biliary obstruction. The primary confluence was blocked in 33 patients and patent in 16 patients. A single, unilateral internal-external catheter or metallic stent was placed in 44 patients. Bilateral catheter or stent insertion was done in 5 patients in whom the primary confluence was blocked and contrast had opacified the contralateral duct during the procedure to prevent cholangitis. In total 28 patients (57.1%) had unilateral biliary drainage and in the rest of 21 (42.9%) bilateral drainage was achieved. Patients were evaluated at one month after the procedure and, thereafter every 3 months. We studied the impact of amount of biliary drainage on the change in the European Organisation for Research and Treatment of Cancer QOL questionnaire (EORTC QLQ-C30) (version 3) scores and by liver function tests.

RESULTS

Mean serum bilirubin level was 19.85 mg/dl prior to the procedure and at one month was 6.02 mg/dl after the procedure, and at 6 months was 3.84 mg/dl, which was statistically significant (p < 0.001). There was a significant improvement in all the QOL parameters (Functional, Symptomatology and Global). The mean increase in the Functional parameter at one month was 19.35 (percentage increase was 46.19%). The mean decrease in the Symptomatology parameter was 21.47 (percentage reduction was 38.5%). The mean increase in the Global parameter was 25.8 (percentage increase was 85.8%). We found that there was no statistically significant difference in the reduction of the serum bilirubin levels (p = 0.136), and also QOL scores between the patients treated with unilateral versus bilateral drainage.

CONCLUSION

Unilobar biliary drainage is safe, feasible, and achieves adequate drainage in the great majority of patients with unresectable malignant biliary obstruction in terms of improvement of quality of life and bilirubin levels as compared to bilobar biliary drainage.

CLINICAL RELEVANCE/APPLICATION

Unilateral percutaneous deployment of catheters or metal stents has a high clinical success rate that provides adequate palliation and improves Quality of Life substantially.

SSA23-08

Wall Suction-assisted Image-guided Therapeutic Paracentesis: A Safe Alternative to Evacuated Bottles

Tatiana Kell MD (Presenter): Nothing to Disclose, Paul B. Shyn MD: Nothing to Disclose, Loraine Eng Wu MD: Nothing to Disclose, Ramin Khorasani MD: Consultant, Medicalis Corp, Stuart G. Silverman MD: Author, Wolters Kluwer nv

PURPOSE

Because evacuated bottles are expensive and in short supply, we assessed the safety of using wall suction to drain and collect large amounts of fluid during image-guided paracentesis procedures.

METHOD AND MATERIALS

This retrospective quality improvement project was HIPAA-compliant and did not require IRB approval. In a hospital-based practice, 551 image-guided paracenteses were performed in 191 consecutive patients (61 males and 130 females, ages 21-94, mean 61) over a 10-month period, using wall suction to collect the fluid. Each patient underwent 1 to 40 (mean 8.3) procedures. The two most common primary diagnoses were malignancy in 142 (74.3%) patients and cirrhosis in 36 (18.8%) patients. Paracenteses were performed using ultrasound (n = 542) or CT (n = 9) guidance, 5-French centesis catheters, extension tubing (3 m long, 5 mm diameter), and 1-3 L plastic collection canisters attached to wall suction (up to -527 mm Hg). Volume of fluid removed and complications were recorded based on review of procedure dictation reports, the electronic medical record, and quality assurance logs with a minimum 30-day follow-up. Complications were graded using Common Terminology Criteria for Adverse Events, version 4.

RESULTS

The volume of fluid removed ranged from 35 to 11,965 ml (mean 3541 ml). Four (0.72%) complications occurred in 551 procedures; a rate similar to historical controls. Grade I complications included prolonged ascites leak (n = 1). Grade III complications included infection (n = 1), hypotension (n = 1) and atrial fibrillation (n = 1). All four complications were unrelated to the use of wall suction, and were treated successfully; no grade II, IV or V complications occurred. The small number of complications precluded adequate statistical power for comparisons to historical controls.

CONCLUSION

The use of wall suction when performing image-guided therapeutic paracentesis is a safe alternative to collecting fluid with evacuated bottles.

CLINICAL RELEVANCE/APPLICATION

The current shortage of evacuated bottles has prompted the safe use of wall-suction to facilitate image-guided therapeutic paracentesis.

SSA23-09

The Effectiveness of Image-guided Peritoneal Dialysis Catheter Placement in a Community Hospital

Paul Erik Dybro MD (Presenter): Nothing to Disclose, Todd Ellis Drasin MD, MPH: Nothing to Disclose
PURPOSE

Minimally invasive image-guided techniques allow placement of peritoneal catheters into traditionally excluded patients, including acutely uremic patients, patients with low cardiac output and/or recent myocardial infarctions, and patients with hepatorenal or cardiorenal syndrome. The following study measures the effectiveness of a community-based minimally invasive image-guided interventional radiology peritoneal dialysis catheter placement service.

METHOD AND MATERIALS

The clinical electronic medical records of 100 consecutive image-guided peritoneal dialysis catheter placements were reviewed at a community-based hospital. Cases were performed between July 2012-March 2013. The referral based included low, medium, and high-risk patients. Cases were a random mix of elective, urgent, and emergent procedures. Two interventional radiology physicians performed all the procedures. Procedures were performed in an interventional radiology suite usually under procedural sedation; a few selected patients received local anesthesia. Ultrasound was utilized to achieve safe peritoneal entry and creation of a rectus muscle tunnel to provide catheter stability. Fluoroscopy was utilized to achieve deep mid line pelvic positioning of the curl tip portion of the catheter.

RESULTS

Initial catheter placement success rate was 92%. There were no complications. Mechanical catheter malfunction-free rates were calculated, and were 94% (78/83) at 3 months, 91% (67/74) at 6 months and 85% (44/52) at 1 year. Excluded from the calculations were cases of peritoneal dialysis loss from psychosocial issues, infections, peritoneal membrane failure, migration to transplant status, hydrothorax, hernia formation, and patient death.

CONCLUSION

Image-guided peritoneal dialysis catheter placement achieves comparable survival rates as laparoscopic catheter based services. Minimal invasive image guided techniques have documented cost advantages to laparoscopic techniques. By expanding the pool of eligible patients for peritoneal dialysis, the imaged guided techniques can increase the utilization of peritoneal dialysis in this country.

CLINICAL RELEVANCE/APPLICATION

Medicare costs for peritoneal dialysis average $20,000 less/patient/year compared to hemodialysis. Increasing utilization rates of peritoneal dialysis as a renal replacement therapy can result in significant cost savings.
Both MRA techniques offered a robust and homogenous hyperintense vessel signal of the assessed vasculature. Qualitative analysis revealed comparable results of vessel conspicuity in subjective ratings for TOF MRA (mean left renal artery = 4.5) and subtracted contrast-enhanced datasets (mean left renal artery = 4.6). Background suppression in subtracted datasets was superior to background suppression of TOF-images, reflected in superior contrast ratio values for subtracted datasets (mean aorta = 0.7) compared to TOF-MRA (mean aorta = 0.4).

CONCLUSION

Our results demonstrate the successful facilitation and comparable diagnostic ability for vessel assessment in TOF-MRA and ultra-low-dose renal MRA at 7T, while preserving high quality vessel assessment.

CLINICAL RELEVANCE/APPLICATION

Preservation of high-quality vessel assessment while facilitation of significant reduction, or respectively complete omission of contrast agent, may be of high diagnostic value for MR angiographic examinations in patients with renal insufficiency.

SSA24-02

Ultra-high-Resolution Imaging of the Intracranial Arteries at 7T: TOF MRA versus Non-enhanced MPRAGE

Lale Umutlu MD (Presenter): Consultant, Bayer AG, Nina Theysohn MD: Nothing to Disclose, Soren Johst: Nothing to Disclose, Michael Forsting MD: Nothing to Disclose, Marc U. Schlamann: Nothing to Disclose, Karsten Wrede: Nothing to Disclose

PURPOSE

The purpose of this study was to intraindividually compare the delineation of intracranial arterial vasculature utilizing ultra-high-resolution TOF MRA versus non-enhanced MPRAGE at 7 Tesla.

METHOD AND MATERIALS

40 subjects were examined on a 7 T whole-body MR system (Siemens Healthcare) utilizing a 32-channel transmit / receive head coil (Nova Medical). TOF MRA was performed with a voxel size (vs) of 0.2 x 0.2 x 0.2 mm3, non-enhanced MPRAGE with a vs of 0.7x0.7 x0.7mm3. For qualitative analysis, two readers assessed the delineation of the following arteries and segments: (1) internal carotid artery [cervical segment, petrous segment, cavernous segment], (2) anterior cerebral artery [A1, A2], (3) anterior communicating artery, (4) middle cerebral artery [M1, M2, M3], (5) posterior communicating artery, (6) posterior cerebral artery [P1, P2], (7) basilar artery. Additionally, (1) overall image quality, (2) vessel sharpness, (3) vessel to background contrast and (4) image impairment due to artifacts was assessed. For qualitative analysis a five-point-scale was utilized for rating (5 = excellent image quality to 1 = non-diagnostic). For quantitative analysis contrast-ratios of the middle cerebral artery in correlation to surrounding grey matter were measured in both sequences. For statistical analysis a Wilcoxon signed rank test was applied.

RESULTS

Both sequences enabled high quality delineation of all assessed vessel segments with superior depiction of the vessels of the anterior circulation (meananterior circulation MPRAGE=4.6 TOF MRA=4.4) compared to the vessels of the posterior circulation (mean posterior circulation MPRAGE=4.1 TOF MRA=3.8). While TOF MRA yielded superior vessel sharpness over MPRAGE (meanvessel sharpness MPRAGE 4.3 TOF MRA 4.6), MPRAGE MRI yielded superior vessel to background contrast (meanvessel contrast MPRAGE=4.6 TOF MRA=4.2), also reflected in higher CR values for MPRAGE MRI.

CONCLUSION

Our results demonstrate the high diagnostic value of both non-enhanced MRA techniques, with overall superiority of MPRAGE MRI, offering a robust and artifact-free high-resolution delineation of the intracranial vasculature.

CLINICAL RELEVANCE/APPLICATION

7T MPRAGE MRI may serve as a high quality diagnostic tool for high-resolution assessment of the intracranial vasculature, particularly for recurrent radiation-free follow-up imaging.

SSA24-03

Contrast-enhanced Magnetic Resonance Angiography (MRA) vs. Digital Subtraction Angiography (DSA): Grading of Stenosis and Therapy Planning in Peripheral Artery Occlusion Disease (PAOD)

Thomas Josef Vogl MD, PhD (Presenter): Nothing to Disclose, Clemens Wurz BA: Nothing to Disclose, Stefan Zangos MD: Nothing to Disclose, Axel Thalhammer MD: Nothing to Disclose, Thomas Schmitz-Rixen MD, PhD: Nothing to Disclose

PURPOSE

To compare contrast-enhanced magnetic resonance angiography (MRA) with conventional digital subtraction angiography (DSA) for grading of stenosis and therapy planning in peripheral artery occlusion disease (PAOD).
angiography (DSA) for detecting stenoses and planning of therapy in patients with peripheral artery occlusion disease (PAOD).

METHOD AND MATERIALS

In this retrospective study 71 patients (20 women / 51 men; mean: 68 years) with established PAOD underwent both imaging modalities in a maximum interval of 40 days. DSA was the standard of reference. The pelvic and leg arteries were divided into 31 anatomic segments, which were graded on a scale from 1-4 (1=no stenosis; 2=stenoses < 70%; 3=stenoses≥70%; 4=occlusion). The pelvic and leg vessel systems were categorized with the TASC II-score into five grades (none, TASC-A, TASC-B, TASC-C, TASC-D) for detecting whether the therapeutic consequences would be the same for both imaging modalities.

RESULTS

Evaluation was possible for 1,937 vessel segments. MRA and DSA agreed in the grading of 1,802 segments (93.03%), and differed in 69 cases in one category, in 28 cases in two and in 38 cases in three categories. In discriminating between hemodynamically relevant (≥70% / occlusion) and non-hemodynamically relevant findings (< 70% / nonstenosis) MRA achieved a sensitivity of 90.59% and a specificity of 96.61%. Evaluation of TASC II-classification for the aorto-iliac region was possible in 56 patients. In 52 patients TASC II-class was the same for DSA and MRA (92.86%; κ=0.88), for the femoral-popliteal region the result was nearly the same, the evaluation of 56 patients showed agreement in 52 patients (92.86%; κ=0.90).

CONCLUSION

There was almost perfect agreement between MRA and DSA in the TASC classification. Thus, the therapeutic consequences are predominantly the same, irrespective of the modality used.

CLINICAL RELEVANCE/APPLICATION

Contrast-enhanced MRA is a valid method for detecting and grading stenoses in patients with PAOD.

FGF-23 a Predictive Parameter in Patients with Non-occlusive Mesenteric Ischemia (NOMI)

Peter Minko MD (Presenter): Speaker, Straub Medical AG Consultant, Straub Medical AG, Matthias Klingele : Nothing to Disclose, Jonas Stroeder MD : Nothing to Disclose, Heinrich Groesdonk : Nothing to Disclose, Arno Buecker MD : Consultant, Covidien AG Speaker, Covidien AG Co-founder, Aachen Resonance GmbH Research Grant, Siemens AG, Hans-Joachim Schafers MD : Nothing to Disclose, Marcus Katoh MD : Consultant, Straub Medical AG Consultant, Medtronic, Inc

PURPOSE

To correlate angiographic findings with kidney specific parameters and to investigate the predictive value of angiography with respect to the outcome in patients with NOMI.

METHOD AND MATERIALS

In this prospective study 63 consecutive patients (mean age:73±8 years) suspected of NOMI after cardiac or major thoracic vessel surgery underwent catheter angiography of the superior mesenteric artery. Images were assessed by two experienced radiologists on consensus basis using a previously published standardized reporting system (Homburger-NOMI-Score). These data were correlated to kidney specific parameters: FGF-23, cystatin, cystatin C, creatinin and glomerular filtration rate (GFR) and outcome data (death, acute renal failure) using linear and logistic regressions, as well as nonparametric test and ROC-analysis.

RESULTS

Significant correlations were found between FGF-23 and the overall NOMI-score (consisting of five categories namely vessel morphology, reflux of contrast medium into the aorta, contrast enhancement and distension of the intestine, as well as the time to portal vein filling; p=0.05) as well as the modified NOMI-score (consisting of three categories namely vessel morphology, reflux of contrast medium into the aorta and time to portal vein filling; p=0.02). No significant correlation was found for creatinin (p=0.07), cystatin (p=0.27), cystatin C (p=0.83) and GFR (p=0.23). Logistic regression revealed a significant correlation between death and the overall NOMI-score (p=0.006) as well as the modified NOMI-score (p<0.001). No significant correlation was found for the development of acute renal failure (p=0.268).

CONCLUSION

FGF-23 significantly correlates with the development of NOMI. Furthermore the applied scoring system allows to predict fatal outcome in NOMI patients.

CLINICAL RELEVANCE/APPLICATION

FGF-23 plays a predictive value for the development of NOMI and correlates significantly with the Homburger-NOMI-Score.

Clinical Routinization of Spectral CT with Individualized Scan Protocol in Abdomen: Image Quality and Radiation Dosage Comparison with Conventional 120kVp Scans

Chen Xiaoxia MMed (Presenter): Nothing to Disclose, Lei Yuxin MMed : Nothing to Disclose, Tian Qian
**Purpose**

To evaluate the feasibility of routinizing spectral CT in abdominal application with individualized scan protocol by comparing image noise and radiation dose of conventional 120kVp scans.

**Method and Materials**

Prospectively randomized 39 patients (BMI: 23.08±3.58) who require contrast-enhanced CT scans in the abdomen to 2 groups: group 1 (n=20) with 120kVp for the plain phase and spectral CT for the enhanced portal venous phase (VP); group 2 (n=19) with spectral CT for plain phase and 120kVp for VP. For the 120kVp scan, the tube current (m A) was automatically adjusted to achieve noise index (NI) of 10, and for spectral CT, a m A was selected based on the average of the min and max m A from the 120kVp m A table for NI=10. Scan ranges were 250mm for both groups. CT dose index (CTDI) and effective dose was recorded. Images of 5mm thickness were reconstructed with 50%ASIR in both groups. Image standard deviation (SD) for the liver parenchyma, erector spinae, fat and portal vein on the conventional 120kVp polychromatic images and 70keV monochromatic images from spectral CT was measured and compared with t-test.

**Results**

The CTDI and effective dose were (13.32±1.19mGy and 6.19±0.55mSv) for spectral CT, about 10% lower than the respective value of (14.35±4.66mGy and 6.68±2.17mSv) for the 120kVp CT. The SD values (in HU) in the spectral CT images were 5.01±0.48, 4.93±0.77, 5.16±0.93 and 5.81±1.14 for the liver parenchyma, erector spinae, fat and portal vein, respectively. These values were statistically lower than the respective values of 6.69±0.85, 6.05±1.86, 5.74±1.09 and 7.44±1.31 in the conventional 120kVp images (p<0.01).

**Conclusion**

With individualized scan protocol, spectral CT provides monochromatic images with lower image noise at the same or lower radiation dose in comparison with the conventional 120kVp scans. The lower dose scan protocol makes it feasible to routinize spectral CT in abdominal applications.

**Clinical Relevance/Application**

Spectral CT with individualized low dose scan protocol can be routinely used in abdominal applications.

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**Prediction of Renal Function Impairment of Donors after Kidney Transplantation: Analysis by Using Abdominal Aortic Calcification under Propensity Score Matching**

**Purpose**

To analyze whether the presence or amount of abdominal aortic calcification (AAC) could predict renal function impairment of donors after kidney transplantation

**Method and Materials**

Between 2010 and 2013, 287 donors undergoing nephrectomy were enrolled. The calcium score (CS) of AAC was quantitatively measured with Agatston score on CT angiography. The donors were divided into AAC (CS>0, n=238) and non-AAC (CS=0, n=49) groups. The propensity score matching was conducted in terms of age, sex, and body mass index. The estimating glomerular filtration rate (eGFR) was measured before, and 1-week, 1-month, 3-month, and 6-month after transplantation. Between two groups, pre- and postoperative eGFRs were compared before and after propensity score matching, respectively.

**Results**

The mean CS was 185.5 ± 263.3 in ACC and 0 in non-ACC (p<0.05). Before propensity score matching, all of pre- and postoperative eGFRs were different between two groups (p<0.05). After propensity score matching, those differences of eGFR disappeared (p>0.05). The presence of AAC was not an indicator for predicting renal function impairment under propensity score matching (p>0.05). However, among AAC group, CS more than 100 was related to renal function impairment as compared to CS of 100 or less (p=0.035). In multivariable analysis, CS more than 100 (OR=12.4, p=0.017) and preoperative eGFR (OR=0.829, p=0.001) were associated with the occurrence of chronic kidney disease (CKD; eGFR<60mL/min/1.73 m2 at 6-month postoperatively).

**Conclusion**

The calcium score more than 100 of abdominal aorta may be a predictor of CKD occurrence after kidney transplantation although the presence of abdominal aortic calcification itself may not be related to postoperative renal function impairment.

**Clinical Relevance/Application**

In renal donors, preoperative CT evaluation in terms of abdominal aortic calcification may help predict renal function impairment after kidney transplantation, which information may allow clinicians to plan the follow-up strategy for donors.

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**Non-invasive Ultrasound Elastography: Feasibility of Using Shear Stress and Axial Deformation as Parameters to Discriminate between Symptomatic and Asymptomatic Carotid Plaques**

**Purpose**

To evaluate the feasibility of routinizing spectral CT in abdominal application with individualized scan protocol by comparing image noise and radiation dose of conventional 120kVp scans.
Parameters to Discriminate between Symptomatic and Asymptomatic Carotid Plaques

Yang Ju MD (Presenter): Nothing to Disclose, Cyrille Naim MD: Nothing to Disclose, Marie-Helene Roy-Cardinal PhD, BEng: Nothing to Disclose, Marie-France Giroux MD: Research Grant, Johnson & Johnson Research Grant, BIOTRONIK GmbH & Co KG Stockholder, Abbott Laboratories, Guy Cloutier PhD: Nothing to Disclose, Gilles P. Soulez MD: Speaker, Bracco Group Speaker, Siemens AG Research Grant, Siemens AG Research Grant, BIOTRONIK GmbH & Co KG Stockholder, Abbott Laboratories

PURPOSE

To evaluate the ability of non-invasive vascular elastography (NIVE) shear stress and axial deformation parameter analysis to discriminate between symptomatic and asymptomatic carotid plaques.

METHOD AND MATERIALS

A total of sixty-four subjects including 18 women (28.1%) and 46 men (71.9 %) ages from 49 to 86 years (average of 70) with 50% or greater carotid stenosis (average of 68.8%; range from 50 to 100%) underwent doppler imaging of internal carotid arteries. A subgroup of 24 patients had neurological symptoms within three months prior to one year after initial examination and were considered as symptomatic; the remainder 40 patients were considered as asymptomatic. Carotid plaques were segmented on ultrasound images and elastograms over multiple heart cycles were computed with NIVE. The axial shear and deformation values were then estimated. Association between shear stress and deformation with symptomatology were estimated using Mann-Whitney for non-normal distribution of data.

RESULTS

The analysis of maximum axial shear strain showed a statistically significant difference between symptomatic and asymptomatic plaques (0.36 ± 0.17 vs 0.44 ± 0.17; P = 0.020). There was also a statistically significant difference between symptomatic and asymptomatic plaques when we compared the following parameter: Minimum Axial Deformation (-0.44 ± 0.24 vs -0.58 ± 0.23; P = 0.012), Maximal Axial Deformation (0.42 ± 0.23 vs 0.57 ± 0.20; P = 0.001), Range of Cumulated Axial Deformation (1.32 ± 0.82 vs 1.84 ± 0.75; P = 0.005) and Minimum Strain Rate (-1.56 ± 0.70 vs -2.27 ± 1.30; P = 0.016).

CONCLUSION

Ultrasound NIVE is feasible in patients with significant carotid stenosis and could be used as a tool to discriminate symptomatic from asymptomatic patients using such parameters as shear strain and axial deformation.

CLINICAL RELEVANCE/APPLICATION

Non-invasive vascular ultrasound could be a useful complementary tool in the identification of patients with significant carotid stenosis who could benefit from surgical treatment.

Ultrasound Examination after Creation of Dialysis Arteriovenous Grafts Forecasts Their Lifespan

Jan Malik (Presenter): Nothing to Disclose, Jaroslav Kudlicka: Nothing to Disclose

PURPOSE

The patency of arteriovenous grafts (AVG) for hemodialysis is mostly limited by stenoses. They decrease the blood flow, with the risk of dialyzed blood recirculation and of thrombosis with access failure. Some risk factors for shorter AVG lifespan are already known and include diabetes mellitus, history of repeated interventions and others. Identification of further risk factors could identify subjects, which would profit from AVG surveillance programs. We hypothesized that abnormal ultrasound (US) finding just after AVG creation would determine such subjects.

METHOD AND MATERIALS

We examined our AVG subjects within 40 days after AVG creation and followed them up for years with US surveillance every 3 months and recorded interventions. According to US finding the AVGs were divided into three groups: 1. normal finding, 2. non-significant stenosis and 3. hemodynamically significant stenosis. The primary endpoint of the study was cumulative AVG patency that is the time interval since creation until final AVG loss. The data were analyzed by Log-rank (Mantel-Cox) test and Student’s t-test and visualized by survival graphs.

RESULTS

Overall, we included 360 AVGs. Median follow up was 565 days. Normal ultrasonographic finding was in 265 cases (78%), non-significant stenosis was in 46 (13%) cases and significant stenosis in 29 (9%) cases. The longest cumulative patency was observed in patients, which had normal US findings at inclusion and it was significantly longer than in non-significant stenosis (p = 0.04); the latter group had longer patency than significant stenosis patients (p=0.03). Survival of normal findings and nonsignificant stenosis groups differed significantly after 443 days (p=0.03) in favor of normal findings as well as the mean time of the first intervention [334 vs. 147 days after AVG creation (p<0.0001), respectively]. Non-significant and significant stenosis groups differed in AVG survival after 453 days (p=0.04) in favor of the former group, which also had longer intervention/free interval (147 vs. 82 days, p=0.03).

CONCLUSION

Early US examination of AVGs identifies subjects at higher risk of access loss. Further research is needed to find out if more frequent surveillance or re-do surgery could prolong the AVG lifespan of these patients.
CLINICAL RELEVANCE/APPLICATION

The presence of any stenosis at early ultrasonography of AVGs is associated with poorer prognosis despite its successful therapy.


Philipp Riffel MD (Presenter): Nothing to Disclose, Stefan Haneder MD: Nothing to Disclose, Holger Haubenreisser: Nothing to Disclose, Bernhard Schmidt PhD: Employee, Siemens AG, Stefan Oswald Schoenberg MD, PhD: Institutional research agreement, Siemens AG, Thomas Henzler MD: Nothing to Disclose

PURPOSE

Previous studies have demonstrated that calculated low keV monoenergetic datasets from Dual energy (DE)CT angiography of the lower extremity can significantly improve contrast-to-noise ratio (CNR) when compared to polyenergetic images (PEI). However, monoenergetic ultra-low keV datasets below 60 keV did not lead to improved CNR due to the dramatic increase in image noise at lower keV levels. The recently introduced frequency-split technique combines the lower spatial frequency stack at low keV for high contrast with the high spatial frequency stack for noise at high keV levels to calculate noise-reduced images at ultra-low keV levels below 60 keV. The aim of this study was to evaluate the objective image quality of ultra-low keV virtual monoenergetic images (MEIs) calculated from lower extremity DECT angiography data.

METHOD AND MATERIALS

20 patients (15 male; mean age 73±13 years) who underwent DECT angiography of the lower extremity were retrospectively included in this study. MEIs from 40 to 120 keV were reconstructed using the frequency-split technique. Signal intensity, noise, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were assessed in external iliac, femoral, popliteal, and lower leg arteries. Comparisons between MEIs and PEIs were performed using a Mann-Whitney U test.

RESULTS

120 arteries were evaluated. 60, 50 and 40 keV images resulted in the greatest improvements in vessel attenuation (+26%, +85%, +180% all p < 0.05) and SNR (+53%, +48%, +48%, all p < 0.05) compared to PEIs. The highest CNR values were found in 50 keV MEIs (18.6 ± 10.4 averaged over all arteries), which were significantly higher compared to PEI (11.7 ± 6.9 averaged over all arteries, all p < 0.05).

CONCLUSION

Combining the lower spatial frequency stack for contrast at low keV levels with the high spatial frequency stack for noise at high keV levels leads to improved image quality of ultra-low keV monoenergetic lower extremity DECT datasets when compared to previous monoenergetic reconstruction techniques without the frequency-split technique.

CLINICAL RELEVANCE/APPLICATION

With a frequency split approach, 40, 50 and 60 keV MEIs provide improved objective image quality in DECT lower extremity angiography compared to standard PEI and should therefore be considered for clinical use when DECT angiography of the lower extremity vessels is performed.

VIS-SUA

Vascular/Interventional Sunday Poster Discussions

Scientific Posters

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AMA PRA Category 1 Credits ™: .50

Sun, Nov 30 12:30 PM - 1:00 PM  Location: VI Community, Learning Center

Participants

Moderator
Ranjith Vellody MD: Nothing to Disclose

Sub-Events

VIS211

Arsenic Trioxide Contained Transcatheter Arterial Chemoembolization for Treatment of Unresectable Hepatocellular Carcinoma: A Prospective Multicenter Randomized Controlled Trial (Station #1)

Tengchuang Ma (Presenter): Nothing to Disclose, Hai Bo Shao MD: Nothing to Disclose, Long Gao: Nothing to Disclose, Hongying Su: Nothing to Disclose, Xu Ke MD: Nothing to Disclose

PURPOSE

To evaluate the efficacy and safety of arsenic trioxide (As2O3) contained transcatheter arterial chemoembolization (TACE) for treatment of unresectable hepatocellular carcinoma (HCC).
METHOD AND MATERIALS

A multicenter randomized controlled trial was conducted on 223 patients with unresectable HCC at twelve tertiary referral center hospitals between January 2007 and December 2010. Patients were randomly assigned to three groups with different intra-procedure drug administration protocols (group 1: TACE-As2O3 20mg, n=69; group 2: TACE-epirubicin 40mg, n=71; group 3: TACE-two drugs combined, n=83). All TACE procedures were carried out by superselective embolization using drug-lipiodol emulsion. Repeated TACEs (mean 2.8 times) were performed at one-month intervals and followed up at three-month intervals. Therapeutic effect was evaluated by mRICIST criterion. The primary end point was overall survival (OS). The secondary end point was time to progression (TTP). Adverse effect (AE) observation obeyed CTCAE 4.0.1 version. Survival analysis was performed with Kaplan-Meier method by Log-rank test. Factors associated with OS and TTP were also analyzed.

RESULTS

There were no treatment-related deaths. By follow-up of 6 to 43 months, there was no significant difference in OS among three groups (16.0, 15.6, 17.2 months in group 1, 2 and 3, p=0.5614). However, TTP in group1 (12.9 months) and group 3 (13.8 months) was significantly longer than that in group 2 (7.7 months, P<0.01). Multivariate analysis showed that BCLC stage was an independent prognostic factor for OS and TTP. Intra-procedure drug administration protocol was a prognostic factor for TTP. On stratification analysis, As2O3 contained TACE (group 1 and 3) showed longer OS (P<0.001) and TTP (P<0.001) in patients in BCLC B stage. The proportion of - AEs in group 2 and 3 was significantly higher than that in group 1 (liver function abnormalities, P<0.05; degree toxicity incidence ,P <0.05).

CONCLUSION

As2O3 contained TACE improved TTP of the patients with unresectable HCC, especially the patients in BCLC B stage (both OS and TTP were prolonged). The toxicity of TACE was not increased for single or combined use of As2O3.

CLINICAL RELEVANCE/APPLICATION

As2O3 contained TACE may prolong TTP and OS of unresectable HCC especially in BCLC B stage without enhancement of toxicity.

VIS212

Endovascular Repair of an Isolated Common Iliac Aneurysm in 21 Patients (Station #2)

Soichiro Hase (Presenter):  Nothing to Disclose , Yuya Koike :  Nothing to Disclose , Motoshige Yamasaki :  Nothing to Disclose , Hiroshi Iwamura :  Nothing to Disclose , Junichi Nishimura MD :  Nothing to Disclose , Naoki Washiyama :  Nothing to Disclose , Mutsumu Fukata :  Nothing to Disclose , Hiroshi Nishimaki MD :  Nothing to Disclose

PURPOSE

To evaluate the clinical results in endovascular aneurysmal repair (EVAR) of isolated common iliac artery aneurysms (CIAAs) retrospectively.

METHOD AND MATERIALS

Between June 2009 and March 2014, 21 patients (17 males) underwent EVAR for isolated CIAAs. The age ranged from 52 to 90 years (mean, 69 years). Unilateral involvement of CIAA was seen in 15 patients, with bilateral involvement in the remaining 5 patients. Internal iliac artery involvement was seen in 2 patients. The maximum diameter of aneurysm ranged from 23 to 55 mm (mean, 35 mm). The bifurcated endograft in 11, the iliac limb of the aortic graft in 7, and the combination of aortic cuff and parallel-aligned iliac extender in 3 patients were used. The follow-up CT was performed at discharge, 3, 6, and 12 months and annually thereafter.

RESULTS

The mean follow-up period was 529 days (range, 30-1768). Technical success was achieved in all 21 patients (100%). No mortality and morbidity were observed during follow-up. Follow-up CT revealed no evidence of type I/III endoleaks and aneurysmal enlargement (>5mm). In 9 CIAAs (33%), shrinkage of aneurysmal sac was observed.

CONCLUSION

Endovascular repair for isolated common iliac aneurysm is feasible with a favorable mid-term result.

CLINICAL RELEVANCE/APPLICATION

Because side branches from a common iliac artery are infrequent, it is easier for complete exclusion of common iliac artery aneurysms than of abdominal aortic aneurysm.

VIS213

Local Control Effect of Microballoon-occluded Transarterial Chemoembolization with Miriplatin for Hepatocellular Carcinoma: A Retrospective Comparison of Conventional TACE with Epirubicin (Station #3)

Masakazu Hirakawa MD (Presenter):  Nothing to Disclose , Yoshiki Asayama MD :  Nothing to Disclose , Akihiro Nishie MD :  Nothing to Disclose , Yasuhiro Ushijima MD :  Nothing to Disclose , Kimitaka Miyajima MD, PhD :  Nothing to Disclose , Hiroshi Honda MD :  Nothing to Disclose
The aim of this retrospective study is to compare the local control effects of microballoon-occluded transarterial chemoembolization (B-TACE) with miriplatin (MPT) and those of conventional TACE with epirubicin (EPIR) for hepatocellular carcinoma (HCC).

Sixty-five HCC cases were treated with TACE using EPIR or MPT. Forty patients (25 men, 15 women; mean age, 73.4 years) were treated using B-TACE with MPT (the MPT-B-TACE group), and 25 patients (15 men, 10 women; mean age, 72.2 years) were treated using TACE with EPIR (the EPIR-TACE group). The local control rates (modified Response Evaluation Criteria in Solid Tumors [mRECIST]), time to local recurrence (Kaplan-Meier and log-rank tests), and adverse events (AEs) were evaluated. Statistical analyses were conducted to evaluate the relationship between the patient's characteristics and local recurrence after MPT-B-TACE using Pearson's Chi-squared test. Multivariate logistic regression analysis was also performed.

There were no significant differences in patient's characteristics between the groups. The overall AE incidence did not significantly differ between the groups. According to the mRECIST, the objective response rate including complete and partial responses, in the MPT-B-TACE group (92%) was significantly higher than that in the EPIR-TACE group (76%). Overall, local recurrences in the MPT-B-TACE group were significantly lower than in the EPIR-TACE group (p < 0.05). Excluding multiple HCC cases, the local recurrence rate in the MPT-B-TACE group was significantly lower than in the EPIR-TACE group (p < 0.05). Local recurrence after MPT-B-TACE was recognized in the 35% patients in the follow-up periods. Tumor size larger than 2cm and tumor number more than three HCCs were significant key factors in the local recurrence after MPT-B-TACE.

MPT-B-TACE was associated with a higher objective response rate and lower local recurrence rate than EPIR-TACE, and both showed similar adverse effects. Tumor size larger than 2cm and tumor number more than three HCCs were risk factors of the local recurrence after MPT-B-TACE.

B-TACE with miriplatin may have great potential advantages in comparison with conventional TACE with epirubicin, and might constitute a novel therapeutic option for unresectable HCC.

To determine the complication and diagnostic yield rates of ultrasound guided native and transplant kidney biopsies over a 5-year period.

Retrospective analysis of 832 biopsies performed in 735 patients who underwent ultrasound guided diagnostic renal biopsies between January 2008 and October 2012 in our institution were identified and analysed from the hospital renal and pathology data bases. Chi-square and Mann Whitney test were used and significance set at <0.05.

A total of 832 biopsies were performed in 735 patients. 314(38%) biopsies were performed as emergency procedures and 518(62%) as elective. The median age of the study group was 54 years (range 10 to 90 years) and M: F ratio 57:43. The overall complication rate was 6.7% (1.3% major and 5.4% minor). The major complication rate in the emergency biopsy group was significantly higher compared to the elective group (2.5% vs 0.8%; p=0.04). Renal function was significantly worse in the major complication group (creatinine 457 umol/l vs 201umol/l, p=0.01). All 11 patients who sustained major haemorrhage received a blood transfusion and 8 underwent emergency arterial embolisation. The risk of major haemorrhage was higher in the transplant compared to native group (2.2% vs 1.0%; p= 0.25). No coagulation profile difference was noted between the major and minor complication groups. No difference was noted in the minor complication rate between the native and transplant groups. In the 30-day periprocedural period there were 2 deaths unrelated to the procedure. Overall diagnostic yield rate was 95.1%, with an average of 12.3 glomeruli in the formalin sample. In the non-diagnostic sample group (4.9%), the average number of glomeruli in the formalin sample was lower at 1.3 glomeruli. No difference was observed between the native and transplant group yield rates.

The complication rate of our cohort group compares favourably with those quoted in the published literature. The major complication rate was significantly higher in the group who underwent biopsy as an emergency procedure, in patients with significantly impaired renal function and in the transplant patient group. There were no biopsy related kidney losses or deaths.
CLINICAL RELEVANCE/APPLICATION

Ultrasound guided diagnostic renal biopsy is a safe procedure with a high diagnostic yield.

VIS210

Low Dose and Low Contrast Medium Volume CT Angiography of the Abdominal Aorta and Lower Extremity Vessels (Station #5)

Yue Dong (Presenter): Nothing to Disclose, Yijun Liu: Nothing to Disclose, Ruxin Wang: Nothing to Disclose, Lifei Sun ARRT, MBBS: Nothing to Disclose, Renwang Pu MBBCh, FRCPC: Nothing to Disclose, Liang Hu: Nothing to Disclose

PURPOSE

To investigate low dose and low contrast medium volume CT angiography and to compare the image quality and diagnostic accuracy at different doses with digital subtraction angiography (DSA) in the evaluation of the abdominal aorta and lower extremity vessels.

METHOD AND MATERIALS

31 patients with a clinical diagnosis of obstructive arterial disease of the extremities underwent MDCT (GE Discovery 750HD) angiography of the aorta and peripheral vessels. Group A: 21 patients, 120kVp, noise index of 7, 150ml of contrast medium 350 at 5ml/s. Group B: 10 patients, 80kVp, noise index of 15, 80ml of contrast medium 350 at 3ml/s followed by 40ml saline flush. Two protocols used auto mA mode and AISR 30% reconstruction. The measurement of radiation dose was based on the CTDI and DLP. Image quality was analyzed by two vascular radiologists in consensus using a three-point scale (poor, better and good). The arterial system was divided into 19 anatomical segments (from abdominal aorta to ankle arteries). Each segment was evaluated for patency by using a five point scale: 1=normal, 2=moderate disease (<50% stenosis), 3=severe stenosis (>50% stenosis), 4=diffuse severe stenosis (>50% stenosis) and 5=complete occlusion. DSA represented the reference.

RESULTS

Mean CTDI and DLP of group B (6.8±1.7mGy, 926.26±172.21mGy•cm) were reduced by 66.7% and 62.8%, compared with group A (20.4±3.6mGy, 2489.42±362.48mGy•cm). The average overall diagnostic image quality for the 2 groups was graded as good or better. No difference in image quality was seen between group A and B (p>0.05). Group A revealed a sensitivity, specificity, accuracy, PPV and NPV of 96%, 96%, 96%, 89% and 99% in the evaluation of the presence and degree of stenosis compared to 93%, 92%, 94%, 84% and 97% for Group B.

CONCLUSION

Low dose scan with low contrast medium volume was a feasible option for the abdominal aorta and lower extremity vessels angiography. This technique provides less contrast medium and lower radiation exposure to the patient while maintaining optimal diagnostic accuracy.

CLINICAL RELEVANCE/APPLICATION

For the abdominal aorta and lower extremity vessels angiography, this technique provides less contrast medium and lower radiation exposure to the patient while maintaining optimal diagnostic accuracy.

VIS214

A Retrospective Evaluation of CT Radiation Dose in CT Guided Cryoablation of Renal Tumors: With and without Radiation Dose Reduction Technique (Station #6)

Tze Min Wah MBChB, FRCR: Consultant, Galil Medical Ltd, Michael Min Gallagher (Presenter): Nothing to Disclose, Christopher Min Hounslow: Nothing to Disclose, Gareth Richard Iball MSC, BSC: Nothing to Disclose

PURPOSE

The aim of this study was to evaluate the CT radiation dose in CT guided cryoablation (CRYO) of renal tumors in a single large teaching institution and to assess the percentage reduction of radiation dose with and without a dose reduction technique in our intra-procedural CT CRYO treatment protocol.

METHOD AND MATERIALS

From 2008 to 2014, a total of 97 patients underwent CT guided CRYO of renal tumors and were included in this retrospective evaluation of their CT radiation dose during treatment. Amongst them were 56 patients (61 procedures; mean age, 65; 37 males and 29 females) without CT dose reduction technique and 41 patients (43 procedures; mean age, 73; 27 males and 14 females) with CT dose reduction technique. The group without CT dose reduction technique were scanned with the same parameters throughout whilst those with the dose reduction technique had sequential reduction of mAs during scanning until the interventional radiologist deemed the increased image noise had compromised the diagnostic quality of the images.

RESULTS

The average DLP with and without CT dose reduction technique was 6044 (+/- SD 2676) mGy-cm and 3354 (+/- SD 1308) mGy-cm. Thus the average DLP was 43.7% lower in the dose reduced group when compared to the non-dose reduced group (p>0.0001) (Figure 1). The total CTDIvol was used to estimate the patient skin dose; in the non-reduced group the maximum ‘skin dose’ was 1.1Gy, vs. 0.38Gy in the dose reduced group. However, there was no significant difference between the number of cryoprobes used, number of CT examination runs or total exam time between the two groups.
CONCLUSION

The use of a sequential mAs dose reduction strategy in our CT CRYO treatment protocol has produced
significant dose reduction for patients undergoing treatment of their renal tumors. In our clinical practice, we
would now advocate the use of this dose reduction strategy at all times as long as the image quality remains
sufficient for the clinical purpose of the examination.

CLINICAL RELEVANCE/APPLICATION

It is important to use the dose reduction strategy during CT CRYO treatment of renal tumors as the radiation
burden can be reduced significantly by the simple sequential mAs dose reduction approach.

VIE206

The Role of Adrenal Venous Sampling in Primary Hyperaldosteronism (Station #7)

Carmen Zevallos Maldonado (Presenter): Nothing to Disclose, Jose Garcia-Medina MD: Nothing to Disclose,
Carmen Aleman: Nothing to Disclose, Maria Carmen Alcantara MD: Nothing to Disclose, Placida
Aleman: Nothing to Disclose, VICENTE GARCIA: Nothing to Disclose

TEACHING POINTS

To describe how is performed the adrenal venous sampling in our service, and its role in the etiological
diagnosis of Primary Hyperaldosteronism.

TABLE OF CONTENTS/OUTLINE

-Primary Hyperaldosteronism: Clinical tests, screening, biochemical tests, ethiological diagnosis and treatment.
-Aldosterone-producing adenoma and bilateral adrenal hyperplasia: Images using computerized tomography
   and magnetic resonance. -Anatomy of the suprarrenal veins and the angiographic patterns of the adrenal veins.
-Technique of adrenal venous sampling used in our service. -Interpretation of the results and complications
   involved in adrenal venous sampling. -Cases in our service.

VIE007-b

Current State of Aortic Dissection Classification and Management (hardcopy backboard)

Preston George Smith MD (Presenter): Nothing to Disclose, Anastasia Frances Barron DO: Nothing to
Discuss, Ulu Cenk Turba MD: Nothing to Discuss, Bulent Arslan MD: Advisory Board, Nordion, Inc
Advisory Board, Angiotech Pharmaceuticals, Inc Speakers Bureau, Nordion, Inc Speakers Bureau, W. L. Gore &
Associates, Inc Consultant, Bayer AG

TEACHING POINTS

1. To highlight key anatomic findings of aortic dissection on CT Angiography and detection of fenestrations, now
   assuming increasing relevance with the rising role of endovascular repair. 2. To review the accepted
   classification systems of aortic dissection demonstrated on CT Angiography as well as newly proposed systems
   of evaluating thoracic aortic dissection.

TABLE OF CONTENTS/OUTLINE

   Thoracic Aortic Dissection statistics. b. Accepted classification systems i. current limitations (loopholes) c.
   Review newly proposed criteria 3. Example cases displaying important points from new and old criteria and
   common misreads based on loopholes in current classifications systems which have potential medicolegal
   ramifications a. Primary entry tear sites as well as extent and directional propagation of dissection i. several
   appearances of true lumens b. Status of the false lumen and extent and location of fenestrations c. Branch
   vessel involvement i. static ii. dynamic 4. Potential complications of new management approaches that may be
   related to endovascular management approaches. 5. Conclusion

VIS-SUB

Vascular/Interventional Sunday Poster Discussions

Scientific Posters

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Sub-Events

VIS217

Tolerability and Efficacy of Transarterial Chemoembolization of Hepatocellular Carcinoma with
70-150 µm Doxorubicin-Loaded-Drug-Eluting-Beads (Station #1)

Keyan B. Marashi MD (Presenter): Nothing to Disclose, Marco A. Cura MD: Nothing to Disclose,
Justin Decker Sacks MD: Nothing to Disclose, James Dale Meler MD: Nothing to Disclose

PURPOSE

To evaluate patient tolerability and efficacy of transarterial chemoembolization (TACE) with 70-150 µm
doxorubicin-loaded drug-eluting beads (DEB) in patients with hepatocellular carcinoma (HCC).

METHOD AND MATERIALS
48 consecutive patients (36 male, mean age 62.3yo, r31-81y) with unresectable HCC who underwent 54 TACE sessions with 70-150 µm doxorubicin-loaded DEB for unresectable HCC were retrospectively reviewed. 31 of 48 patients (65%) were classified as Barcelona Clinic Liver Cancer stage A, 15 (31%) were stage B, and 2 (4%) were stage C. Tumor size ranged from 1.3 cm to 8.5 cm (24 focal, 24 multifocal). Doxorubicin dose ranged from 7.5mg to 150mg. At the time of submission, follow-up imaging was available for 32 patients and was evaluated using mRECIST.

RESULTS

42 patients underwent a single session of TACE and 6 patients underwent two sessions. One procedural complication was encountered: a dissection of the common hepatic artery. 49 sessions resulted in discharge within 24 hours of TACE. 5 sessions required admission greater than 24 hours: 1 for nausea, fever, and emesis, 3 for abdominal pain, and 1 for unrelated medical care. Of the 32 patients for which follow-up imaging was available, 7 demonstrated complete response (21.9%), 10 demonstrated partial response (31.2%), 12 demonstrated stable disease (37.5%), and 3 demonstrated progressive disease (9.4%). Mean follow-up time since DEB-TACE was 122 days (r4-940 days). 4 patients were bridged to transplant. During follow-up, one patient death was recorded secondary to complications of liver transplant. Kaplan-Meier survival at 3, 6, and 12 months was 100%, 95%, and 95% respectively.

CONCLUSION

TACE with 70-150 µm doxorubicin-loaded DEB appears safe and effective for treatment of patients with unresectable HCC. In our population, the procedure was tolerated well, with the majority of patients showing favorable to stable tumor response.

CLINICAL RELEVANCE/APPLICATION

In vivo studies show that smaller 70-150 µm DEB penetrate further into tissue resulting in greater and more uniform drug coverage, but clinical studies to assess tolerability and efficacy are lacking.

VIS218

Percutaneous Interventions on Intragraft Stenoses within Failing Prosthetic Arteriovenous Grafts: Analysis of Patency Rates (Station #2)


PURPOSE

While endovascular outcomes on venous anastomosis and central venous stenoses have been extensively studied, there is a paucity of data on intragraft stenoses. The purpose of this study was to evaluate outcomes of endovascular treatment of intragraft stenosis in prosthetic hemodialysis grafts.

METHOD AND MATERIALS

Our procedural database was retrospectively reviewed for all percutaneous interventions on prosthetic AV grafts from 2005 through 2011. Specifically, AV grafts presenting with first-time intragraft interventions were identified, resulting in 186 unique AV grafts (83 males, 103 females, mean age 59.7 years). An intragraft stenosis was defined as a 50%+ luminal narrowing greater than 2 cm from the arterial and venous anastomosis requiring intervention. Post-intervention access patencies were calculated using Kaplan-Meier analysis. Lesion patency was determined based on time until angiographically proven >50% restenosis of the treated lesion.

RESULTS

Development of the first intragraft stenosis within an access occurred at a median graft age of 20.7 months (interquartile range 12.0-33.9 months). A total of 231 first-time intragraft stenoses were identified in 186 AV grafts. Graft thrombosis was present in 63%. Angioplasty was technically successful in 86%; 14% requiring stenting due to inadequate response to angioplasty. A concurrent extragraft stenosis was identified in 76% of accesses. At 3, 6, and 12 months, the post-intervention primary patency rates were 56%, 40%, and 23%, respectively. At 3, 6, and 12 months, secondary patency rates were 84%, 77%, and 67%, respectively. The lesion-specific patency rates were 79%, 52%, and 30% at 3, 6, and 12 months, respectively. Graft thrombosis was associated with significantly worse primary patencies (32% versus 53% at 6 months, p=0.014) but not secondary or lesion patency rates. Angioplasty and bailout stenting had similar patency rates. Graft age did not correlate with patency rates.

CONCLUSION

Angioplasty was highly successful for treatment of intragraft stenoses. Percutaneous intervention on these first-time intragraft stenosis yielded 6-month primary, secondary, and lesion patency rates of 40, 77, and 52%, respectively.

CLINICAL RELEVANCE/APPLICATION

Percutaneous interventions on first-time intragraft stenoses yielded post-intervention patency rates that exceed the goals stated by the 2006 K/DOQI guidelines and are thus justified.
Endovascular Embolization of Visceral Artery Pseudoaneurysms using N-Butyl Cyanoacrylate or Glue: Preliminary Experience in a Tertiary Care Centre (Station #3)

Madhusudhan Kumble Seetharama MD, FRCR (Presenter): Nothing to Disclose, Shivanand Ramachandra Gamanagatti MBBS, MD : Nothing to Disclose, T. V. Prasad MD : Nothing to Disclose, Pramod Garg MBBS, MD : Nothing to Disclose, Peush Sahni MBBS, MS : Nothing to Disclose, Arun Kumar Gupta MBBS, MD : Nothing to Disclose

PURPOSE

1. To evaluate the feasibility, safety and efficacy of n-butyl cyanoacrylate (NBCA) in embolization of visceral artery pseudoaneurysms (PsA).

2. To illustrate and discuss the indications for the use of NBCA in visceral artery PsA.

METHOD AND MATERIALS

30 patients (25 males, 5 females; age range: 15 - 50 years) of gastrointestinal bleed with 30 visceral artery PsA embolized using NBCA between Jan 2011 and Dec 2013 were retrospectively evaluated. The reasons for not using coils, which is the embolizing agent of choice, were assessed in each case. All PsA were embolized using co-axial technique. Glue - lipiodol mixture (25% - 30% glue concentration) was injected in small aliquots (0.1 - 0.3 mL) with serial flushing till the PsA was completely embolized. The technical and clinical success rates were evaluated along with the encountered minor and major complications.

RESULTS

All patients were embolized using NBCA (100% primary technical success) at first presentation. The reasons for using glue as primary embolizing agent were PsA arising from main artery which cannot be sacrificed (18 patients), inadequate landing zone for the coils (4 patients), inability to reach close or distal to the PsA (5 patients) and failed previous coil embolization (3 patients). Mean amount of glue used per procedure was 0.24 mL. Recurrence of PsA occurred in 3 patients indicating a clinical success of 90%. All the three were embolized using coil, glue and thrombin, respectively with 100% secondary technical success. Minor and major complications were seen in 3 patients (10%) each which were managed without major consequences.

CONCLUSION

NBCA is a safe and effective embolizing agent in expert hands and in selective cases where coils cannot be used or have failed.

CLINICAL RELEVANCE/APPLICATION

Embolization of visceral PsA with coils / microcoils may not be possible in some unusual situations and in such cases NBCA can prove to be an effective embolizing agent in experienced hands.

Role of Robotic Arm in CT Guided Biopsies (Station #4)

himanshu pendse : Nothing to Disclose, Suyash Kulkarni : Nothing to Disclose, Ashwin M. Polnaya MD : Nothing to Disclose, Nitin Sudhakar Shetty MBBS, MD : Nothing to Disclose, KETAN GAIKWAD : Nothing to Disclose, Kunal Bharat Gala MBBS, MD (Presenter): Nothing to Disclose, Meenakshi Haresh Thakur MD : Nothing to Disclose

PURPOSE

To explore the role of robotic arm in CT Guided Biopsies. To assess the accuracy of CT guided biopsy using a robotic device in targeting a lesion

METHOD AND MATERIALS

50 patients were analyzed on whom robotic device was used to perform CT Guided biopsy. MAXIO Robotic Arm and Navigation Software (Perfint Pvt Ltd., India) was used in this study. Informed consent was taken. Plain and post-contrast CT study of the required area was performed. This was fed in the navigation software of the robotic arm. The trajectory of the needle was planned on the software. Robotic arm was programmed to align at the desired point of entry at the required angle and depth. The biopsy was performed along this guided trajectory. Later, the image of the actual trajectory taken by the needle and the planned trajectory were superimposed. The difference in the entry point and actual point reached in the lesion by the needle on the actual biopsy image and planned image by the software is compared. This error is measured in millimeters. This is then analyzed for its statistical significance

RESULTS

50 patients were analyzed. There were 30 males and 20 females. The mean age was 55.46 years. The mean size of the lesion was 46 mm. Out of 47 patients, 26 were lung masses, 11 were pelvic masses, 2 were bone lesions, 5 were mediastinal masses, 1 each of liver, pancreatic and gastric lesions and 3 paravertebral masses. Effectiveness of Needle Placement: CT biopsy was technically possible in 47 out of 50 patients. Target off site >5mm is seen in 3 out of 47 patients leading to accuracy of 93%. The number of re-positioning were 1.46 per patient ranging from 1-3 per patient. The number of check scans were 1.5/patient.

CONCLUSION

Percutaneous image guided procedure with use of a robotic arm entails various advantages over free hand techniques with improvement in accuracy and fewer number of check scans. Robotic arms may be used to target deep seated lesions which need multiple repositioning with free hand techniques. Patient motion is a
major detrimental factor in execution of biopsy using robotic arm.

**CLINICAL RELEVANCE/APPLICATION**

Robotic assisted biopsies can improve accuracy, decrease the number of check scans and thus indirectly decreasing the radiation dose and time required for the procedure.

**VIS216 The Clinical Application of Normalized Utility of Contrast Medium in Combination with BMI Dependent kVp in Abdominal CT Angiography (CTA) (Station #5)**

Liu Xiaoyu MD (Presenter): Nothing to Disclose, Xiaoyan Meng MD : Nothing to Disclose, Hao Tang : Nothing to Disclose

**PURPOSE**

To assess the clinical application of normalized utility of contrast medium and kVp based on patient body-mass-index (BMI) in abdominal CTA.

**METHOD AND MATERIALS**

Eighty patients with different BMI were enrolled to undergo unenhanced and enhanced dual-phase abdominal CT scan using 370mgI/ml concentration contrast medium. Patients were divided into 3 test groups and 1 control group based on their BMI value: group A (n=20, BMI<23) with 80kVp and a total volume of contrast medium at 200mgI/kg; group B (n=20, 23=<BMI<26), 100kVp and 250mgI/kg contrast medium; group C (n=20, BMI>=26), 120kVp and 300mgI/kg contrast medium. Group D (n=20, without BMI restriction) was scanned at 120kVp and with a total volume of contrast medium at 1ml/kg. CT number of aorta in the arterial phase (AP), portal vein in the portal phase (PP) and hepatic parenchyma in both phases was measured. Image quality was assessed and compared among the 4 groups by statistical method.

**RESULTS**

There was no significant difference for the CT value (in HU) of hepatic parenchyma in AP and PP among 4 groups (group A: 81.91±8.37 and 112.97±12.36; group B: 80.13±3.66 and 104.85±9.39; group C: 76.32±9.17 and 101.83±15.76; group D: 76.18±8.74 and 103.07±14.51, all p>0.05). The CT value (in HU) of the aorta during AP in group A (305.32±76.11) was significantly higher than the other 3 groups (272.54±54.85, 252.51±32.89, 262.99±41.62, respectively) (p<0.05). There was no difference for the CT value of the portal vein in PP among 4 groups (160.19±22.76, 147.13±19.97, 148.66±21.78 and 147.76±24.61, respectively) (p>0.05). There was no significantly difference in the subjective image quality score among 4 groups (4.55±0.51 vs. 4.75±0.45 vs. 4.65±0.48 vs. 4.73±0.46, respectively) (P>0.05). Volume CT dose index (CTDIdvol, in mGy) were 33.58±4.47, 63.63±4.03, 96.06±7.12 and 98.89±7.04 for A, B, C and D groups, respectively.

**CONCLUSION**

BMI-dependent contrast medium injection and tube voltage selection scheme substantially reduces both contrast dose and radiation dose for patients with small BMI without adversely affecting vessel enhancement and image quality, compared with the conventional scan protocol.

**CLINICAL RELEVANCE/APPLICATION**

The BMI-dependent contrast medium injection and tube voltage selection scheme in CT angiography (CTA) improves patient safety without degradation of vessel enhancement and image quality.

**VIS220 Percutaneous and Laparoscopic Cryoablation (CA) of Renal Carcinomas: Mid-term CT and MR Imaging Follow-up (Station #6)**

Gianpiero Cardone MD (Presenter): Nothing to Disclose, Maurizio Papa MD : Nothing to Disclose, Paola Mangili PhD : Nothing to Disclose, Giorgio Guazzoni MD : Nothing to Disclose, Giuseppe Balconi : Nothing to Disclose

**PURPOSE**

This study aims to determine the safety and efficacy of CA in the management of small renal carcinomas and to assess its mid-term outcome.

**METHOD AND MATERIALS**

We report the mid-term CT/MR imaging follow-up in 115 pts who gained at least 5 years follow-up after CA of 96 renal carcinomas. Treatment was administered under laparoscopic US guidance in 101 pts and using percutaneous CT guidance in 14 pts. Pts were followed up clinically, biochemically and by imaging 24 hours after surgery, and subsequently every 6 months. Imaging follow-up was obtained using a 1,5T MR system in 104 cases and using CT in 11 pts with contraindications to MR.

**RESULTS**

24 hours after treatment all cryolesions were more than 1 cm larger than the original masses; cryolesions decreased in size by an average of 38% at 1 month, 64% at 6 months, 80% at 12 months and 93% at 84 months following LC. Early postprocedural MR and CT ce- images showed complete ischemia of cryolesions. Follow-up revealed no evidence of local recurrence in 111/115 pts (96%). 4 pts showed local recurrence at 12, 24 and 96 months. 12/115 pts (9%) demonstrated metachronous nodules in the same or in the contralateral
kidney at 12, 24 and 48 months. 2 pts showed a pancreatic metastatic nodule at 12 and 24 months. 11/115 pts died for metastasis of a previous malignancy. 1 pt showed ureteral fistula and 1 pt showed proximal ureteral stenosis. No significant rise in creatinine level was noted postprocedurally. After surgery 11% of the cases showed small perilesional haematomas.

CONCLUSION

Our experience suggests that CA is a safe, well tolerated and minimally invasive therapy for small renal carcinomas. MR is an effective tool in the imaging follow-up of renal lesions treated with CA, and the high contrast resolution of MR allows a better evaluation of vascularization of treated areas on subtracted ce images compared to CT. CT can be used as an alternative choice to MR, but lower contrast resolution of CT to MR makes it difficult to differentiate the cryolesion from the surrounding perilesional collections. A limit of CA is the difficulty to perform repeated treatments in the same kidney.

CLINICAL RELEVANCE/APPLICATION

CA is a safe, well tolerated and minimally invasive therapy for small renal carcinomas. MR and CT are effective imaging techniques in the follow-up of renal lesions treated with CA.

Thoracic Duct Embolization (TDE) for Chylothorax: A Clinical and Illustrative Review for the Non-Interventional Radiologist (Station #7)

Teaching Points

After viewing this exhibit, the learner should be able to:

1. Understand the pathophysiology and clinical presentation of chylothorax.
2. Compare TDE with alternative treatment strategies in managing chylothorax.
3. Discern the relevant operative anatomy including the cisterna chyli and its tributaries.
4. Describe the procedure and technique of ultrasound-guided intranodal lymphangiography and TDE.
5. Recognize typical post-procedural imaging findings of TDE (e.g. radiographs, CT).

Table of Contents/Outline

I. Pathophysiology and Clinical Presentation of Chylothorax
II. Available Treatment Options including TDE
III. Relevant Anatomy
IV. Technique: Intralymphatic lymphangiography and TDE
V. Potential Outcomes and Complications
VI. Post-TDE Imaging
VII. Summary/Conclusions
Mesenteric ischemia is the result of inadequate perfusion and oxygen delivery to the small intestine caused by vascular obstructions. Acute mesenteric ischemia (AMI) brought on by the abrupt occlusion of the superior mesenteric artery is a medical emergency. Mortality rate of AMI has been reported as high as 80%. Prompt CT angiography of the abdomen is the diagnostic imaging of choice. In contrast, chronic mesenteric ischemia (CMI) is the result of gradual obstructions of multiple splanchnic arteries. 90% of cases are caused by advanced atherosclerotic. Clinical diagnosis is difficult because symptoms are often vague and nonspecific. The classic clinical triad of gradual weight loss, fear of large meal, and post-prandial bowel angina may be absent. The gradual nature of the arterial obstruction promotes development of collateral arteries. The finding of an occluded splanchnic artery on angiography is not necessarily diagnostic of CMI. In difficult cases, a physiologic test that can demonstrate the sequelae of bowel ischemia would be helpful. Different imaging protocols have been proposed to detect changes in blood flow and oxygen saturation in the mesenteric circulation after a meal challenge. We will review some of these protocols and their abnormal physiologic responses indicative of CMI.

**RC112B**

**Renal MRA and Functional MRI**

Ulrike I. Attenberger MD (Presenter): Research Consultant, Bayer AG

**LEARNING OBJECTIVES**

1) To describe the technical pre-requisites for successful contrast and non-contrast-enhanced renal MRA (i.e. signal-to-noise-ratio, scan time, spatial resolution, voxel size). 2) To review contrast-agent dose optimization strategies. 3) To understand the basics of functional renal MR imaging techniques and to illustrate their potential implications on patient care.

**ABSTRACT**

Due to technical advances such as higher field strengths, parallel imaging techniques, and dedicated multi-element coils, contrast-enhanced (CE-MRA) has become a robust and valuable diagnostic tool for the assessment of the renal vasculature. Driven by the advent of nephrogenic systemic fibrosis (NSF), interest in low-dose CE-MRA protocols and non-enhanced MRA techniques is greater than ever. In addition to the assessment of the renal vasculature by MRA, functional MRI techniques such as perfusion or diffusion-weighted imaging allow for a non-invasive, radiation-free functional assessment of the kidneys. This is of particular interest for patients with impaired renal function but without any signs of vascular pathology. With the implementation of functional MRA techniques, changes in kidney function can be assessed even in the absence of any vascular pathology. The focus of this presentation is to summarize current state-of-the-art techniques for contrast and non-contrast-enhanced MRA as well as functional MRI of the kidney with a special focus on technical prerequisites, a discussion of the advantages and disadvantages of various techniques, and perspectives on future developments.

**RC112C**

**Functional CTA in Athletes**

Richard Lee Hallett MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify anatomic and functional lesions that predispose to vascular entrapment and fibrotic syndromes in athletes. 2) Describe methods to assess vascular entrapment and fibrotic syndromes in athletes using dynamic, functionally challenged CTA and MRA. 3) Describe the imaging findings for diagnosis and follow-up of affected athletes.

**ABSTRACT**

While exercise is a mainstay in preventing and treating atherosclerotic peripheral vascular disease, some vascular disorders manifest primarily in athletes. Both recreational and competitive athletes are at risk for development of non-atherosclerotic vascular diseases. These disease entities range from iliac endofibrosis in cyclists, popliteal entrapment syndrome in running sports, and thoracic inlet / outlet syndromes in "overhead" athletes. Recently, computed tomography angiography (CTA) and magnetic resonance angiography (MRA) have become valuable diagnostic options for many vascular diseases that can occur in the athlete. Optimum imaging in these disorders requires the ability to tailor the exam protocol to the specific disease entity and vascular territory in question. By combining rapid CT image acquisition with functional, physiologic provocative maneuvers, diagnostic information can be maximized. Newer blood-pool MR contrast agents also allow functional assessment without ionizing radiation exposure. This session will review the pathophysiology, risk factors, diagnosis, and classification of vascular diseases seen in the athlete. Logical protocol development utilizing (when necessary) provocative maneuvers will be reviewed. Interpretation strategies for interacting with these resulting large, dynamic datasets will also be reviewed.

**URL’s**

www://stanford.edu/~hallett

**Active Handout**


**RC112D**

**Pre and Post Reconstructive Surgery Vascular Imaging**

Frank John Rybicki MD, PhD (Presenter): Research Grant, Toshiba Corporation

**LEARNING OBJECTIVES**
1) To understand and be able to implement surgical planning vascular imaging protocols for transplant imaging.
2) To review the strengths and weaknesses between the imaging modalities that can be used for vascular mapping. 3) To understand vascular re-organization after complex vascular anastamosis for transplantation.

ABSTRACT

Vascularized Composite Allotransplantation (VCA) refers to transplantation of organ donor tissues with their own donor vascular supply that require vascular anastamoses to the recipient. This work included face and extremity transplantation, and includes some of the most dramatic and complex transplantations to date. There is a growing need for detailed vascular imaging as the number of sites performing these studies increases. Moreover, additional studies such as abdominal wall transplantation are on the horizon and will be performed in the near future. Radiologists play a significant and growing role in determining the proper selection of recipients, and the vascular maps are critical for the team in the success of the transplantation. This lecture will review the imaging before and after transplantation, and the content will include imaging protocols, key findings, and new information the reveals the biology after transplantation in a face transplant cohort of patients.

RC212
Peripheral Artery Disease (PAD)
Refresher/Informatics

LEARNING OBJECTIVES

1) Discuss the basic pathology of peripheral artery disease. 2) Describe the risk factors associated with the development of peripheral artery disease. 3) Outline the benefits of providing a comprehensive clinical service in the management of PVD. 4) Discuss how to build a PVD practice. 5) Describe the basic techniques employed in the treatment of PVD.

Sub-Events

RC212A
Clinical Overview of PAD
Stephen Thomas Kee MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC212B
Lower Extremity CTA
Richard Lee Hallett MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Describe techniques for patient selection, acquisition, reconstruction, and interpretation of lower extremity CTA. 2) Describe evidence-based results for lower extremity CTA, and expected impact on patient care. 3) Describe a coherent plan that integrates lower extremity CTA into cost-effective clinical care.

ABSTRACT

Peripheral arterial disease (PAD) is a common cause of morbidity and mortality in developed countries. Traditionally, imaging for risk stratification and therapeutic planning involved catheter angiography. In recent years, cross-sectional imaging by CTA and MRA has proven a robust technique for non-invasive PAD assessment. Given ubiquity of CT scanning technology, CTA is widely available. High resolution datasets can be acquired rapidly, which facilitates assessment of clinically laible or trauma patients. To be optimally effective, CTA techniques require particular attention to contrast medium and scan protocol. With appropriate protocol design, data acquisition requires limited operator dependence. The acquired 3D dataset is rich with information, but requires careful scrutiny by the interpreting physician. Volumetric review of these datasets produces the most accurate results. Extensive small vessel calcification remains a potential barrier to full assessment of pedal vessels by CTA. Recent published data validates the clinical effectiveness of CTA for diagnosis of PAD and for the direction of treatment planning. Ongoing research aims to exploit the newest generation of CT scanners to acquire additional information, including dual energy data, time-resolved information, and radiation dose savings.

URL's

www://stanford.edu/~hallett
Lower Extremity MRA
Harald Kramer MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Identify the appropriate technique for peripheral MRA depending on the available hardware and the clinical question and condition of the patient. 2) Differentiate between different contrast agents and their specific characteristics. 3) Choose between different contrast agent application schemes depending on the technique used and the clinical question. 4) Compare the pros and cons of contrast-enhanced and non-contrast-enhanced techniques for peripheral MRA.

ABSTRACT
The prevalence of symptomatic peripheral artery disease (PAD) ranges around 3% in patients aged 40 and 6% at an age of 60 years. Additionally, the prevalence of asymptomatic PAD lies between 3% and 10% in the general population increasing to 15% to 20% in persons older than 70 years of age. However, these data still might underestimate the total prevalence of PAD since screening studies showed that between 10% and 50% of all patients with intermittent claudication (IC) never consult a doctor about their symptoms. These data prove the need for an accurate and reliable method for assessment of the peripheral vasculature. Digital subtraction angiography (DSA) still serves as the reference standard for all vascular imaging techniques. However, because of the absence of ionizing radiation, the use of non-nephrotoxic contrast agents or even non-contrast-enhanced sequences and the large toolbox of available techniques for high-resolution static and dynamic imaging Magnetic Resonance Angiography (MRA) constitute an excellent non-invasive alternative. Different acquisition schemes and contrast agent application protocols as well as different types of data sampling for static, dynamic, contrast- and non-contrast-enhanced imaging enable to tailor each exam to a specific question and patient respectively.

Endovascular Treatment of PAD
Stephen Thomas Kee MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

Interventional Series: Embolotherapy
Series Courses

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.75
Mon, Dec 1 8:30 AM - 12:00 PM Location: S406B

Participants
Moderator
Jafar Golzarian MD: Nothing to Disclose

LEARNING OBJECTIVES
1) Describe indications and technical aspects of embolization for symptomatic prostatic hypertrophy. 2) Explain the rationale and treatment of low flow malformations. 3) Describe the preparation of cyanoacrylates for embolization. 4) Describe two complications related to embolization. 5) List two important studies on embolotherapy.

Sub-Events
Using Glue—How I Do It
Yasuaki Arai (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Learn features of glue as embolic material, 2) Learn clinical situations that glue is preferable to be chosen, 3) Understand how to use glue, and 4) Be aware of pitfalls using glue in embolization.

A Mixture of N-Butyl Cyanoacrylate, Lipiodol and Ethanol under Flow Control Using an Arteriovenous Malformation (AVM) Model, Is It Useful for Embolization
Masaki Ishikawa MD (Presenter): Nothing to Disclose, Masahiro Horikawa MD: Nothing to Disclose, Barry T Uchida: Nothing to Disclose, Hans A Timmermans: Nothing to Disclose, John Andrew Kaufman
**Purpose**

Recently, a mixture of n-butyl cyanoacrylate, Lipiodol and ethanol at ration of 1:1:3 (NLE 113) as new embolization material was introduced. The character of this embolization material is changed because n-butyl cyanoacrylate (NBCA) polymerization can be accelerated by addition of ethanol to NBCA and Lipiodol. Controllability of embolization for AVMs remains controversial. We evaluated usability of NLE in vitro model for AVMs.

**Method and Materials**

An original simulation circuit component including an artificial nidus was constructed to generate pulsatile flow (Figure 1). This system was filled with heparinized swine blood. NBCA and Lipiodol mixtures at ratios of 1:1, 1:3, 1:5 and 1:10, and NLE 113 with flow control or without flow control was injected to achieve complete embolization. Results of embolization were classified as complete filled, proximal embolization, pass through or sift to distal after balloon deflation, and each session was compared (Figure 2).

**Results**

NLE 113 with flow control was complete filled in 6/6 cases (Figure 3). NBCA and Lipiodol mixture at ration of 1:1 with flow control was complete filled in 3/6 cases. NBCA and Lipiodol mixture at ration of 1:5 without flow control was complete filled in 3/6 cases. Other sessions did not achieve complete filled embolization.

**Conclusion**

Optimal embolization control of the AVM model was best using NLE 113 with flow control.

**Clinical Relevance/Application**

In liquid embolic materials have difficult controllability, NLE 113 have excellent controllability under flow control. NLE 113 can be acceptable as embolic material for arteriovenous malformation.

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**Embolization Treatment for Intractable Bladder Bleeding—Clinical Efficacy and Safety**

Maria Tsitskari MD (Presenter): Nothing to Disclose, Lazaros Reppas BS: Nothing to Disclose, Dimitrios Filippiadis MD, PhD : Nothing to Disclose, Kostantinos Palialexis : Nothing to Disclose, Chrisostomos Kostantos : Nothing to Disclose, Elias Brountzos MD : Nothing to Disclose

**Purpose**

We evaluated the outcomes of embolization treatment for intractable bladder bleeding after failed conservative treatment.

**Method and Materials**

We retrospectively studied the records of 1 woman and 10 men with a mean age of 76 years referred between February 2008 and March 2014 for bladder embolization after failed conventional therapy. The underlying pathologies included bladder cancer in 9 patients, prostate cancer in 1 and metastatic osteosarcoma of the urinary bladder in 1 case. Embolization was feasible in 10 out 11 patients. It consisted of superselective embolization of the superior or inferior vesical arteries with particles or glue in 10 patients, and selective proximal gelfoam sponge particle occlusion of the anterior division of the internal iliac artery in 1 patient. Clinical bleeding control and post-embolization angiography findings were used to assess outcomes.

**Results**

The technical success rate was 90% (10 of 11 cases). In the one patient embolization was not possible, due to severe tortuosity of the iliac arteries. Bleeding was controlled after the first procedure in 8 patients, and after a repeat procedure in 2. Non target embolization of the buttocks ant the anterior abdominal wall was encountered in 1 patient. Late bleeding recurrence was reported in 2 of the 10 survivors. Mean post-embolization follow up was 30 months. During follow up 4 patients died, due to underlying conditions.

**Conclusion**

Selective vesical artery embolization is effective for the control of refractory, life threatening bladder bleeding.

**Clinical Relevance/Application**

Selective angiographic embolization is safe and effective to control refractory, life threatening bladder bleeding. This procedure should be considered the treatment of choice since it usually obviates the need for emergency surgery in these severely ill patients.
Endovascular Treatment for Aldosterone Producing Adrenal Adenoma: A Long Term Follow-up Study

Yasutaka Baba MD (Presenter): Nothing to Disclose, Sadao Hayashi MD: Nothing to Disclose, Kohei Nagasato: Nothing to Disclose, Takashi Yoshiura MD, PhD: Nothing to Disclose

PURPOSE
To investigate the efficacy of endovascular treatment for aldosterone producing adrenal adenoma (APAA) including the long term results.

METHOD AND MATERIALS
We retrospectively analyzed treatment results of 42 APAAs in 42 consecutive patients (12 male and 30 females; mean age, 47 years) that were treated by endovascular treatment (arterial or venous embolization) with absolute ethanol (AE) between August 1992 and June 2013. 25 adenomas were located in the right adrenal gland while 17 were in the left. The mean size of the adenomas was 14mm (range, 8-30 mm) in diameter. Before embolization, we mapped all feeding arteries of the adenoma. Then we determine the volume of AE to use for embolization by adrenal arteriograms or CT images. Prophylactic microcoil embolization of distal feeding arteries was performed in order to avoid unintentional AE injection. In venous embolization, a balloon catheter was used to avoid the reflux of AE. In order to prevent pain and vascular spasm during arterial embolization, we injected lidocaine into the feeding arteries. In addition, we used anti-alpha blocker and calcium blocker to prevent hypertension and hypercatecholaminemia. We evaluated the technical success rate which was defined as normal range of both serum aldosterone concentration and renin activity within 1 month after treatment and acute complications. Moreover, we evaluated rates of improvement in hypertension and normalization of serum aldosterone concentration and renin activity in the follow-up period. The mean follow-up period was 1309 days.

RESULTS
The number of treatment session was 56 and average dosage of AE was 1.8 mL (range, 0.2-7 mL). Technical success rate was 88% (37/42) and five patients were subsequently treated by operation. Acute complication comprised of pain (64%), unstable blood pressure (23%) and pleural effusion (11%) without major complications. Rates of improvement in hypertension, normalization of serum aldosterone concentration and renin activity in the follow-up period were 72% (27/37), 97% (36/37), and 97% (36/37), respectively.

CONCLUSION
Endovascular treatment is less invasive and efficient therapeutic option for APAAs.

CLINICAL RELEVANCE/APPLICATION
Endovascular embolization of APAA is a promising treatment option.
**Embolization of Intraosseous AVM**

Wayne Francis Yakes MD (Presenter): Nothing to Disclose

**PURPOSE**

AVM of bone is a difficult management problem. Because standard embolic agents are rarely curative and only palliative, ethanol and ethanol with coils are evaluated to curatively treat bone AVMs as an alternative management strategy.

**METHOD AND MATERIALS**

Twenty-nine patients (17 f, 12 m; age range 6 - 48 years, mean: 19 years) presented with bone AVMs involving the upper extremity, lower extremity, pelvis, spine, and head and neck areas. All patients underwent MR, arteriography, and endovascular repair of their bone AVMs. Ethanol alone, ethanol with coils, and coils were the sole embolic agents utilized.

**RESULTS**

Twenty-eight of twenty-nine patients are cured of their intraosseous AVM at follow-up (range 8 months - 168 months; mean: 54 months). One patient’s therapy is on-going (mandible/maxilla/face AVMs). Complications include one coil migration to the lung (retrieved without sequelae), three patients with skin injury in the lower extremity (healed uneventfully), and one patient with chronic weakness left quadriceps femoris muscle group, which was present prior to treatment and not improved with treatment of her pelvic/iliac wing AVM. One patient had a right maxilla infection/sinusitis treated by antibiotics.

**CONCLUSION**

Bone AVMs in the literature are rarely cured, save by amputation. Ethanol or ethanol with coils has proven to be consistent in ablating bone AVMs and are durable at long-term follow-up, in essence curing the AVM. When bone AVM is present in an extremity, multiple AVMs in that extremity can occur, an unexpected finding. Acceptable low complication rates are noted in this series.

**CLINICAL RELEVANCE/APPLICATION**

AVM of bone is a difficult management problem. Because standard embolic agents (glue, PVA, Onyx, Embospheres, etc.) are rarely curative and only palliative, ethanol and ethanol with coils are evaluated to curatively treat bone AVMs as an alternative management strategy.

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**Acquired Non–Traumatic Peripheral Arteriovenous Fistula**

Wayne Francis Yakes MD (Presenter): Nothing to Disclose

**PURPOSE**

To determine the etiology of acquired non-traumatic arteriovenous vascular fistula (AVF), evaluate their venous physiology and determine management strategies. Non-traumatic acquired AVF of the peripheral vascular system and its management has not been described or published in the world's literature.

**METHOD AND MATERIALS**

Ten patients (2 males, 8 female; age range 47 - 84 yrs; mean age: 66 years) presented with acquired peripheral arteriovenous fistulization of veins causing swelling and venous hypertensive changes in the lower extremities and left upper extremity. All presented with enlargement and swelling of their left lower extremity. Additionally, one patient had enlargement of her left buttock; one patient had bilateral lower extremity severe swelling with venous stasis changes in the legs, one patient had gross edema of the left upper extremity, two patients had non-healing venous stasis ulcers complicated with cellulitis; and one patient had a left femoral fracture that was surgically treated previously and due to a spine injury, was paraplegic. All patients had great difficulty with ambulating. No patient had a history of blunt or penetrating trauma. All patients underwent ultrasound, arteriography and lower extremity venography in their work-up.

**RESULTS**

All patients were discovered to have acquired (non-congenital) extensive AVF in the pelvic, groin, leg, thigh and left shoulder; four patients had major venous chronic occlusions. After treating their AVF endovascularly, all patients had resolution of their swelling despite the venous occlusions. The non-healing ulcers totally healed.

**CONCLUSION**

This lesion is not described in the world's literature. The only similar lesion reported in the world's literature is dural AVF of the sagittal/transvers/sigmoid/cavernous sinuses. This is the first report of this entity occurring in the periphery and successful management strategies.

**CLINICAL RELEVANCE/APPLICATION**

Cure of these difficult lesions is possible with endovascular approaches utilizing coils and by eliminating the fistulas and the venous hypertension; stenting of the disease vein segments also proved successful in eliminating the numerous AVF in the vein wall.
Khawla Boughanmi (Presenter): Nothing to Disclose, Khalil Riadh Hamza MD: Nothing to Disclose

PURPOSE
Intra lesion injection of sclerosant agent and peripheral compression of venous out flow are responsible of elevation of intra lesion's pressure that can induce peripheral diffusion of the sclerosis agent. We developed the concept of (LPS) by placing multiple needles in the (PVM). These needles work as multiple valves that allow the free circulation of the sclerosant agent and the outflow of the extra injected fluid. This technique is used for the treatment of low flow vascular malformations and peripheral AVM (nidus and venous side)

METHOD AND MATERIALS
In a period of 76 months (September 2006 – December 2013), 170 patients were treated with this concept: 122 patients with venous malformations (VM), 28 patients with lymphatic malformation (LM) including 26 patients with macro cystic LM and two patients with micro cystic LM, and in two case of micro cystic LM. Absolute ethanol (AE) was used in 88 patients: in 44 VM complementary to foam, in 24 LM and in 20 cases of peripheral AVM. Glue (isobutyl 2 cyanocrylate) was used in 4 cases of AVM complementary to AE or before using AE. Up to 7 sessions were performed per patient.

RESULTS
Technical success was reached in all cases. Loss of volume at MRI ranged from 25% to 80% except for two patients who presented with large size VM. All patients were cosmetically improved and relieved of pain. Swelling of the lesion occurred in all treated cases and it was well tolerated and controlled with NSAIDs with resolution in few days (4-7 days). Significant complications occurred in 3 patients and consisted of phlyctena, fistula and necrosis. They were managed conservatively.

CONCLUSION
LPS concept using 3% STS foam, Laurumacrogol and AE in our experience over more than six years has proven the technique to be effective with dramatic decreasing of complications. AE is used to treat macro cystic LM, superficial AVM and complementary to STS foam in some VM with extreme care concerning the volume injected.

CLINICAL RELEVANCE/APPLICATION
Placing multiple needles in peripheral vascular malformation allow free circulation of the sclerosing agent these needles work as multiple valves that allow an exit of the sclerosing agent. The technique is effective with dramatic decreasing of complication. Actually we used this approach to treat VM, cystic LM and superficial AVM.

Predictive Quantification of Infarction Volume before Partial Splenic Embolization for Hypersplenism
Toshihiro Tanaka MD (Presenter): Nothing to Disclose, Tetsuya Masada: Nothing to Disclose, Hideyuki Nishiofuku: Nothing to Disclose, Takeshi Sato: Nothing to Disclose, Shinsaku Maeda: Nothing to Disclose, Kimihiko Kichikawa MD: Nothing to Disclose, Hiroshi Anai MD, PhD: Nothing to Disclose, Masayoshi Inoue MD: Nothing to Disclose

PURPOSE
To obtain the optimal splenic infarction volume is the key to achieve high efficacy and to reduce the risk of complications after partial splenic embolization (PSE). We have developed a new system to predict the infarction splenic volume before PSE using computed volumetric analysis software. The aim of this study is to evaluate the accuracy of this prediction system.

METHOD AND MATERIALS
The data, from 12 patients with hypersplenism who had received PSE, was retrospectively analyzed. 3-dimensional (3-D) arteriography image was reconstructed from the contrast enhanced CT obtained before PSE. Using a 3-D image analysis system (SYNAPSE VINCENT™), the volume of the area supplied from each splenic branch was calculated based on the Voronoi Diagram. The estimated infarction volume was defined by the total sum of the volume supplied from each embolized branch. The actual infarction volume was calculated on the contrast enhanced CT obtained 1 week after PSE. Pearson Correlation Coefficients was used to assess the correlation between the estimated infarction volume and the actual infarction volume.

RESULTS
The mean estimated and actual infarction volumes were 65.4±14.6% and 60.9±10.2%, respectively. The mean difference between them was 7.29±6.93%. The actual infarction volume was strongly correlated with the estimated infarction volume (p= 0.791, P=0.002). There were no complications in any of the patients. The mean platelet count significantly increased from 7.96×10⁴/µL before PSE to 15.6×10⁴/µL two weeks after PSE (the increased ratio: 259±93.9%).

CONCLUSION
Our results demonstrated that infarction splenic volume can be precisely predicted before PSE using computed volumetric analysis software. This new system could be helpful for tailoring planning of PSE to achieve optimal splenic infarction volume in patients with hypersplenism.

CLINICAL RELEVANCE/APPLICATION
Predictive quantification of splenic infarction volume using the Voronoi Diagram method is accurate, which could be useful for planning before PSE.

**Technical Aspects of Prostate Embolization—Why this is not UFE**

Jafar Golzarian MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**5 Papers in 15 Minutes: Studies in Embolotherapy that Everyone Should Know**

Sue Ellen Hanks MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe indications and technical aspects of embolization for symptomatic prostatic hypertrophy. 2) Explain the rationale and treatment of low flow malformations. 3) Describe the preparation of cyanoacrylates for embolization. 4) Describe two complications related to embolization. 5) List two important studies on embolotherapy.

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**MSMC22**

**Cardiac CT Mentored Case Review: Part II (In Conjunction with the North American Society for Cardiac Imaging) (An Interactive Session)**

**Multisession Courses**

**CT VA CA**

AMA PRA Category 1 Credits ™: 1.75
ARRT Category A+ Credits: 2.00
Mon, Dec 1 10:30 AM - 12:15 PM   Location: S406A

**Participants**

Moderator

Moderator
Vincent B. Ho MD, MBA: In-kind support, General Electric Company

**LEARNING OBJECTIVES**

1) Understand how to interact with 4D cardiac CTA data for proper interpretation. 2) Compare methods for characterizing coronary stenoses and learn what is most appropriate in various situations.

**Sub-Events**

**MSMC22A**

**Coronary Artery Disease I: Native Vessel Disease**


**LEARNING OBJECTIVES**

View learning objectives under main course title.

**MSMC22B**

**Coronary Artery Disease II: Native Vessel Disease**

Smita Patel MBBS (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**MSMC22C**

**Valves and Cardiac Function**

Andrew John Bierhals MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.
ABSTRACT
Cardiac CT can provide information on valves and function when retrospective ECG gating is used in the acquisition. These studies require extensive image post-processing to accurately depict the moving structures. This presentation will highlight basic image acquisition as well as the evaluation of normal and abnormal patients.

Korea Presents: Exploring Evidence in Cardiovascular Imaging

Special Courses

IR CT VA

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50
Mon, Dec 1 10:30 AM - 12:00 PM Location: E353C

Participants

Moderator Tae-Hwan Lim MD, PhD : Nothing to Disclose
Moderator Arthur E. Stillman MD, PhD : Nothing to Disclose

LEARNING OBJECTIVES

This session is part of Korea Presents at RSNA 2014.

Sub-Events

SPCP21A Opening Remarks
RSNA President N. Reed Dunnick MD Nothing to Disclose , Tae-Hwan Lim MD, PhD Nothing to Disclose , Jongmin John Lee MD, PhD Nothing to Disclose

Korea and Korean Society of Radiology (KSR)
This session is part of Korea Presents at RSNA 2014.

ABSTRACT
Korea and Korean Society of Radiology (KSR) Following dinosaurs, Homo erectus, and Homo sapiens, our ancestors have inhabited in and around Korean peninsula. In a history of many dynasties for 5000 years, Republic of Korea was established in 1947 AD. In 2013, the population was counted as 51,098,531 (26th / 225 countries) within 100,210 km2(111th / 208 countries). The number of medical doctor per 100,000 population has been increasing continuously up to 214 in 2012. Among 113,000 medical doctors, 3,465 board-certified radiologists are registered in 2014. KSR was founded in 1945. Korean congress of radiology (KCR) has continued every year till now. From 2010, KCR was organized as an international congress with the official language of English. This year, over 75% of sessions were conducted in English. Topics for only Korean doctors and some basic educational sessions were in Korean. Additional on the regular members (76.0%), 604 resident members (13.3%) and 478 international members (10.5%) are registered in KSR (4,547 in total). During the KCR, about 10% of registrants are usually from abroad. As a diligent radiology society in Asia-Oceania region, KSR conducts diverse international activities including visiting symposium, KSR fellowship, invited speaker exchange, awarded poster exchange, joint symposium, national delegate exchange, journal collaboration, booth exchange, and visiting professorship. So far, international collaboration has been established between KSR and 20 countries or societies world-wide. The globalization of KSR is on the purpose of giving more opportunities for KSR members to improve themselves through international communication. Also KSR aims for ;a synergic evolution together with our partner societies. As a world leading radiology society, RSNA has been a source of motivation and is a chance of globalization for KSR and its members.

URL
http://www.radiology.kr

Jin Hur MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Understand the stroke subtype and the risk factors of cardio-embolic stroke. 2) Describe the imaging modalities in the assessment of cardiovascular risk in stroke patients. 3) Describe the advantages and disadvantages of cardiac CT and MRI in the use of assessing cardio-embolic sources in stroke patient. 4) Discuss the prognostic value of cardiac CT for risk stratification in stroke patients.

This session is part of Korea Presents at RSNA 2014.
ABSTRACT

Cardiogenic emboli have been estimated to be the causative factor in 20% to 40% of all stroke cases. Therefore, identification of a cardiac source of embolism in stroke patients is important for proper therapeutic management. Currently, transesophageal echocardiography (TEE) is considered the reference standard method for the detection of potential sources of cerebral embolism. TEE offers high resolution images of the left atrium (LA) and its appendage as well as the thoracic aorta for the evaluation of left atrial blood stasis and aortic atherosclerosis. Although TEE is widely available, it is a semi-invasive test, usually performed under conscious sedation. In current clinical practice, there is a need for a less invasive modality that is capable of assessing the cardiovascular system for embolic stroke patients. Cardiac magnetic resonance imaging (MRI) is an appealing modality to evaluate a suspected embolic stroke patient. Cardiac MRI can adequately image potential embolic sources such as LV thrombi, cardiac masses, aortic plaques or LAA thrombi. Recently introduced multidetector computed tomography (MDCT) with subsecond rotation times and a dedicated cardiac reconstruction algorithm can acquire 3-dimensional data of the heart, enabling detailed visualization of not only the coronary arteries but also other cardiac structures such as the left atrial appendage (LAA), myocardium, valves, and septa. Therefore, MDCT can play a significant role as a non-invasive procedure in the detection of the cardioembolic origin of stroke. Radiologists should be familiar with their imaging features as identification has significant management and prognostic implications.

Is Screening of Coronary Heart Disease with Coronary CT Angiography Necessary? Coronary CT Angiography in Asymptomatic Patients

Sang Il Choi MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To review the use of various multimodality imaging techniques for assessing subclinical coronary artery disease. 2) To demonstrate the current multimodality appropriate use criteria for detection and risk stratification of coronary artery disease in asymptomatic subjects. 3) To recognize the potential role and limitations of coronary CT angiography as screening tool in asymptomatic subjects.

This session is part of Korea Presents at RSNA 2014.

Is CT Stress Perfusion Comparable to FFR in Assessing Ischemic Heart Disease? Multicenter Trial PERFUSE

Byoung Wook Choi MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the clinical role and indication of myocardial perfusion with computed tomography. 2) Acess the study design and rationale to compare myocardial perfusion with computed tomography with FFR regarding to clinical utility. 3) Able to set up a proper protocol of computed tomography for myocardial perfusion in clinical practice. 4) Assess the technical advances and consideration of computed tomography in myocardial perfusion.

This session is part of Korea Presents at RSNA 2014.

ABSTRACT

The FAME trial demonstrated the superiority of FFR (fractional flow reserve)-guided revascularization strategy over angiography-guided treatment. The functional significance of coronary artery stenosis is now considered as the standard reference for revascularization. Non-invasive imaging for myocardial ischemia can be used for identifying functionally significant stenosis as well. Evaluation of myocardial ischemia by using CT has been reported as a new alternative non-invasive method. According to a recent study, as compared to FFR and invasive angiography, the combination of CT angiography (CTA) and CT perfusion (CTP) was highly accurate in detection and exclusion of myocardial ischemia. The PERFUSE (Stress Coronary Perfusion Versus FReactional Flow Reserve Guided Percutaneous Coronary IntErvention) trial is a multicenter, randomized, controlled, noninferiority trial in the comparison of CTP- and FFR-guided percutaneous coronary intervention (PCI). The objective of this trial is to compare outcomes of composite of any of all cause mortality, myocardial infarction, and unplanned hospitalization with revascularization at 1 year after CTP-guided PCI to FFR-guided PCI in angina patients with coronary artery disease. The inclusion criteria is patients who referred for CTA because of angina or angina equivalent symptom and having more than 70% diameter stenosis at least one major epicardial coronary artery on CTA. A total 1000 patient will be enrolled (500 per each arm) and randomized to either FFR guided or CTP-guided groups. Twenty centers in Korea are participating in the study.

Closing Remarks

Byung Ihn Choi MD, PhD (Presenter): Research Consultant, Samsung Electronics Co Ltd, James P. Borgstede MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

This session is part of Korea Presents at RSNA 2014.

ABSTRACT

First of all, I’d like to thank members of Board of Directors of RSNA including Dr. Dunnick (President), and Dr. Baron (Chairman) and Dr. Borgstede (Liaison for international affairs) for inviting Korea to RSNA which is the most prestigious organization in the field of Radiology in the year of meaningful centennial anniversary of RSNA.
During the last 30 years, I have attended RSNA more than 20 times since 1985 when I was a visiting fellow of UC San Francisco. Since then, advance of RSNA has been amazing in every aspect of the meeting not only in quality but also in quantity, about 60,000 attendants for the meeting and more than 50,000 members from all over the world. RSNA really became a global congress of Radiology. Therefore, KSR is now trying to follow this unbelievable progress of RSNA as a role model of KCR. Personally, I love RSNA because RSNA is an ideal place for me to learn recent updated knowledge and cutting edge information of radiology, and to meet old and new friends. Also, I can enjoy rich cultural environment in Chicago including music, fine art and natural resources. As an honorary member of RSNA and a past president of KSR, I'll try to do my best to enhance a mutual friendship and collaboration between RSNA and KSR. Finally, I'd like to congratulate the celebration of 100th scientific assembly and annual meeting of RSNA and wish RSNA a glorious future.

SSC14

Vascular/Interventional (IR: Hepatic Tumor Embolization)

Scientific Papers

IR VA GI

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50

Mon, Dec 1 10:30 AM - 12:00 PM  Location: E351

Participants

Moderator
Nael El Said  Saad  MBBCh : Research Consultant, Veran Medical Technologies, Inc Proctor, Sirtex Medical Ltd

Moderator
Hyun Sik  Kim  MD : Nothing to Disclose

Sub-Events

SSC14-01

A Mechanism of Transcatheter Arterial Embolization-mediated Improvement of Drug Penetration in Liver Cancer

Bin   Liang (Presenter):  Nothing to Disclose , Gan-Sheng   Feng  MD :  Nothing to Disclose , Chuansheng   Zheng :  Nothing to Disclose

PURPOSE

Transcatheter intraarterial techniques can improve drug penetration in liver cancer and thus enhance the efficacy of chemotherapy, but its mechanism remains unclear. Intratumoral interstitial fluid pressure (IFP) has been found to be an important determinant of drug penetration in solid tumors. The present study is designed to determine whether transcatheter arterial embolization modifies IFP, and to evaluate whether the modified IFP is related to the improvement of drug penetration in liver cancer.

METHOD AND MATERIALS

VX2 tumors were implanted in the livers of 16 rabbits. The animals were divided into 4 groups of 4 animals each. Group 1 (doxo iv) animals received doxorubicin intravenous injection; group 2 (doxo ia) animals received doxorubicin hepatic intraarterial infusion; group 3 (doxo ia + E) received doxorubicin hepatic intraarterial infusion followed by embolization; group 4 (doxo + L ia + E) received hepatic intraarterial infusion of doxorubicin mixed with lipiodol followed by the embolization. After transcatheter treatment, wick-in-needle technique (Mikro-Tip pressure catheter) was used to measure IFP in tumor tissues, and immunofluorescence technique to evaluate the distance of doxorubicin fluorescence from the nearest blood vessel (recognized by CD31).

RESULTS

Tumors in the group 3 (doxo ia + E) and 4 (doxo + L ia + E) showed a significant decrease in IFP compared with the group 1 (doxo iv) and 2 (doxo ia) tumors (P < 0.05) within 1 hour after treatment. Embolization led to a decrease of IFP by 27.11% in group 3 and 31.81% in group 4 tumors, respectively. The change in IFP was significantly correlated with doxorubicin penetration distance (r = 0.671, P = 0.004).

CONCLUSION

Transcatheter arterial embolization reduce tumor IFP, which probably is responsible for the improvement of drug penetration in liver cancer.

CLINICAL RELEVANCE/APPLICATION

Our results reveal a novel mechanism of transcatheter arterial embolization-mediated improvement of drug penetration in liver cancer. The decrease in tumor IFP, generated by embolization, contributes to drug penetration in liver cancer. Thus, decreasing tumor IFP could represent a promising therapeutic strategy for improving the effectiveness rates of transcatheter therapies for liver cancer.

SSC14-02

Comparison of Drug Release between Conventional Chemoembolization and Drug Eluting Beads Chemoembolization
Jae Hwan Lee MD (Presenter): Nothing to Disclose, Kyu Ri Son MD: Nothing to Disclose, Hyo-Cheol Kim MD: Nothing to Disclose

PURPOSE
The purpose of this study was to compare the in vitro drug release characteristics of DC bead and various kinds of Lipiodol emulsion, and to compare the tumor response in animal liver tumor model.

METHOD AND MATERIALS
We prepared 4 types of Lipiodol emulsion: A) 10 mg of DOX in 0.5 ml of contrast media mixed with 2 ml of Lipiodol, B) 10 mg of DOX in 1.25 ml of contrast media mixed with 1.25 ml of Lipiodol, C) 10 mg of DOX in 0.5 ml of normal saline (NS) mixed with 2 ml of Lipiodol, D) 10 mg of DOX in 1.25 ml of NS mixed with 1.25 ml of Lipiodol. DC bead of 100-300 µm in diameter were loaded with DOX (37.5 mg/ml) according to the manufacturer's instruction. Drug release from emulsions or DC bead was evaluated in in vitro model. Three weeks after implantation of VX2 carcinomas in the liver, TACE was performed using A) 4:1 volume ratio of Lipiodol and DOX solution, B) 1:1 volume ratio of Lipiodol and DOX solution, C) DC bead.

RESULTS
The released amounts (%) of DOX at 24 h are as follows: 20.64 ±0.20% for DC bead, 42.65 ±1.51% for Lipiodol:DOX in NS = 4:1, 45.74 ±2.14% for Lipiodol:DOX in Pamiray = 4:1, 60.92 ±1.45% for Lipiodol:DOX in NS = 1:1, and 56.91 ±2.31% for Lipiodol:DOX in Pamiray = 1:1. AUC value of group A was significantly lower than that of group B (p < 0.05), but there is no significant difference compared to that of group C. AUC value of group B was 3.43-fold higher than that of group C (p < 0.05). Cmax value of group A exhibited significant difference compared to those values of group B and C (p < 0.05). Particularly, Cmax value of group B was 12.12-fold higher than that of group C (p < 0.05).

CONCLUSION
Stable Lipiodol emulsion can be created by excessive Lipiodol mixed with DOX dissolved in contrast media. DOX release from Lipiodol emulsion depends on volume ratio of Lipiodol and DOX solution. DC bead has more sustained DOX release than Lipiodol emulsion.

CLINICAL RELEVANCE/APPLICATION
(Dealing with making effective chemoembolic mixture in TACE) DOX - contrast media mixture with excessive lipiodol forms more stable emulsion, and DC bead has more sustained DOX releasing capacity than Lipiodol emulsion. These knowledge may be useful in achieving effective drug delivery to HCC in TACE.

SSC14-03
Conventional Transarterial Chemoembolization versus Drug Eluting Bead-Transarterial Chemoembolization for the Treatment of Hepatocellular Carcinoma

Roman Kloeckner MD (Presenter): Nothing to Disclose, Friederike Prinz: Nothing to Disclose, Christian Ruckes: Nothing to Disclose, Arndt Weinmann: Nothing to Disclose, Christoph Dueber MD: Nothing to Disclose, Michael Bernhard Pitton MD: Nothing to Disclose

PURPOSE
To compare the overall survival (OS) of patients suffering from hepatocellular carcinoma (HCC) treated with lipiodol - based conventional transarterial chemoembolization (cTACE) and drug eluting bead-transarterial chemoembolization (DEB-TACE).

METHOD AND MATERIALS
An electronic search of our radiology information system revealed a total of 674 patients receiving TACE between 11/2002 and 07/2013. 520 received cTACE, and 154 received DEB-TACE. In total, 424 patients were excluded due to a tumor entity different from HCC (n=91), liver transplantation following TACE (n=119), lack of histological grading (n=58), incomplete laboratory values (n=15) and other reasons (e.g. previous systemic chemotherapy, previous cisplatin-based TACE) (n=141). Therefore, 250 patients were included for comparative analysis (174 cTACE; 76 DEB-TACE).

RESULTS
Both groups were not significantly different in terms of sex, etiology of liver cirrhosis, overall status (BCLC), liver function (Child-Pugh), portal invasion, tumor load, and tumor grading (all p > 0.05). Mean number of treatment sessions was 4±3.1 in the cTACE group versus 2.9±1.8 in the DEB-TACE group. The median survival in the cTACE group was 409 days (95% CI: 321-488 days) compared to 369 days (95% CI: 310-589 days) in the DEB-TACE group (p=0.76). In the subgroup of Child A patients, the median OS was 602 days (484-792 days) for cTACE versus 627 days (364-788 days) for DEB-TACE (p=0.39). In Child B and Child C patients the OS was considerably lower with 233 days (165-315 days) versus 226 days (114-335 days) (p=0.53).

CONCLUSION
The present study showed no significant difference in OS between cTACE and DEB-TACE in a large and well-selected cohort of HCC-patients.

CLINICAL RELEVANCE/APPLICATION
Currently, there is no firm evidence to prefer DEB-TACE to cTACE. Further prospective randomized trials with a hard endpoint are needed.
**SSC14-04**

**Chemoembolization with Dc Beads Preloaded with Irinotecan (DEBIRI) vs. Doxorubicin (DEBDOX) as a Second Line Treatment for Liver Metastases from Cholangiocarcinoma: Technical Aspects, Complications, and Efficacy**

Giulia Agostini (Presenter): Nothing to Disclose, Massimo Venturini MD: Nothing to Disclose, Stefano Cappio MD: Nothing to Disclose, Giulia Cammi: Nothing to Disclose, Francesco Aldo De Cobelli MD: Nothing to Disclose, Alessandro Del Maschio MD: Nothing to Disclose

**PURPOSE**

TACE with drug-eluting beads is routinely performed using Doxorubicin and Irinotecan in the treatment of HCC and hepatic metastases from colorectal cancer, respectively. Conversely, there is no specific drug indication in the treatment of other hypervascular liver metastases. Aim of our study was to compare the efficacy of DEBIRI vs. DEBDOX in the treatment of unresectable hepatic metastases from cholangiocarcinoma.

**METHOD AND MATERIALS**

In 2013, 10 patients affected by multiple cholangiocarcinoma hepatic metastases, resistant to the first line CT regimen, were enrolled: 5 were submitted to lobar/segmental TACE with DEBIRI (100mg Irinotecan/1vial) and 5 with DEBDOX (50mg Doxorubicina/1vial), performed every 3 weeks. Patients treated with DEBIRI received ant-pain pre-medication consisting of a 30 mg of morphine and 3-4 ml of intra-arterial lidocaine. All the procedures were performed with a trans-femoral approach using a microcatheter. Complications and efficacy of the two different types of treatment were assessed with contrast-enhanced MDCT (RECIST and mRECIST criteria) performed at baseline and 72 hours after each procedure.

**RESULTS**

A total of 32 TACE were performed (mean: 3.2 TACE/patient). All the treatments were well tolerated, with one only case of asymptomatic cholecystitis spontaneously recovered. Response rates assessed at the end of the treatment cycle of patients treated with DEBDOX were 5/5 PD while the ones of the patients treated with DEBIRI were 2/5 PR, 2/5 SD and 1/5 PD, with the appearance of a variable necrosis percentage.

**CONCLUSION**

Anti-pain drug administration in patients treated with DEBIRI and the use of the microcatheter lead to a good treatment tolerability and a low complication rate. In our experience, DEBIRI was more effective than DEBDOX as a second line treatment of hepatic metastases from cholangiocarcinoma.

**CLINICAL RELEVANCE/APPLICATION**

In our experience, DEBIRI was more effective than DEBDOX as a second line treatment of hepatic metastases from cholangiocarcinoma.

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**SSC14-05**

**The Effect of Age on Survival Outcomes in Unresectable Hepatocellular Carcinoma Treated with DEB-TACE: Surveillance, Epidemiology and End Results (SEER) Database vs. Tertiary Cancer Center**

Minzhi Xing MD (Presenter): Nothing to Disclose, Nima Kokabi MD: Nothing to Disclose, Hyun Sik Kim MD: Nothing to Disclose

**PURPOSE**

To evaluate the effects of age on survival outcomes in patients with advanced unresectable hepatocellular carcinoma (HCC) treated with Drug-Eluting Bead Chemoembolization (DEB-TACE) or best supportive care in a large-scale population study.

**METHOD AND MATERIALS**

Under IRB approval, our institute's cancer registry was queried for patients with advanced unresectable HCC diagnosed from Sept 2005 to Dec 2010, treated with DEB-TACE. Eighteen registries of the U.S. Surveillance, Epidemiology and End Results (SEER) database were queried for patients with advanced HCC not amenable to surgery/radiation diagnosed in the same time period. Baseline characteristics, median overall survival (OS) from HCC diagnosis and median OS from first DEB-TACE were stratified by age at HCC diagnosis. Survival analysis and 95% confidence intervals (CI) were calculated using Kaplan-Meier estimation.

**RESULTS**

A total of 20,897 SEER patients with unresectable HCC who received neither radiation nor cancer-directed surgery and 231 patients who received DEB-TACE for advanced unresectable HCC were included. Of these, 11649 SEER patients and 155 DEB-TACE patients who were <65 years at diagnosis. All groups were similar for gender, race, bilobar disease, portal vein thrombosis, and mean largest tumor size (p>0.05). Median OS in patients <65 years was similar to patients ≥65 years at HCC diagnosis (4.1 vs. 4.0 months, p>0.05). Significant differences in median OS from HCC diagnosis between groups were observed in patients <65 years at diagnosis (SEER vs. DEB-TACE, 4.0 vs. 23.47 months, p<0.0001) and ≥65 years at diagnosis (SEER vs. DEB-TACE, 4.0 vs. 21.1 months, p<0.0001).

**CONCLUSION**

In a population-based study, DEB-TACE therapy in patients with advanced, unresectable HCC demonstrated significantly greater median OS compared to best supportive care regardless of age at diagnosis.
Regardless of age at HCC diagnosis, DEB-TACE therapy in patients with advanced, unresectable HCC demonstrates significant survival benefit vs. best supportive care.

**Degradable Starch Microspheres Transarterial Chemoembolisation (DSM-TACE) of Multifocal HCC: Diffusion-weighted Magnetic Resonance Imaging (DWI) Evaluation of Therapeutic Efficacy Compared with Contrast Enhanced CT**

**PURPOSE**

To investigate usefulness of diffusion-weighted magnetic resonance imaging (DWI) for early detection of the response after transcatheter arterial chemoembolization using degradable starch microsphere (DSM)-TACE for hepatocellular carcinoma (HCC) compared with contrast enhanced computed tomography (CECT) using the modified RECIST (mRECIST).

**METHOD AND MATERIALS**

Thirty patients with inoperable multifocal HCC underwent to DSM TACE. DSM TACE was performed every 4 to 6 weeks with a mixture of DSMs and Doxorubicin at a dose of 50 mg/m2 for three time. Magnetic resonance imaging (MRI) including breathhold echoplanar DWI sequences was performed prior to therapy (baseline MRI), 15 days after every DSM TACE (early MRI) as well as after 3 months (follow-up MRI). Intratumoral apparent diffusion coefficient (ADC) were measured independently by two radiologists. Relative change in ADC values (%ADC), α-fetoprotein level and tumor response on follow-up with contrast CECT after 3 months were determined. HCC lesions were divided into two groups, responder and non-responder. The correlation between %ADC and mRecist results was determined, and %ADC was compared between the two groups. Statistical analysis was performed using univariate comparison, and paired t test as well as Pearson’s correlation.

**RESULTS**

Median progression-free survival (PFS) was 8 months, and overall survival was 21 months. Survival analyses showed significant effects of pretreatment α-fetoprotein level (P = .03) and ADC ratio (P < .005) on PFS and substantial effects of mRECIST (.05 < P < .1). After DSM TACE, the percent change in ADC (%ADC) from before to after therapy was significantly increased in non-responder lesions (79.2+/-11.4%) compared to responder lesions (7.0+/-49.7%, p=0.001). Positive correlations were observed for relative change between %mean ADC and complete or partial response (r = 0.536). Mean ADC were significantly greater in the responder group than in the non-responder group.

**CONCLUSION**

The ADC ratio 1 month after DSM TACE was an independent predictor of PFS, which showed stronger association with tumor response than mRECIST evaluated with CECT. In this study, therapeutic efficacy of DSM-TACE in HCC using DWI MRI analysis could be demonstrated.

**Diffusion-weighted magnetic resonance imaging (DWI) could be useful for early detection of response in patients with multifocal HCC treated with DSM TACE.**

**CRP as a Predictor of Response to TACE in HCC**

**PURPOSE**

The prognostic value of C-reactive protein (CRP) in patients with hepatocellular carcinoma (HCC) is well established, but there exists relatively little data in its use in HCC patients undergoing transarterial chemoembolization (TACE). We sought to look at outcomes in our institutions in patients who underwent TACE for HCC. We further sought to evaluate the value of pre-embolization CRP levels in predicting clinical and radiological outcomes following TACE.

**METHOD AND MATERIALS**

This multi-center study involved a retrospective review of 34 patients (73±7.9 years, 29 male) who underwent a total of 100 TACE procedures over a six-year period. Pre-procedure CRP values were available in 90% of cases. Other factors evaluated included liver function tests and tumour markers (Bilirubin, Alkaline Phosphatase, transaminases (AST/ALT), gamma glutamyl transpeptidase (GGT), and alpha-fetoprotein). Following TACE, we evaluated both clinical factors (overall survival) and radiological response to TACE (as measured by modified RECIST criteria (mRECIST) on follow-up CT at 3 months). SPSS was used to analyze the results via T-Test, Mann-Whitney test, Pearson correlation, Spearman correlation and Kaplan-Meier analysis.
RESULTS
Follow-up imaging was available in 85% of patients. Median follow-up was 28 months (range 1-76). No association was found between CRP and liver function tests, tumour markers, patient age or other biochemical parameters (r<0.3 for all comparisons). An abnormal pre-procedure CRP was found to be independently and significantly associated with both disease response (on a per procedure basis on follow up imaging, p<0.001) and overall patient survival. A CRP >20mg/l before first TACE treatment carried the worst prognosis (mean survival 9.25 Vs 17.76 months, p=0.007).

CONCLUSION
Serum CRP measurement can be used to predict response to TACE in patients with HCC.

CLINICAL RELEVANCE/APPLICATION
CRP is a cheap and widely-available test which can be used as a pre-procedural predictor of response to TACE in patients which HCC. It can be used to help risk-stratify those patients who would benefit from TACE.

SSC14-08 Trans-Arterial Ethanol Embolisation (TAETE) vs Conventional Chemoembolisation (cTACE) in the Treatment of BCLC Intermediate Stage HCC
Francesco Somma MD (Presenter): Nothing to Disclose, Roberto D'Angelo MD: Nothing to Disclose, Gianluca Gatta: Nothing to Disclose, Roberto Grassi: Nothing to Disclose, Francesco Fiore MD: Nothing to Disclose

PURPOSE
Hepatocellular carcinoma (HCC) is nowadays the third leading cause of cancer deaths worldwide. A variety of treatment modalities have been reported including resection, chemoembolisation, external irradiation, radiofrequency or percutaneous ethanol ablation. Our aim is to retrospectively evaluate the efficacy and safety of transarterial embolisation of intermediate HCC, using a mixture 1:1 of Ethanol and Lipiodol, that we named Trans-Arterial Ethanol Embolisation (TAETE), compared with conventional Trans-Arterial Chemo-Embolisation (cTACE)

METHOD AND MATERIALS
87 patients (37.93% male; 62.07% female; range of age 36-86 years) with documented hepatic lesions of 1.4 to 5.4 cm in size were elected to TAETE (Ethanol and Lipiodol, 1:1) or cTACE (Epirubicin and Lipiodol), through a super-selective catheterization with direct injection in the tumor-feeding arteries. Both procedures were followed by the intrarterial administration of embolizing agents (70-150µ).

RESULTS
TAETE and cTACE therapies were performed in 45 and 42 patients, respectively. Thirty days after the procedure, a Multislice Computed Tomography (MSCT) showed in all patients at least partial response according to RECIST1.1 and EASL criteria, while in 51/87 (58.62%) patients a complete resolution was observed, with no statistically significant difference between the two groups. On the contrary, there was significant difference in the overall incidence of side-effects, such as in the occurrence of post-embolisation syndrome (p<0.001).

CONCLUSION
Compared to cTACE, TAETE showed to be more effective in the size-reduction of tumoral mass with similar anti-tumor effects at thirty-day MSCT control and better toxicity profile, which makes it extremely useful in patients with more than one lesion or in case of relapse.

CLINICAL RELEVANCE/APPLICATION
Considering the onset of adverse events according to CTCAE version 4.0 (2009), TAETE is less invasive than cTACE (p=0.019, chi2-test with Yates-correction), showing no significative difference in the radiological tumor response according to mRECIST and EASL (p=0.958, chi2 test). TAETE could be used in elderly HCC patients or in case of multiple treatments

SSC14-09 90Y Loaded Glass Microspheres versus Sorafenib for Hepatocellular Carcinoma with Portal Vein Thrombosis: A Retrospective Study
Yan Rolland MD, PhD (Presenter): Consultant, BTG International Ltd, Julien Edeline : Nothing to Disclose, Eveline Boucher : Nothing to Disclose, Etienne Garin MD : Consultant, BTG International Ltd

PURPOSE
PVT is a main negative prognostic factor for HCC patients. The goal of this study is to analyse retrospectively patients treated with TheraSphere (T) or sorafenib (S) or both TheraSphere plus sorafenib (T+S).

METHOD AND MATERIALS
61 consecutive PVT patients were retrospectively included. Patients treated with sorafenib received a standard dose. Patients treated with TheraSphere were treated using a personalized dosimetric approach. Median progression free survival (PFS) and overall survivals (OS) were estimated with the Kaplan-Meier methos and compared with a log-rank test.

RESULTS
90Y loaded glass microspheres (36%), 90Y loaded glass microspheres plus Sorafenib (36%), Sorafenib (26%), and 90Y loaded glass microspheres plus Sorafenib (26%). Median PFS and OS were estimated with the Kaplan-Meier method.
18 patients received T only (30%), 29 S only (48%) and 14 received both T+S (23%). Main PVT was present in 38% of the patients treated by T and 52% for those treated by S only (ns). For patients treated with T the mean lobe dose was 146Gy and 13 patients (40%) received an intensification (mean lobe dose = 197Gy). PFS was 7.7 m (IC 95% : 6.5-8.9) in the group T vs 3.5 (IC 95% : 1.8-5.2) in the group S only (p = 0.026). OS was 23.4 months (IC 95% : 20.6-26.2) in the group T vs 5.1 (IC 95% : 2.3-7.8) in the group S alone (p<0.001). In the group T, OS was not significantly different if the patients received T alone or both T+S, respectively 24.0months vs 21.5 months (p = 0.96). For patients with a maximum of 3 lesions OS was still significantly higher for patients treated by T (23.8 months) than for those treated by S only (5.1 months, p<0.001). For patients with unilateral PVT results were still significantly better for T : OS were 24.0 vs 6.5 months for patients treated respectively with T or S alone (p<0.001).

CONCLUSION

In this retrospective study TheraSphere, using a personalized dosimetric approach and intensification, significantly increases OS of PVT patients versus sorafenib.

CLINICAL RELEVANCE/APPLICATION

Glass microsphere radioembolization significantly increases overall survival for hepatocellular carcinoma with portal vein thrombosis.
Surgery (MRgFUS) and Uterine Artery Embolization (UAE)—Main Differences, Advantages and Therapeutic Response (Station #2)

Fabiana Ferrari MD (Presenter): Nothing to Disclose, Anna Miccoli MD: Nothing to Disclose, Francesco Arrigoni: Nothing to Disclose, Eva Fasce MD: Nothing to Disclose, Antonio Barile MD: Nothing to Disclose, Carlo Masciocchi MD: Nothing to Disclose, Aldo Victor Giordano: Nothing to Disclose, Sergio Carducci: Nothing to Disclose

PURPOSE
To evaluate the response in the uterine fibroid treatment, using UAE and MRgFUS, comparing these two techniques, in terms of Non Perfused Volume extent and reabsorption, complication, hospitalization time and clinical outcomes.

METHOD AND MATERIALS
From October 2010 to December 2012, 65 patients affected by symptomatic uterine fibroids were treated in our department. Thirty-eight of them were treated using MRgFUS and 27 with UAE. Treatment was chosen according to patients age and fibroid vascularization and accessibility. We compared patients of the same age, affected by the same number of fibroids, showing similar dimensions and localization. They were controlled three times, after 3, 6 and 12 months, respectively. We evaluated non perfused volume (NPV) extent, reabsorption time, clinical response and hospitalization time.

RESULTS
We obtained a NPV mean value of 95%, using UAE and a mean value of 91.5% using MRgFUS. We observed a reduction of the necrotic area of 70% in patients treated with UAE and of 50% in women treated with MRgFUS after 12 months from the treatment. Twenty-five out of 27 patients (92.5%), treated with UAE, presented abdominal pain and bloating, fever and vomiting; they had a mean hospitalization time of 3 days and returned to a normal life in 25 days. Only 2 out of 27 (7.5%) returned to a normal life in 10 days. Patients treated with MRgFUS had no complications, a mean hospitalization time of 1 day, returning to a normal life in 5 days, an earlier bleeding reduction and a progressive cycle regularization.

CONCLUSION
Our study demonstrates that both techniques candidate as a valid alternative to surgery. In our experience, UAE is more radical, it seems to have a shorter reabsorption time but a longer convalescence. MRgFUS is more repeatable, shows less post-treatment symptoms, a good clinical response and should be the first choice when possible.

CLINICAL RELEVANCE/APPLICATION
These two techniques are a valid therapeutic solution of interventional radiology in uterine fibroid treatment in terms of symptom resolution and treatment efficiency.

Peri-Procedural Pain Control Following the Universal Application of Conscious Sedation and Neuraxial Analgesia in Patients Undergoing Uterine Fibroid Embolization (Station #3)

Alexandros Pappas MD (Presenter): Nothing to Disclose, Dana Haddad MD, PhD: Nothing to Disclose, Harvinder S. Jagait MD: Nothing to Disclose, Alexander Vinzons MD: Nothing to Disclose, Dimitris Giannaris: Nothing to Disclose, George Trister: Nothing to Disclose, Joseph James Arampulikan MD: Nothing to Disclose

PURPOSE
Peri-procedural pain control in patients undergoing uterine fibroid embolization (UFE) utilizing conscious sedation and concurrent neuraxial analgesia (CS+NA) has been suggested to be more effective in post-procedural pain control than conscious sedation alone (CS). This study assesses the effectiveness of post-procedural pain control since the implemented the universal application of CS+NA for patients undergoing UFE at our institution.

METHOD AND MATERIALS
A retrospective study was performed reviewing the self reported pain rating scales (1-10) after UFE during the two year period following the universal application of CS+NA in November 2011. Since that time, a total of 19 patients underwent UFE for symptomatic uterine fibroids, 18 of which were included in the study. The mean value was assessed with a two-tailed student t-test comparing post-procedure pain levels to patients having had CS alone during the three year period from November 2008 - November 2011 (21 patients). We assessed the effectiveness of the CS+NA protocol at 4 and 24 hours post procedure.

RESULTS
The mean pain scores at the 24 hour time point was 0.7 for CS+NA and 2.5 for CS. The t-statistic of the difference in percent agreement was significant at the 0.02 critical alpha level, t(37) = 2.5899, p = 0.0137 (t-value = 2.5899, Degrees of freedom = 37, Two-tailed probability = 0.0137). The mean pain scores at the 4 hour time point was 2.2 for CS+NA and 4.4 for CS. The t-statistic of the difference in percent agreement was significant at the 0.01 critical alpha level, t(37)= 2.8907, p = 0.0064 (t-value = 2.8907, Degrees of freedom = 37, Two-tailed probability = 0.0064).

CONCLUSION
The results of this retrospective study measuring the effectiveness of the universal application CS+NA at our institution to CS alone show that simultaneous neuroaxial analgesia and conscious sedation at the time of uterine fibroid embolization provides superior analgesia at both 4 and 24 hours post-procedure.
**CLINICAL RELEVANCE/APPLICATION**

An anticipatory pain management strategy through the periprocedural application of neuraxial analgesia for uterine fibroid embolization may improve inpatient comfort, decrease time to discharge, and decrease the likelihood of readmission for pain.

**VIS221**

**Evaluation of Contrast Protocol and Tumour Delineation using Ultrafast Cone-beam Computed Tomography: Initial Experience (Station #4)**

Thomas Josef Vogl MD, PhD : Nothing to Disclose, Emmanuel Chukwudum Mbaliiske MD : Nothing to Disclose, Bita Panahi MD : Nothing to Disclose, Jijo Paul MSc, PhD (Presenter): Nothing to Disclose

**PURPOSE**

To evaluate two ultrafast cone-beam CT (CBCT) imaging protocols with different acquisition and injection parameters regarding image quality and required contrast media during hepatic transarterial chemoembolization (TACE).

**METHOD AND MATERIALS**

In 62-patients (male: 34, female: 28; mean age: 56.8 years; range: 33-83) CBCT was performed during TACE for intra-procedural guidance. Imaging was performed using two ultrafast CBCT acquisition protocols with different acquisition and injection parameters (imaging protocol 1: acquisition time-2.54s, contrast-6ml with 3s delay; imaging protocol 2: acquisition time-2.72s, contrast-7ml with 6s delay). Image evaluation was performed both qualitatively and quantitative methods. Contrast injection and dose parameters were compared with values from literature.

**RESULTS**

Imaging protocol 2 provided significantly better image quality than protocol 1 at the cost of slightly higher contrast load and higher X-ray dose. Although imaging protocol 1 was able to visualize the hepatic vasculature, it mostly failed to delineate the tumors. In contrary, imaging protocol 2 showed excellent enhancement of hepatic parenchyma, tumor and feeding vessels.

**CONCLUSION**

Tumor delineation and visualization of feeding vessels are clearly possible using imaging protocol 2 with ultrafast CBCT-imaging. Due to the ultrafast CBCT-imaging a reduction of required contrast volume and dose compared to previous publications could be achieved.

**CLINICAL RELEVANCE/APPLICATION**

Ultrafast CBCT is a new imaging technique used for imaging of patients during transarterial chemoembolization. Information related to ultrafast CBCT imaging is scarce in literature. Contrast material volume and radiation dose reductions were achieved using ultrafast CBCT-imaging. Ultrafast CBCT contrast material injection protocol is established during transarterial chemoembolization.

**VIS222**

**Balloon Dilation for Tuberculous Tracheobronchial Strictures: A Single-Center Experience in 113 Patients during 17 years (Station #5)**

Ji Sung Jang (Presenter): Nothing to Disclose, Jin Hyung Kim MD : Nothing to Disclose, Young Chul Cho BS : Nothing to Disclose, Ho-Young Song MD : Nothing to Disclose, Ji Hoon Shin MD : Nothing to Disclose, Jung-Hoon Park MS, RT : Nothing to Disclose, Eun Jung Jun PhD : Nothing to Disclose, Wei-Zhong Zhou : Nothing to Disclose

**PURPOSE**

To determine whether balloon dilation is a safe and long-term efficacy of treating tuberculous tracheobronchial stricture (TTBS) in a large series of 113 patients.

**METHOD AND MATERIALS**

With ethics committee approval, records for 113 consecutive patients who underwent balloon dilation for TTBS with our interventional radiology department (1997-2014) were obtained retrospectively. Balloon dilations were performed under bronchoscopic and fluoroscopic guidance. Outcomes were number and/or frequency of balloon dilations, technical success, primary and secondary clinical success, improvement in respiratory status, airway patency rate and adjuvant treatment after balloon dilation.

**RESULTS**

A total of 167 balloon dilation sessions were performed in 113 patients, with a range of 1-8 sessions per patient (mean 1.5 sessions). The balloon dilation was successful in 82 (73%) of the 113 patients after a single (n = 67) or multiple (n = 15) balloon dilations. Clinical failure occurred in 31 patients (27%). In these 31 patients, symptoms recurred 1 day - 113 months (mean, 13 months) after repeat balloon dilations, and they required adjuvant treatment such as temporary stent placement (TSP) (n = 12), cutting balloon dilation (CBD) (n = 12), radiation-eluting balloon dilation (REBD) (n = 3) or surgery (n = 4). The primary patency rates at 1, 6 months and 1, 3, 5 and 10 years were 92%, 62%, 54%, 29%, 25%, and 10%, respectively. The secondary patency rates at 1, 6 months and 1, 3, 5 and 10 years were 99%, 85%, 75%, 51%, 44%, and 24%, respectively. Pre-, immediately and post-procedural pulmonary function test (PFT) results showed significant improvements between pre and immediately after dilation in the mean forced vital capacity (FVC) (P < .001), forced
expiratory volume in 1 second (FEV1) \((P = .001)\), forced expiratory flow 25\%-75\% (FEF 25-75\%) \((P = .020)\) and peak expiratory flow (PEF) \((P = 0.005)\).

**CONCLUSION**

Balloon dilation seems to be a simple and safe primary treatment modality for TTBS. In addition, the secondary clinical success with repeat balloon dilation is acceptable. TSP, CBD and REBD may be considered in patients with TTBS resistant to balloon dilation.

**CLINICAL RELEVANCE/APPLICATION**

Balloon dilation may be a successful treatment modality for healing tuberculous tracheobronchial stricture as well as for improving pulmonary function.

**VIS226**

**Pre-procedure Apparent Diffusion Coefficient as a Predictor of Response to Drug-eluting Bead Transarterial Chemoembolization of Hepatocellular Carcinoma (Station #6)**

Rahul Anil Sheth MD (Presenter): Nothing to Disclose, Quanzheng Li PhD : Nothing to Disclose, Suvranu Ganguli MD : Research Grant, Merit Medical Systems, Inc Consultant, Boston Scientific Corporation, Rahmi Oklu MD, PhD : Nothing to Disclose

**PURPOSE**

To investigate pre-procedure intratumoral apparent diffusion coefficient (ADC) in patients with hepatocellular carcinoma (HCC) undergoing drug-eluting bead transarterial chemoembolization (DEB-TACE) as a predictor for response to therapy.

**METHOD AND MATERIALS**

An Institutional Review Board (IRB) approved retrospective evaluation of patients undergoing doxorubicin DEB-TACE for HCC was performed. Patients with no prior history of locoregional therapy and with MRI examinations that included diffusion weighted imaging performed within 3 months prior to and following their initial DEB-TACE procedure between 2012 - 2014 were included. MRI imaging features including size, contrast enhancement pattern, T2 signal intensity, and ADC value were measured on the pre- and post-MRI studies for tumors between 10mm and 80mm in maximal dimension. Patient characteristics including age, gender, cause of liver disease, Childs-Pugh score, and mortality were recorded as well.

**RESULTS**

A total of 23 patients with 35 tumors were identified. Based upon their ADC values, tumors were classified as "low ADC" (ADC < 0.001 mm²/sec; \(n = 14\)) or "high ADC" (ADC > 0.001 mm²/sec; \(n = 21\)). There was no statistically significant difference in patient age, gender, cause of liver disease, or tumor size between the two groups. However, there was a statistically significant \((p < 0.005, \text{Mann-Whitney test})\) difference in percent ADC change between the pre- and post-MRI examinations, an imaging finding that predicts progression free survival. Tumors with low ADC on pre-procedure imaging demonstrated significantly less interval increase in ADC value following DEB-TACE than tumors with intrinsically high ADC value.

**CONCLUSION**

ADC value may serve as a pre-procedure indicator for response to DEB-TACE in patients with HCC.

**CLINICAL RELEVANCE/APPLICATION**

Predicting response to minimally invasive oncologic interventions can assist in proper patient selection, patient counseling, treatment planning, and selection of the most appropriate locoregional therapy.

**VIE175**

**The Right Tool for the Job: A Review of the Various Biopsy Devices and How They Are Used (Station #7)**

Aaron B. Wickley MD (Presenter): Nothing to Disclose, Michael Jason Reiter DO : Nothing to Disclose, Liem Thanh Mansfield MD : Nothing to Disclose, Ryan Becton Schwope MD : Nothing to Disclose, William Russell Thomas MD : Nothing to Disclose

**TEACHING POINTS**

1. Image-guided percutaneous needle biopsy plays a crucial role in the diagnosis of malignancy. It is more accurate than fine needle aspiration due to its ability to preserve tissue architecture and is less invasive than open surgical biopsy.
2. Percutaneous biopsy permits tissue sampling of almost any body part. As such, an array of available devices exists, each with specific functionality based on the anatomic area to be biopsied.
3. Most common biopsy device categories include aspiration needles, cutting needles, trephine needles, drill-powered devices, and vacuum-assisted devices.
4. Radiologists should be familiar with the components of various biopsy devices. This improves efficiency, increases likelihood of a diagnostic sample and avoids device failure or patient harm.

**TABLE OF CONTENTS/OVERVIEW**

1. Role of image-guided percutaneous biopsy.
2. Overview of biopsy types A. Aspiration needles B. Cutting and trephine needles C. Drill-powered devices D. Vacuum-assisted devices 3. Available devices by anatomic region A. Breast i. Core Biopsy (Achieve, etc.) ii. Vacuum-assisted (Mammatome, etc.) B. Musculoskeletal i. Core Biopsy (Bonopty, etc.) ii. Drill-powered (OnControl, etc.) C. Body i. Aspiration (Chiba, etc.) ii. Core Biopsy (Quick-core, etc.)
Prostate Artery Embolization: Clarifying a Challenging Anatomy (Station #8)

Veena Radhakrishnan Iyer MD (Presenter): Nothing to Disclose, Prashant Shrestha MD: Nothing to Disclose, Gregory Snyder MD: Nothing to Disclose, Andrew Misselt MD: Nothing to Disclose, Jafar Golzarian MD: Nothing to Disclose

TEACHING POINTS

Prostate artery embolization (PAE) is being actively studied for BPH and is used for refractory hematuria of prostatic origin. The most challenging part of PAE is identifying the prostatic artery. On review of this exhibit the reader will understand the anatomical supply of the prostate gland and origin and important anastomoses of the prostatic arteries, as relevant for embolization. The value of cone-beam CT to increase confidence of correct catheter placement is also demonstrated.

TABLE OF CONTENTS/OUTLINE

We performed a retrospective review of PAE performed in 15 men (30 hemipelves) at our hospital. We describe:

1. Branching pattern of the internal iliac artery
2. Origin and number of prostate arteries in each hemipelvis. Several classic variants are described.
3. Important and dangerous anastomoses of prostatic arteries with bladder, rectum, pudendal and median sacral branches. The value of CBCT is highlighted.

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In vitro Study of the Newly Designed Antireflux Metallic Stent for Distal Biliary Obstruction (Station #1)

Hiroshi Anai MD, PhD (Presenter): Nothing to Disclose, Yasushi Fukuoka: Nothing to Disclose, HIROKI ISHIDA: Nothing to Disclose, Mai Teranishi: Nothing to Disclose, Toshiyasu Yuba: Nothing to Disclose, Kimihiko Kichikawa MD: Nothing to Disclose

PURPOSE

Metallic stent for malignant biliary obstruction has an important role in reduction of jaundice and induction of aggressive treatment for advanced biliary or pancreatic cancer such as anticancer agent. However longer survival has been obtained due to chemotherapy and/or radiation therapy after improvement of jaundice by metallic stent, complications associated with metallic stent such as stent obstruction or reflux cholangitis have been encountered and such complications are sometimes critical to worsen quality of life and shorten survival.

The main cause of such complications in the patient treated with metallic stent placed across duodenal papilla is formation of bacterial biofilm as a result of the reflux of food residue and debris formation.

METHOD AND MATERIALS

We have developed the newly designed anti-reflux metallic stent (ARMS). The purpose of this in vitro study was to evaluate antegrade and retrograde flow of some various size of this stent and to determine the appropriate one. This ARMS has fully covered by silicon material and has biceps valve at the duodenal side. We prepared six types of ARMS (the diameter(mm)/ the length of the valve(mm), A:10/8, B:10/5, C:10/2, D:8/8, E:8/5, F:8/2). The length of each type of ARMS was 5cm. Each ARMS was set at the exit of the water tank with antegrade placement to measure the volume of the antegrade flow and next also set with retrograde placement to measure the flow resistance under various pressure (0.2, 0.5, 1, 2kPa). We evaluated using with saline and glycerin solution (60 cP) which has similar viscosity to human bile.

RESULTS

The flow rate of antegrade ARMS placement showed highest flow rate with each condition in stent B (stent diameter; 10mm, valve length; 5mm). (Figure) The flow of retrograde ARMS placement did not show any reflux in each ARMS type under all pressure.

CONCLUSION

One type of our developed newly designed ARMS showed good flow at antegrade fashion and no reflux at retrograde fashion. It should be evaluated at clinical use.

CLINICAL RELEVANCE/APPLICATION

Ideal anti-reflux metallic stent will prevent duodeno-biliary reflux and biliary drainage then can prolong the survival. So this in vitro study plays an important role in this field.
Visualization and Volume Estimation of Mouse Hindlimb Arteriogenesis Using MicroCT Imaging (Station #2)

James F. Baker (Presenter): Nothing to Disclose, Michael J Zhang: Nothing to Disclose, Chin Ng PhD: Nothing to Disclose

PURPOSE
The purpose of this study was to evaluate the imaging parameters required for the accurate visualization and quantification of arteriogenesis to assess efficacy of novel therapeutics.

METHOD AND MATERIALS
Three sets of mice with surgically induced ischemia of the right hindlimb were imaged on a small animal CT scanner set at 80kVp, 1800ms, 500µA, and 2X2 binning. The first set of samples were injected with Microfil, a silicone based contrast agent, prepared using manufacturer’s instructions and then fixed with formalin. The second set of samples were prepared in the same manner as the first set, and then decalcified using Cal Ex II for 48 hours. The third set of samples were injected with a Microfil solution that was prepared without using the diluent recommended by the manufacturer and then decalcified using the same process as sample set two. The samples were then analyzed using the software Analyze 11.0 and segmented via thresholding. To verify the accuracy of volume measurements, a set of MicroCT phantoms were created using a iodine based gel and PEEK tubing. The tubing was filled with the iodine gel and then cut into various lengths. The phantoms were then scanned using the same parameters as the mouse hind limbs.

RESULTS
The first set of samples could not be accurately be segmented from the underlying bone due to the linear attenuation coefficient (LAC) of bone and Microfil being very similar resulting in similar intensities and an inability to accurately measure the vascular volume. Decalcification of the second set of samples created a greater separation in LAC of the vasculature and surrounding tissue. This allowed for an accurate segmentation of the vascular network and visualization of vessels larger than small arterioles. The lack of dilution in the third set of samples created a change in intensity of the small arterioles resulting in their visualization. The analysis of the MicroCT phantoms revealed that the volume of the phantoms could be estimated with an accuracy of 96.6±2.0%.

CONCLUSION
The results illustrate the ability to not only visually observe the growth and change in blood vessel number and size, but also that the volume of these changes can be measured accurately.

CLINICAL RELEVANCE/APPLICATION
Peripheral arterial disease (PAD) represents a continuum of disease that range from asymptomatic PAD, intermittent claudication, critical limb ischemia, acute limb ischemia and amputation.

Short-term Rosuvastatin Therapy Prevents CIAKI in Female Patients with Diabetes and CKD: A Subgroup Analysis of TRACK-D Study (Station #3)


PURPOSE
The multicenter TRACK-D study demonstrated periprocedural use of rosuvastatin effectively reduced the risk of contrast-induced acute kidney injury (CIAKI) in patients with diabetes mellitus (DM) and chronic kidney disease (CKD) undergoing coronary/peripheral arterial angiography or percutaneous intervention. This analysis investigated the value of such preventive strategy for CIAKI according to sex.

METHOD AND MATERIALS
1,954 of the TRACK-D population (2,998) were women. The average age of females was older than that of males (64.10 ± 7.41 vs 60.02 ± 8.91, p < .01). Men had more hypertension, peripheral vascular disease, DM and anemia (all p < .05). Baseline level of serum creatinine (Scr) was higher in males (98.44 ± 20.04 vs 82.73 ± 25.58, p < .01). So was estimated glomerular filtration rate (74.75 ± 14.15 vs 73.44 ± 16.75, p < .05). Women had higher level of total cholesterol and LDL-C (p < .01). 535 females and 963 males were assigned to receive rosuvastatin. The overall incidence of CIAKI was 3.6% and 2.8% in females and males, respectively. The control group, women had a higher rate of CIAKI (5.3% vs 3.1%, p = .04). Females treated with rosuvastatin had a significantly lower rate of CIAKI compared with controls (2.1% vs 5.3%, p < .01). A statistically significant difference in the incidence of CIAKI between the rosvastatin group and the control group was seen in women with CKD stage 2 (1.2% vs 4.1%, p = .01), but not in those with CKD stage 3 (3.3% vs 8.4%).

CONCLUSION
The results illustrate the ability to not only visually observe the growth and change in blood vessel number and size, but also that the volume of these changes can be measured accurately.

CLINICAL RELEVANCE/APPLICATION
Peripheral arterial disease (PAD) represents a continuum of disease that range from asymptomatic PAD, intermittent claudication, critical limb ischemia, acute limb ischemia and amputation.
Untreated females were associated with a higher risk of CIAKI compared with their male counterparts. Short-term rosuvastatin treatment reduced the risk of CIAKI in women with DM and CKD, which was consistent with the results from overall TRACK-D population.

**CLINICAL RELEVANCE/APPLICATION**

The study did reconfirm that females had higher risk of CIAKI even with a better lab result before procedure. Periprocedural use of rosuvastatin is an easy and practicable preventive method.

### VIS228

**Focal Laser Ablation of Prostate Cancer—Short Term Outcomes versus Conventional Therapy (Station #5)**

**J Ryan Mikus MD (Presenter): Nothing to Disclose , Jacqueline Sue Aoughsten RN : Nothing to Disclose , Eric Michael Walser MD : Nothing to Disclose**

**PURPOSE**

To assess the short-term side effect outcomes of focal laser ablation (FLA) for the treatment of prostate cancer versus conventional treatment.

**METHOD AND MATERIALS**

Records of 140 referrals for evaluation for MR-guided prostate cancer FLA were retrospectively reviewed. FLA was performed on 23 patients (16%). Clinical follow-up for patients receiving FLA was performed post-intervention, with follow-up periods ranging from 3 months to one year. Clinical course and complications were reviewed. All patients had Sexual health in men scoring (SHIM) and International prostate symptom scoring (IPSS) before and 2-12 months after FLA.

**RESULTS**

100% technical success was achieved (23/23). No major complications (including adverse effects on sexual function, urinary function, and bowel function) were observed in any of 23 patients after FLA at 2 month post-intervention (0%). 3 patients experienced minor complications after FLA—one urinary tract infection successfully treated by oral antibiotics; hematuria for 3 days, self-limited; and urinary urgency with incontinence for 3 days, self-limited. Historical data for prostatectomy, external beam radiation, and brachytherapy demonstrates at least moderate adverse effects on sexual function (29%, 30%, 39%, respectively), urinary function (59%, 28%, 34%), and bowel function (3%, 16%, 15%), at 2 months post-intervention. There was no significant difference in SHIM scores and IPSS scores before and up to 12 months after FLA (p<0.05).

**CONCLUSION**

Focal laser ablation of prostate cancer has high technical success, and the short-term effects of FLA on sexual, urinary, and bowel function are favorable in comparison to conventional therapy for prostate cancer.

**CLINICAL RELEVANCE/APPLICATION**

Focal laser ablation of prostate cancer is a promising new technique, primarily due to its superior side-effect profile, as demonstrated. Long term follow-up and efficacy data is forthcoming.

### VIS232

**Cone-beam Computed Tomography with Three-dimensional Reconstruction Techniques versus Conventional Digital Substraction Angiography in Transcatheter Arterial Chemoembolization for Hepatocellular Carcinoma (Station #6)**

**Long Gao (Presenter): Nothing to Disclose , Hai Bo Shao MD : Nothing to Disclose , Tengchuang Ma : Nothing to Disclose , Xu Ke MD : Nothing to Disclose**

**PURPOSE**

To evaluate the efficacy of cone-beam computed tomography (CBCT) with three-dimensional (3D) reconstruction techniques in transcatheter arterial chemoembolization (TACE) for hepatocellular carcinoma (HCC) compared with conventional digital subtraction angiography (cDSA).

**METHOD AND MATERIALS**

This retrospective study was performed on 36 consecutive HCC patients who underwent super-selective TACE. CBCT was performed on 16 patients (35 tumors), 3D-angiography, 3D-roadmap and multi-planar reconstruction techniques were used to guide operation and evaluate embolization efficacy. The other 20 patients (44 tumors) received cDSA during TACE. Distinguishability of feeding arteries, detectability of HCC lesions, technical success of super-selective catheterization, operating time, cumulative X-ray exposure of patient, dosage of contrast agent (CA) and lipiodol depositing proportion (one-month postoperative contrast-enhanced CT as reference standard) were compared between groups.

**RESULTS**

All TACE procedures were carried out fluently. There were no severe procedure related complications. All patients received one-month CT follow-up. CBCT with 3D techniques showed better efficacy in showing feeding arteries (87.5% vs. 55%, p<0.01), detectability of HCC lesions (97.14%, 34 of 35 vs. 70.45 %, 31 of 44, p=0.028) and technical success rate of super-selective catheterization (91% vs. 75%, p=0.043) than cDSA.
Moreover, procedures with CBCT spent less CAs (28 vs. 36 ml, p=0.44). However, procedures with CBCT spent longer operating time (43 vs. 32 mins, p<0.01) and induced more X-ray dosage exposure (242 vs. 157 mGy, p=0.015) than those with cDSA. On lipiodol depositing evaluation, the coincidence rate of CBCT with one-month CT follow-up was significantly higher than that of cDSA (100% vs. 76%, p<0.01).

CONCLUSION

Compared with cDSA, CBCT with 3D reconstruction techniques showed better clinical application efficacy in feeding artery distinguishability, tumor detectability, catheterization guidance and embolism efficacy evaluation in TACE for HCC patients although consuming more operating time and X-ray exposure.

CLINICAL RELEVANCE/APPLICATION

Application of CBCT with 3D reconstruction techniques may have potentially encouraging values in improving the efficacy of TACE for HCC patients.

VIE193

What Interventional Radiologist Needs to Know about Treatment Response Evaluation of Liver Malignancies in Response to Locoregional Therapies (Station #7)

Christelle Chedrawy MD : Nothing to Disclose, Daniel Anthony Falco DO : Nothing to Disclose, Bimal Bharatkumar Patel DO : Nothing to Disclose, Pedram Rezai MD (Presenter) : Nothing to Disclose

TEACHING POINTS

Surgical resection remains the treatment of choice for hepatocellular carcinoma (HCC) and metastatic liver cancer (MLC). However, only up to 25% of the patients are surgical candidates. Consequently, the majority of these patients are treated with systemic chemotherapeutic agents or locoregional therapies. The objective of this presentation is to discuss different imaging biomarkers of treatment response evaluation in HCC and MLC.

TABLE OF CONTENTS/OUTLINE

An overview of anatomical imaging biomarkers such as WHO, RECIST and volumetric evaluation will be provided. Biomarkers that monitor alterations in function of neoplastic cell in response to treatment such as EORTC and DWI MR will be discussed. Eventually, liver-specific biomarkers of treatment response such as mRECIST, EASL and Choi criteria will be discussed.

VIE114

Fibromuscular Dysplasia: What the Radiologist Should Know (Station #8)

Lionel Varennes (Presenter): Nothing to Disclose, Florence Tahon : Nothing to Disclose, Adrian Imre Kastler MD, MSC : Nothing to Disclose, Sylvie Grand MD : Nothing to Disclose, Kamel Boubagra : Nothing to Disclose, Arnaud Attye MD : Nothing to Disclose, Frederic Thony MD : Nothing to Disclose, Alexandre Krainik MD, PhD : Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: 1. To increase awareness amongst radiologists about DFM. 2. To review both common and uncommon imaging findings in patients with Fibromuscular Dysplasia 3. To provide the necessary diagnostic tools in order for the radiologist to play an important role in the diagnosis

TABLE OF CONTENTS/OUTLINE

A - Fibromuscular dysplasia epidemiologic reminder B - Fibromuscular dysplasia pathophysiology C - Clinical manifestation of Fibromuscular dysplasia B Review of imaging findings - Common imaging findings - Uncommon imaging findings C Role of imaging techniques in Fibromuscular dysplasia diagnosis : diagnostic strategies - Ultrasound - CT Scan - MRI - DSA D - Differential diagnosis E - Go home messages

VIE011-b

The Arterial Vasculature of the Stomach with a Focus on Fundal Supply: A Primer for Bariatric Embolization (hardcopy backboard)

Ryan J. Brandt MD (Presenter): Nothing to Disclose, Eric K. Hoffer MD : Nothing to Disclose, Trent Shelton DO : Nothing to Disclose

TEACHING POINTS

1. To review the basic theory and technique for bariatric embolization. 2. To review the arterial supply of the stomach with a focus on the supply to the fundus.

TABLE OF CONTENTS/OUTLINE

Bariatric embolization is a percutaneous interventional procedure in development, which seeks to help patients lose weight by targeting the ghrelin producing cells in the fundus of the stomach. Recent animal studies testing the procedure have been complicated by gastric ulceration, which makes knowledge of the arterial supply of the stomach and particularly the fundus important for developing a safe embolization technique for use in humans. A literature review was performed to identify the vascular supply to the fundus. The left gastric artery and short gastric arteries are major suppliers to the fundus. Additional sources of fundal supply include the posterior gastric artery, left inferior phrenic artery, accessory left gastric artery, left gastroepiploic and less commonly, the left middle suprarenal artery. Using CT angiography, graphical illustrations and digital subtracted angiography, we have demonstrated the arterial supply of the stomach. Digital subtracted angiography cine
loops embedded in QR codes were used to demonstrate dynamic arterial filling. Selected illustrative cases were used to further demonstrate arterial anatomy and pathology.

**MSMC23**

**Cardiac CT Mentored Case Review: Part III (In Conjunction with the North American Society for Cardiac Imaging) (An Interactive Session)**

**Multisession Courses**

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Mon, Dec 1 1:30 PM - 3:00 PM  Location: S406A

**Participants**

**Moderator**

Harold Ira Litt MD, PhD : Research Grant, Siemens AG Research Grant, Heartflow, Inc

**Moderator**

U. Joseph Schoepf MD : Research Grant, Bracco Group Research Grant, Bayer AG Research Grant, General Electric Company Research Grant, Siemens AG

**Sub-Events**

**MSMC23A**  
**Pulmonary Veins and Pericardium**

Jacobo Kirsch MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe normal versus anomalous pulmonary venous anatomy. 2) Understand the imaging findings of complications of ablation for atrial fibrillation. 3) Describe abnormalities of the pulmonary veins identifiable on routine CT. 4) Identify the most common pericardial abnormalities evaluated with CT.

**MSMC23B**  
**Coronary Artery Disease III: Native Vessel Disease**


**LEARNING OBJECTIVES**

1) Understand pathology of the native coronary arteries beyond simple plaque disease. Topics will include coronary artery aneurysms, anomalies, and fistulae. 2) How to optimize the study performance and interpretation will be addressed as well.

**ABSTRACT**

The goal of this session is to learn how to interpret pathology involving the coronary arteries beyond the detection of coronary artery stenosis. Focus on exam acquisition protocols, study interpretation protocols, and minimizing radiation dose are addressed. Specific topics addressed will also include coronary artery aneurysm, myocardial bridging, anomalous coronary arteries as well as vasculitis. Potential pitfalls will be addressed and pearls for study optimization will also be discussed.

**MSMC24**

**Cardiac CT Mentored Case Review: Part IV (In Conjunction with the North American Society for Cardiac Imaging) (An Interactive Session)**

**Multisession Courses**

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Mon, Dec 1 3:30 PM - 5:30 PM  Location: S406A

**Participants**

**Moderator**

David A. Bluemke MD, PhD : Research support, Siemens AG

**Moderator**

Frank John Rybicki MD, PhD : Research Grant, Toshiba Corporation

**LEARNING OBJECTIVES**

1) To understand the clinical indications for retrospective ECG gated cardiac CT; 2) To illustrate methods to assess myocardial...
function from cine cardiac CT images. 3) To illustrate methods to assess normal and abnormal valvular function from cine cardiac CT images.

**ABSTRACT**

The mentored case review provides the opportunity for the attendees to learn the image acquisition, post-processing, and diagnosis for a wide variety of cardiac diseases commonly encountered in CT.

**Sub-Events**

**MSMC24A**  
**Coronary Artery Disease and Incidental Noncardiac Findings**  
Jill E. Jacobs MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify and evaluate coronary plaques and stenosis. 2) Identify and characterize common incidental extracardiac findings on coronary CT angiography.

**MSMC24B**  
**Adult Congenital Heart Disease**  
S. Bruce Greenberg MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the increasing incidence and morbidity of congenital heart disease in adults. 2) Understand the long term complications of treated and untreated congenital heart disease. 3) Describe CT techniques for imaging adults with congenital heart disease. 4) Demonstrate morphologic changes in the heart and great vessels in untreated, palliated and corrected congenital heart disease.

**MSMC24C**  
**Coronary Artery Disease IV: Native Vessel Disease and Arterial and Venous Bypass Grafts**  
Gautham P. Reddy MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify focal areas of stenosis in the coronary arteries on CT. 2) Describe the appearance of bypass graft stenosis on coronary CT. 3) Review the diagnosis of aneurysms in the native coronary arteries and in bypass grafts.

**RCC25**

**Precision Medicine through Image Phenotyping**

**Refresher/Informatics**

**IN BQ VA CH CA IN BQ VA CH CA**

**AMA PRA Category 1 Credits ™**: 1.50  
**ARRT Category A+ Credits**: 1.50  
**Mon, Dec 1 4:30 PM - 6:00 PM**  
**Location: S501ABC**

**Participants**

Moderator  
Ella A. Kazerooni MD : Nothing to Disclose

**LEARNING OBJECTIVES**

1) To learn what the term precision medicine means. 2) To understand how informatics intersects with clinical radiology to enable precision medicine in practice. 3) To learn through concrete examples how informatics based radiology precision medicine impacts health.

**ABSTRACT**

Biomarkers have been embraced by both the scientific and regulatory communities as surrogates end points for clinical trials, paving the way for their widespread use in medicine. The field of imaging biomarkers has exploded, and the their integration into clinical practice relies heaving on and intersects with the field of bioinformatics. Once specific biomarkers are show to have value, easily integrating them into the digital environment of the radiologist and communicating them to the health care providers and or directly to patients efficiently and seamlessly is important for their value and impact on health to be realized. Culturally, it is taking radiologists from the era of description and largely qualitative reporting, into a quantitative future state, and leveraging informatics to extract information from imaging alone ot together with data available in the electronic medical record is essential for future sucess in this new world. To get there, understanding the impact of this approach as a value of our services, and standardization of imaging techniques along the lines of what the RSNA QIBA initiative is designing, are essential, so that imaging biomarkers are robust, accurate and reproducible. Embraching this approach enables and facilitates new approaches, relationships of imaging and IT researchers, vendors and consumers, to fully realize the possiblities. This course will discuss and describe the overall constructs, and use tangible exams of using this in practice today and for the future.

**Sub-Events**

**RCC25A**  
**Imaging Biomarkers Meet Informatics: The Personalized Medicine Construct**  
Ella A. Kazerooni MD (Presenter): Nothing to Disclose

**IN BQ VA CH CA IN BQ VA CH CA**
**LEARNING OBJECTIVES**

View learning objectives under main course title.

**ABSTRACT**

View abstract under main course title.

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**RCC25B**

**Lung Nodules: Combining Population and Patient Specific Data to Inform Personalized Decision Making**

Eliot L. Siegel MD (Presenter): Research Grant, General Electric Company Speakers Bureau, Siemens AG Board of Directors, Carestream Health, Inc Research Grant, XYBIX Systems, Inc Research Grant, Steelcase, Inc Research Grant, Anthro Corp Research Grant, RedRick Technologies Inc Research Grant, Evolved Technologies Corporation Research Grant, Barco nv Research Grant, Intel Corporation Research Grant, Dell Inc Research Grant, Herman Miller, Inc Research Grant, Virtual Radiology Research Grant, Anatomical Travelogue, Inc Medical Advisory Board, Fovia, Inc Medical Advisory Board, Toshiba Corporation Medical Advisory Board, McKesson Corporation Medical Advisory Board, Carestream Health, Inc Medical Advisory Board, Bayer AG Research, TeraRecon, Inc Medical Advisory Board, Bracco Group Researcher, Bracco Group Medical Advisory Board, Merge Healthcare Incorporated Medical Advisory Board, Microsoft Corporation Researcher, Microsoft Corporation

**LEARNING OBJECTIVES**

1) Describe how data from a clinical trial can be repurposed as a decision support tool. 2) List some of the potential techniques that can be utilized to predict likelihood of a malignant nodule from the NLST database. 3) Explain how the Fleischner Guidelines can be personalized utilizing data from NLST and PLCO. 4) Detail the implications for lung screening trials of having access to NLST and PLCO data. 5) Demonstrate how a healthcare enterprise can create their own local reference database using information from their own patient population.

**ABSTRACT**

The era of personalized/precision medicine offers the potential to utilize patient and lesion specific data to personalize screening and diagnostic work-up, diagnosis, and treatment selection to a particular patient to optimize effectiveness. Although recently, the emphasis has been on utilization of genomic data in personalized medicine, there is a 'gold mine' of useful data in previously conducted clinical trials as well as patient medical electronic records that has, until now, gone largely untapped. The purpose of this presentation is to describe how the screening, diagnosis, and treatment of lung nodules can be personalized utilizing data from the NLST and PLCO clinical trials and how the Fleischner Guidelines and screening criteria for lung cancer can be modified according to the characteristics of an individual patient and individual nodule. The presentation will also include ways in which a facility can collect local data on their own patients to supplement these reference databases with experience from their own patient population.

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**RCC25C**

**Managing Cardiovascular Care through Image Phenotyping Combined with Patient Level Data**

John Jeffrey Carr MD, MS (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

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**RC350**

**CTA from Head to Toe (How-to Workshop)**

Refresher/Informatics

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AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 8:30 AM - 10:00 AM  Location: E260

**Participants**

Moderator
Alison Wilcox MD : Speaker, Toshiba Corporation

**Sub-Events**

**RC350A**

**Cardiac CT- Pre, Peri and Post Procedural Management**

Bonnie Garon MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review preprocedural patient preparation including appropriate patient selection, beta blockade, contraindications and alternatives beta blockers. 2) Discuss how to manage nonstandard patients (atrial
fibrillation, pacemaker, young adults). 3) Periprocedural issues including vasodilation, continued heart rate control, and breathholding requirements. 4) Image acquisition including radiation dose reduction techniques, technique choice, and post CABG patient. 5) Postprocedural complications include contrast reactions and their management.

ABSTRACT

Cardiac CTA involve slightly more preparation than the standard CT acquisition. Heart rate control is the most important aspect that needs to be addressed prior to the patient arriving in the radiology department. Periprocedural issues mostly involved how to optimize technique while having the lowest radiation dose especially in the new age of dose reduction. Almost as important as heart rate management is how to treat postprocedural complications especially contrast reactions. This presentation will discuss these aspects and include treatment options as well as their alternatives.

**RC350B**

**TEVAR/EVAR- Pre, Post and Periprocedural Evaluation**

Alison Wilcox MD (Presenter): Speaker, Toshiba Corporation

**LEARNING OBJECTIVES**

1) What are some clinical indications for acute aortic imaging. 2) What are some CT parameters that can aid in various diagnosis? 3) What are some of common complications seen in TEVAR and EVAR? 4) What are the important measurements and vessel variants that help guide surgical approach. 5) New suggestions for type B management. 6) What are some imaging problems and pitfalls and some methods to assist. 7) Briefly discuss TAVR acquisition.

**ABSTRACT**

The acute aorta is part of a syndrome of diseases affecting the aorta with significant overlap of findings and clinical presentations. Clinically the diagnosis is difficult as there is overlap between patients with suspected coronary disease, pulmonary embolism and acute aortic syndrome. In the past several years, minimally invasive surgery with Thoracic Endovascular Aortic Repair (TEVAR) or Endovascular Aortic Repair (EVAR) have become increasingly popular. The images choices include gated vs non gated studies, non-contrast imaging, and delayed imaging. The literature is mixed on how and when to use these modalities. The complications of these procedures is often complex and subtle as well. Knowledge of these vascular complications is imperative for patient management. In addition, these patients often have significant atherosclerotic disease elsewhere that might be limiting factors for stent placement, including renal insufficiency. Newer scanners and imaging techniques can reduce radiation dose, and limit the amount of contrast delivery to preserve renal function while preserving image quality. TAVR is an example of another minimally invasive technique gaining popularity that has imaging challenges. Again, newer scanning techniques with limited contrast delivery can provide excellent image quality while limiting radiation dose and preserving renal function.

**RC350C**

**Peripheral CTA—A How-to**

Ilya Lekht MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Enhance knowledge of normal and abnormal coronary and cardiac anatomy, with an emphasis on differentiating benign from significant variants. 2) Demonstrate the spectrum of nonatherosclerotic congenital and acquired diseases that may affect the coronary arteries. 3) Demonstrate the spectrum of non-atherosclerotic congenital and acquired diseases that may affect the heart.

**ABSTRACT**

A variety of non-atherosclerotic conditions are detectable on cardiac CT scans, including diseases of the heart, and disease processes which may affect the coronary arteries, or other vascular structures. Cardiac CT has a number of unique advantages in detecting non-atherosclerotic conditions, including congenital and acquired diseases. The focus of this presentation will be non-atherosclerotic conditions of the coronary arteries and of the heart. Variants of normal and abnormal anatomy of the coronary arteries will be discussed, including tips for identifying when coronary anatomic variants are significant. Acquired, non-atherosclerotic diseases of the coronary arteries will also be discussed. This presentation will also discuss the spectrum of non-atherosclerotic diseases of the heart which may be detected at cardiac CT, including congenital and acquired valvular and cardiac diseases. At the end of this exhibit, the viewer will have a better appreciation for abnormal coronary and cardiac anatomy and the broad spectrum of non-atherosclerotic cardiovascular diseases which may be seen at cardiac CT.

**RC352**

**Doppler US: Abdominal and Visceral Applications (Hands-on Workshop)**

**Refresher/Informatics**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Tue, Dec 2 8:30 AM - 10:00 AM   Location: E264
LEARNING OBJECTIVES

1) Understand basic concepts associated with abdominal and visceral Doppler. 2) Describe ultrasound techniques, protocols, and diagnostic criteria for evaluation of abdominal and visceral arteries. 3) Gain experience in Doppler techniques through personalized hands-on scanning of models with a variety of ultrasound machines. 4) Describe common pitfalls in Doppler examinations.

ABSTRACT

This hands-on course will focus on the details that constitute good Doppler technique in the evaluation of vascular flow within the abdomen and pelvis. Technical considerations for optimization of Doppler images will be discussed and the concepts will be applied to abnormalities commonly encountered in patients. Initial two brief lectures will begin by discussing important aspects of abdominal and visceral Doppler. The majority of the session will give participants an opportunity to scan live models to improve technical skills in color and spectral Doppler. Faculty will be available at multiple stations using a variety of ultrasound machines. Participants will be encouraged to inquire about specific arterial territories of interest in the abdomen and pelvis during the hands-on component of the course.

RC353

3D Printing: A Powerful Tool for Applied Imaging Science

Refresher/Informatics

IN IR VA NR IN IR VA NR IN IR VA NR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Tue, Dec 2 8:30 AM - 10:00 AM Location: N226

Participants

Moderator
Frank John Rybicki MD, PhD: Research Grant, Toshiba Corporation

LEARNING OBJECTIVES

1) To review current applications for 3D printing in biomedical imaging science. 2) To discuss clinical problems in radiology for which imaging science with 3D printing can potentially improve patient care.

ABSTRACT

In broad terms, 3D printing can be used for to enhance clinical care and to enable investigation that would otherwise not be possible. This talk focuses on those research applications. For example, 3D models of individual phantoms will enable studies in CT that may be limited by radiation concerns, the delivery of large volumes of contrast, or both. In addition, research can be used to simulate individual organ systems. Finally, complicated pathophysiology may be amenable to 3D models and thus 3D technologies can expand current research in multiple applications.

URL’s

http://www.brighamandwomens.org/Departments_and_Services/radiology/Research/aisl.aspx

Sub-Events

RC353A Validation of Coronary Contrast Gradients Using 3D Coronary Phantoms

Dimitris Mitsouras PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

3D printed models are poised to expand current investigations toward accurate functional CT and MR imaging that will likely open new horizons for diagnostic tool development that is not otherwise feasible due to patient considerations such as radiation burden, scan time, and monetary cost. 3D printing can produce hollow structures (e.g. vessels and airways) that, with appropriate selection of the printing technology (particularly with respect to the so-called "support" material) can replicate human physiology, including at the moment vascular compliance. Vascular phantoms have been successfully created from rotational digital subtraction angiography, CR, and MRI data sets. Early attempts begun with negative molds, namely 3D printing of a solid lumen to be used as mold around which to cure a silicon "vessel" wall. At present, the "vessel" wall can be printed with high accuracy {
Blood Flow in the Thoracic Aorta Elucidated with 3D Models

Michael  Markl  PhD (Presenter):  Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Flow sensitive MRI offers the ability to assess anatomy as well as flow characteristics in healthy and pathological blood vessels and is therefore an attractive tool for the diagnosis of vascular diseases. However, in-vivo studies do not allow the prediction of hemodynamic changes due to vascular modifications. Realistic vascular in-vitro 3D phantoms in combination with MRI flow measurements allow to model different vascular deformations and evaluate their effect on blood flow dynamics. This presentation will provide a review of the methods for the in-vitro simulation of aortic 3D blood flow with realistic boundary conditions and review previously reported application for the simulation of common aortic pathologies and their impact on aortic hemodynamics.

3D Printing in Interventional Radiology and Vascular Surgeries

Matthew D Tam  FRCR (Presenter):  Nothing to Disclose

LEARNING OBJECTIVES

1) Describe potential workstream flows from CTA to a 3D printed model of the aorta. 2) Discuss the potential role of solid and hollow models of the vasculature to aid procedure planning, procedure execution and patient outcomes. 3) Gain an insight into future developments of the 3D printing industry.

ABSTRACT

3D printing has a major role to play in healthcare - procedure planning and execution, implant and device design, as well as facilitating better patient communication strategies and patient outcomes. Anatomically accurate patient-specific models of the vasculature can be constructed using 3D printing technologies. CT angiograms and DICOMS can be processed and the data converted into computer-aided design files using a range of different techniques and software. CAD files can then be 3d printed. In the setting of endovascular aneurysm repair, solid models of the lumen can be created and may be used to better understand complex anatomy. Hollow models can be created which can facilitate procedure execution through patient-specific rehearsal. 3D printing technologies will have further impact upon vascular and interventional radiology as both software, hardware and material science improves.

3D Printing in Otolaryngology

Glenn E.  Green  MD (Presenter):  Nothing to Disclose
Maryam  Ghadimi Mahani  MD (Presenter):  Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

3D Printing of Viable Tissues

Roger R.  Markwald  PhD (Presenter):  Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the development of the use of 3D applications in support of surgical reconstruction. 2) Describe the use of 3D Medical Applications in the support of Wounded Warrior Care.

ABSTRACT

Digital design and manufacturing technologies have been leveraged by the military in support of Wounded Warrior care since before the year 2000. A dedicated service for medical modeling was developed at the WRNMMC to provide 3D planning and manufacturing in the support of the DOD and wounded warrior care, expanding services to surgical simulations, development of surgical guides and custom implants, as well as support of research, occupational health and prosthetics worldwide. The purpose of this presentation is to present a review of the development of the use of digital design, digital manufacturing, and the establishment of 3D Medical Applications Center in support of Wounded Warrior Care.

URL's

http://www.wrnmmc.capmed.mil/ResearchEducation/3DMAC/SitePages/home.aspx

Future Applications in 3D Printing

Frank John  Rybicki  MD, PhD (Presenter):  Research Grant, Toshiba Corporation
LEARNING OBJECTIVES

1) To review the current innovative literature in 3D printing related to radiology. 2) To hypothesize and discuss future applications in 3D printing for radiology.

ABSTRACT

One of the main applications of 3D visualization is to enhance diagnoses for which the anatomy in question is complex. Additionally, the planning for a specific intervention often requires a volumetric assessment. 3D printing in radiology is rapidly growing as a means to realize real 3D objects in 2D surfaces. The promise of this technology in the near future has spawned several new hypotheses that may define future applications. The purpose of this lecture is to review the literature and discuss novel ways that printed models can enhance radiology diagnoses and investigations.

URL’s

http://www.brighamandwomens.org/Departments_and_Services/radiology/Research/aisl.aspx

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**VSPD31**

**Pediatric Series: CV/IR**

**Series Courses**

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**AMA PRA Category 1 Credits ™:** 3.25

**ARRT Category A+ Credits:** 3.50

**Tue, Dec 2 8:30 AM - 12:00 PM  Location:** S102AB

**Participants**

- **Moderator**
  - Rajesh Krishnamurthy MD: Research support, Koninklijke Philips NV
  - Travel support, Koninklijke Philips NV
- **William Eugene Shiels DO**: President, Mauka Medical Corporation
  - Royalties, Mauka Medical Corporation
  - Patent holder, Mauka Medical Corporation
- **John Miras Racadio MD**: Research Consultant, Koninklijke Philips NV
  - Travel support, Koninklijke Philips NV

**Sub-Events**

**VSPD31-01**  
Peripheral Vasc Imaging Technical Tips

Shreyas Shreenivas Vasanawala MD, PhD (Presenter): Research collaboration, General Electric Company
- Stockholder, Morpheus Imaging, Inc

**LEARNING OBJECTIVES**

1) Know an approach to the choice of contrast agent for peripheral vascular imaging. 2) Know indications for non-contrast and pre-contrast imaging. 3) Know the types of fat suppression and how to pick which method to use. 4) Know sequence parameter modifications that enable imaging within stents.

**ABSTRACT**

This presentation will focus on methods of optimizing the MR imaging of peripheral vessels, addressing four questions. The first question is which contrast agent to choose. Most MR imaging can be performed with standard extracellular gadolinium agents. However, there are some advantages and disadvantages of blood pool agents that will be discussed. Next, situations when pre-contrast or non-contrast imaging is necessary are covered. Mostly, these sequences are only necessary in situations where the technical quality of post-contrast imaging is in doubt. Third, approaches to fat suppression will be covered. The benefits and disadvantages of two-point Dixon methods compared with subtraction and spectrally selective suppression will be reviewed. Finally, MR imaging in the presence of vascular stents will be covered, including sequence modifications that enable visualization within the stents.

**VSPD31-02**  
Validation of Quantitative Phase Contrast MRI Assessment of Cerebral Haemo/Hydro Dynamics in Children

Eusra Hassan (Presenter): Nothing to Disclose; John Caine: Nothing to Disclose; Stavros Michael Stivaros
- PhD, FRCR: Medical Director, Obsidian Health Limited

**PURPOSE**

Quantitative phase contrast MRI (PCMRI) enables the flow of blood or CSF to be measured over a cardiac cycle. PCMRI in children presents unique challenges in implementation relating to ECG acquisition technique and MRI scanning parameters which this study investigates.
METHOD AND MATERIALS

PCMRI was performed to measure flow through the right and left internal carotid and basilar arteries (rICA, lICA, BA), superior sagittal sinus (SSS), straight sinus vein (StrS), CSF through the foramen magnum (FM) and aqueduct of sylvius (AQ). Velocity encoding (venc) was varied based on evidence of under or oversampling. PCMRI experiments were performed using central ECG gating and then repeated using peripheral pulse gating. The imaging was analysed by three experienced observers in the field of PCMRI analysis using the image analysis programme, Segment, to allow the respective flow rates to be calculated.

RESULTS

Data was collected from 16 children aged 1 to 15 years (mean 4 years 6 months). Nine children had central and peripheral pulse gating employed. The mean flow rates measured with peripheral gating was ICA = 0.094ml/s, right ICA = 0.092ml/s, BA = 0.056ml/s, SSS = 0.007ml/s, StrS = 0.001ml/s, FM = 0.01ml/s, AQ = 0.001ml/s. Mean flow rates with central ECG measurements were ICA = 0.091ml/s, rICA = 0.091ml/s, BA=0.057ml/s, SSS = 0.042ml/s, StrS = 0.006ml/s, FM = 0.003ml/s, AQ = 0.001ml/s. No significant statistical difference was detected based on the acquisition technique. Compared to published adult literature, the velocity encoding gradients (venc) in our childhood cohort were significantly different with arterial =120cm/s, venous=25cm/s and CSF=16cm/s.

CONCLUSION

Our data shows no significant difference with regard to peripheral versus central pulse measurement for PCMRI acquisition in children. Peripheral PCMRI acquisition is much easier to apply and better tolerated in the paediatric cohort. In addition this work provides child specific venc values for PCMRI assessment, which differs from published adult data.

CLINICAL RELEVANCE/APPLICATION

It is recognised that there exists a complex interaction between cerebral arterial, venous and CSF flow rates in hydrocephalus. Quantitative PCMRI allows for non-invasive assesment of these haemo/hydrodynamic flows which may one day supersede invasive intracranial monitoring. This work looks to develop and validate paediatric focused application of PCMRI for such applications.

VSPD31-03 Cardiac Phase-dependent Image Quality of the Coronaries in Pediatric Cardiac High Pitch Computed Tomography

Matthias Stefan May (Presenter): Speakers Bureau, Siemens AG, Wolfgang Wust MD : Nothing to Disclose, Michael Uder MD : Speakers Bureau, Siemens AG, Michael Marcus Leil MD : Siemens AG, Siemens AG Research Grant, Siemens AG Research Grant, Bayer AG Research Consultant, Bracco Group, Oliver Rompel : Nothing to Disclose

PURPOSE

The purpose of this study was to retrospectively evaluate the best cardiac phase for visualization of the coronaries in children younger than 1 year undergoing Cardiac High Pitch Computed Tomography (CT). The study applies to the declaration of Helsinki.

METHOD AND MATERIALS

Cardiac CT was performed on a second generation Dual-Source CT in 95 Patients (median age 31 days, range 1-336 days) with a high-pitch protocol (p=3,2) at 80 kVp, automatic exposure control and a total collimation of 2x64x0,6mm. The ECG-trace was used as trigger for automated heart-phase (HP) selection. Retrospective data analysis was carried out in dependence of the HP (<20%/n=9, <30%/n=17, <40%/n=10, <50%/n=26, <60%/n=14, <70%/n=13, <80%/n=6). Motion artifacts in the coronary arteries were recorded for the proximal and distal segments on a 5-point Likert scale by two radiologists.

RESULTS

Mean heart rate was 137 bpm (andplusmn; 27 bpm) and was not statistically different between the HP-groups (p=0.629). Image quality of the coronary arteries was best at andndash;50% and worst below 20% of the HP for both, the proximal and distal segments (andndash;50%;0.001). Visualization was still good and without statistically significant differences at andndash;40% for the proximal (p=0.13) and at andndash;40 and andndash;60% for the distal segments (p=0.27/0.06). Inter rater agreement was substantial (andkappa;=0.701).

CONCLUSION

Pediatric cardiac CT should be performed at 40-50% of the cardiac cycle in children below 1 year for best visualization of the coronaries.

CLINICAL RELEVANCE/APPLICATION

Technical settings undergoing pediatric cardiac CT should be optimized to obtain stable images at 40-50% of the
4D Flow MRI Improves Hemodynamic Evaluation in Patients with D-transposition of the Great Arteries Following the Arterial Switch Operation Compared to 2D Phase Contrast MRI and Doppler Echocardiography

Marleen Vonder: Nothing to Disclose, Kelly Jarvis (Presenter): Nothing to Disclose, Susanne Schnell: Nothing to Disclose, Michael Markl PhD: Nothing to Disclose, Joshua D. Robinson MD: Nothing to Disclose, Cynthia Karfias Rigsby MD: Nothing to Disclose, Bradley D. Allen MD: Nothing to Disclose, Alex Barker: Nothing to Disclose

PURPOSE
Pulmonary artery (PA) stenosis either at the anastomosis or in the branch PAs is the most common complication leading to intervention after the arterial switch operation (ASO) for D-transposition of the great arteries (DTGA). Accurately depicting PA stenosis is paramount for postoperative DTGA evaluation. 2D PC MRI (2D PC) or Doppler echo (echo) rely on velocity quantification in a single imaging plane and one-directional velocity encoding and may not detect the peak velocity across entire vessel segments. 4D flow provides 3-directional velocity encoding and full volumetric coverage of the great arteries and may improve hemodynamic evaluation. Our aim was to compare peak velocities measured by 2D PC and 4D flow with the gold standard echo in patients with DTGA s/p ASO.

METHOD AND MATERIALS
Eleven patients with DTGA s/p ASO who underwent 2D PC and 4D flow were included (mean age 13.2 y (range 1-30)). Peak velocities were measured in the ascending aorta (AAo), main (MPA), right (RPA), and left (LPA) pulmonary arteries. Echo data was available in 10/8/5/4 patients in the AAo/MPA/RPA/LPA. Peak velocities were measured with: 1) a single cross section for 2D PC, 2) velocity maximum intensity projections (MIPs) of the entire aorta and PAs for 4D flow and 3) spectral Doppler for echo.

RESULTS
Significantly higher peak velocities were found with 4D flow than 2D PC in the AAo (1.27±0.37m/s vs 1.11±0.24m/s, p=0.021), MPA (2.22±1.17m/s vs 1.34±0.54m/s, p=0.006), RPA (2.20±0.67m/s vs 1.63±0.65m/s, p=0.026) and LPA (2.14±0.73m/s vs 1.64±0.69m/s, p=0.003) indicating the potential of 4D flow to provide improved stenosis assessment. Correlation analysis showed moderate to strong relationships between 4D and 2D PC in the AAo (R²=0.624), MPA (R²=0.696), RPA (R²=0.301) and LPA (R²=0.757) but consistent velocity underestimation by 2D PC (slopes of linear regression =0.38 - 0.82). No difference in peak velocity was found between 4D flow and echo for all vessels.

CONCLUSION
4D flow assessment of peak velocities in DTGA s/p ASO was similar to echo and superior to 2D PC which consistently underestimated peak velocities.

CLINICAL RELEVANCE/APPLICATION
Improved assessment of peak pulmonary artery velocities using 4D flow velocity MIPs in DTGA s/p ASO may more accurately depict significant stenoses.

The Application of 70 kV Technique Combined with Sinogram Affirmed Iterative Reconstruction (SAFIRE) in Infants with Total Anomalous Pulmonary Venous Connections: An Experimental Study with Dual-Source CT

Yan Wang MMed, MS (Presenter): Nothing to Disclose, Dapeng Shi MD: Nothing to Disclose

PURPOSE
To explore the application of dual source CT with ultra-low tube voltage (70kV) combined with iterative reconstruction algorithm (SAFIRE) in infants with total anomalous pulmonary venous connections.

METHOD AND MATERIALS
This prospective study was approved by institutional review board, and written informed consents were obtained from all patients’ parents. Twenty three infants (13 male and 10 female, mean age 3 months, range 1-36 months, mean weight 5kg) suspected of total anomalous pulmonary venous connections (TAPVC) in our hospital, underwent cardiovascular examination with DSCT and trans-thoracic echocardiography (TTE) one week before surgery. All DSCT scans used the Flash mode with a tube voltage of 70 kV, and the tube current, amount of contrast medium and injection rate were adjusted according to patients’ weight. Images were reconstructed with iterative reconstruction algorithm SAFIRE. DSCT and TTE results were compared with the results from surgery. Image quality was evaluated, and effective radiation dose (ED) was calculated.

RESULTS
All 23 cases were confirmed as TAPVA in operations, DSCT diagnosed all 23 cases, TTE missed 1 case; however 22 cases were diagnosed correctly as TAPVA with DSCT except one mixed type case, 16 cases were diagnosed correctly with TTE, and 3 mixed type cases were misdiagnosed, 3 infracardiac were diagnosed when information from CT was considered. Seventy three anomalous pulmonary veins were identified by DSCT, which results in a detection rate of 91.6%(73/76); 65 were identified by TTE, with a detection rate of 85.5%(65/76); 39 combined malformations were detected by DSCT among all 41 malformations from surgery, with a detection rate of 95.1%(39/41), 40 combined malformations were detected by TTE, with a detection rate of 97.6%(40/41). For DSCT scans, image quality was good or excellent for 21 patients and diagnostic in 2 patients. The mean effective radiation dose ED was (0.95 ± 0.32) mSv.
CLINICAL RELEVANCE/APPLICATION
Flash mode on DSCT with a combination of 70kV tube voltage and iterative reconstruction algorithm SAFIRE has a good performance in infants with complicated TAPVC.

VSPD31-06  Cardiac Magnetic Resonance Imaging in Pediatric Patient’s ≤ 18 Years with Suspected Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC): A Correlation to Genetics
Wieland Staab MD (Presenter): Nothing to Disclose, Jan Martin Sohns MD: Nothing to Disclose, Martin Fasshauer MD: Nothing to Disclose, Christian Sohns: Nothing to Disclose, Joachim Lotz MD: Research Cooperation, Siemens AG, Christina Unterberg-Buchwald: Nothing to Disclose, Alexander Schwarz: Nothing to Disclose

PURPOSE
This study sought to determine the clinical influence of right and left ventricular findings in pediatric patients undergoing cardiac magnetic resonance imaging (CMRI) ≤ 18 years with suspected arrhythmogenic right ventricular cardiomyopathy (ARVC).

METHOD AND MATERIALS
In a consecutive series between September 2010 and December 2013 (38 months), 79 (14.0 ± 3.9 years, 46 male) young patients ≤ 18 underwent contrast-enhanced magnetic resonance imaging (CMRI) and genetic analysis after biopsy for evaluation clinically suspected ARVC.

RESULTS
Overall, 5 patients showed major criteria due to a combination of moderate to severe RV dysfunction and dilation as well as regional akinsia. Applying the revised TFC, 6 patients showed minor abnormalities such as mild RV dilatation, dys-synchronous RV contraction or regional akinsia. Overall 11 out of 12 (92%) patients with positive genetic characteristics were found to have major or minor abnormalities applying the revised Task Force Criteria. Here, positive predictive value (PPV) was 100%, negative predictive value (NPV) was 93%, sensitivity was 93% and specificity was 100%. Mean RVEDVI/BSA was 80 ± 16 and mean EF was 51 ± 8 in the whole study population. A subgroup analysis revealed a significantly (p = 0.01) decreased mean EF of 36 ± 9 and an increased RVEDVI/BSA of 101 ± 10 in 11 patients with major or minor abnormalities according to the revised TFC.

CONCLUSION
This is the first study applying the revised Task Force Criteria (TFC) regarding the detection of ARVC in young patient’s ≤ 18. In the current study, CMRI revealed 11 out of 12 patient’s (major and minor TFC) with positive findings in genetics with perfect positive predictive value and specificity.

CLINICAL RELEVANCE/APPLICATION
Applying the revised Task Force Criteria (TFC) regarding the detection of ARVC in young patient’s ≤ 18 may increase the diagnostic value of CMR in this context.

VSPD31-07  3D Printing of Complex Intracardiac Morphology
Shi-Joon Yoo MD (Presenter): Owner, 3D HOPE Medical

LEARNING OBJECTIVES
1) Understand 3D printing process for heart models. 2) Know the utility of 3D printing in pediatric cardiac imaging and surgery. 3) Know the limitations of 3D printing technology. 4) Predict the future avenues of 3D printing in pediatric cardiology

ABSTRACT
Rapid prototyping or 3D printing is an additive manufacturing technique where the object is digitally decomposed into thin layers and the printer adds the print material layer by layer until a physical model of the whole object is built. The prototype models can be made of solid material like plastic or ceramic, or rubber like material with some resemblance of myocardial texture. Any 3D volume image data can be used for 3D printing. The most ideal is high-resolution isotropic voxel data with ECG-gating and breath-holding or respiration navigation. Breath-held and ECG-gated CT angiograms are most commonly applicable data set; MR angiograms with ECG-gating and respiration navigation obtained after injection of a blood pool contrast agent provides uniform enhancement of the blood pool with the spatial resolution comparable to CT angiograms. Using 3D image data of contrast angiograms, 3D models of both blood pool and endocardial surface can be manufactured. The blood pool model can be reproduced from contrast-enhanced angiograms by using thresholding technique and manual adjustment. The endocardial surface anatomy can be reproduced by graphically adding a layer outside the blood pool. When it is printed, the added layer is a shell of the cavity, the inner surface of which represents the endocardial surface anatomy that will be encountered with at operation. The major clinical applications of 3D printing in pediatric cardiology are planning and simulation of surgical procedures for complex congenital heart diseases such as atypical forms of double outlet right ventricle and criss-cross heart. 3D print models allow instantaneous understanding of complex anatomy and eliminates the chances of misunderstanding and inappropriate choice between biventricular and univentricular repairs. In addition, 3D print models are valuable educational resources. This presentation will show a few clinical examples where 3D printing played the major role in surgical decision.

VSPD31-08  Percutaneous Drainage Procedures in Children
LEARNING OBJECTIVES

1) Review common indications for percutaneous drainage procedures in children. 2) Understand unique differences or special considerations needed in performing percutaneous drainage procedures in children versus adults.

Palliative Percutaneous Cryoablation in the Pediatric and Young Adult Population

Brian Faustino Baigorri MD (Presenter): Nothing to Disclose, Peter John Littrup MD: Founder, CryoMedix, LLC Research Grant, Galil Medical Ltd Research Grant, Endo Health Solutions Inc Officer, Delphinus Medical Technologies, Inc, Hussein D. Aoun MD: Nothing to Disclose, Barbara A. Adam MSN: Nothing to Disclose, Mark J. Krycia BS: Nothing to Disclose, Evan N. Fletcher MS, BA: Nothing to Disclose, Matthew Prus BS: Nothing to Disclose, Mohamed M. Jaber MD: Nothing to Disclose

PURPOSE

To assess the safety and efficacy of cryoablation for palliation and local tumor control in the pediatric/young adult oncology population.

METHOD AND MATERIALS

CT and/or US-guided percutaneous cryoablations were performed using established adult parameters of N+1 cryoprobes for N(cm) tumor diameter. Ablation locations were noted as head and neck, thoracic, liver, kidney, and soft tissue. Tumor type, complications, and length of stay were recorded. Tumors and ablation zones were measured in 3 planes. Complications were graded by the Common Terminology of Complications and Adverse Events (CTCAE v4.0). Patients received CT or MRI follow-up at 1, 3, 6, 12, 18, 24 months and yearly thereafter.

RESULTS

CT and/or US-guided cryoablation was performed on 111 tumors in 36 pediatric and young adults in 82 procedures. All patients received only conscious sedation. An average age of 23 (range 1.6-38) was observed in the pediatric population due to the proportion of young adult sarcoma patients. Benign tumors included 5 osteoid osteoma and 4 desmoids, and the malignant tumors included 32 alveolar soft part sarcomas, 24 renal cell carcinomas, 13 osteosarcomas, 6 synovial sarcomas, and 37 miscellaneous. Tumor ablation location was noted as: 52 thoracic, 11 liver, 12 kidney, and 36 soft tissue. Patient mortality was 0%, with all adverse events being mild/moderate except for two major complications (2.4%). One was due to a bronchopleural fistula following lung ablation of an osteosarcoma metastasis, and the other was due to anticipated facial edema requiring tracheotomy in a head and neck procedure. Local treatment failure or progression occurred in 2.7%(3/111) and satellite recurrence in 6.3%(7/111) of tumors.

CONCLUSION

CT guided percutaneous cryoablation is a safe treatment alternative in the pediatric and young adult population with associated low morbidity, and should be considered in the management of oligoneoplastic disease. Multifocal use of cryoablation is safe for pediatric patients with outcomes similar for adults, also emphasizing its low peri-procedural pain.

CLINICAL RELEVANCE/APPLICATION

Like adults, pediatric oncology patients also suffer from the morbidities of managing localized cancer recurrence or progression. Cryoablation provides for low pain, complication and recurrence rates.

CT-guided Placement of Hyperthermia Catheters to Support Regional Deep Hyperthermia for Pediatric Malignancies

Rotem Shlomo Lanzman MD (Presenter): Nothing to Disclose, Rudiger Wessalowski: Nothing to Disclose, Oliver Mills: Nothing to Disclose, Philipp Heusch MD: Nothing to Disclose, Gerald Antoch MD: Speaker, Siemens Medical AG Speaker, Bayer AG Speaker, BTG International Ltd, Patric Kroepil MD: Nothing to Disclose

PURPOSE

Percutaneous hyperthermia catheter allow for the placement of Bowman probes for temperature measurements inside the tumor during deep regional hyperthermia treatment. The aim of this study was to evaluate the safety and effectiveness of CT-guided placement of percutaneous hyperthermia catheter in pediatric malignancies.

METHOD AND MATERIALS

Forty pediatric patients (mean age 5.8 ± 5.6 years, range 0-18 years) scheduled for regional deep hyperthermia treatment of germ cell tumors (n=20), rhabdomyosarcoma (n=11), Ewing's sarcoma (n=3), desmoplastic tumor (n=3), hepatoblastoma (n=1), nephroblastoma (n=1) and lymphoma (n=1) were included in this retrospective analysis. A total of 46 hyperthermia catheters were placed under CT-guidance into tumors in the pelvis (n=29), liver/upper abdomen (n=6), neck (n=3), lower limb (n=5) and vertebral column (n=3). In all patients, the tumor was approached using a 13G puncture sheath under CT-guidance and a 6F percutaneous hyperthermia catheter (Somatex, Medical Technologies) was placed via the sheath inside the
tumor. The duration of the intervention, technical success, periinterventional complications and the distance of the probe within the tumor were analyzed.

RESULTS
44 of 46 (95.7%) percutaneous hyperthermia catheters were placed successfully in the tumor. Mean tumor diameter was 4.7 ± 3.5 cm and the mean catheter distance within the tumor was 3.7 ± 3.3 cm. One hyperthermia catheter was placed 8 mm below a rhabdomyosarcoma in the lower limb and one hyperthermia catheter dislocated from a superficial metastasis immediately after the procedure. Mean procedure time was 39.5 ± 16.3 min. No complications were observed.

CONCLUSION
CT-guided hyperthermia catheter placement is a safe and reliable method to support treatment control in deep regional hyperthermia for pediatric malignancies.

CLINICAL RELEVANCE/APPLICATION
Deep regional hyperthermia is a promising salvage treatment option for pediatric malignancies. CT-guidance placement of hyperthermia catheter is a safe and reliable procedure and can therefore be recommended to support temperature measurements inside the tumor during deep regional hyperthermia treatment.

First Phase-1 Study in the Treatment of Duchenne Muscular Dystrophy (DMD) by Multiple Intra-Arterial Transplantations of Mesoangioblasts (MABs) in 5 Dystrophic Children: Safety, Preliminary Efficacy, and Future Perspectives
Massimo Venturini MD (Presenter): Nothing to Disclose, Giulio Cossu: Nothing to Disclose, Letterio Salvatore Politi MD: Nothing to Disclose, Michele Colombo: Nothing to Disclose, Giulia Agostini: Nothing to Disclose, Alessandro Del Maschio MD: Nothing to Disclose

PURPOSE
DMD, a syndrome characterized by progressive absence of dystrophin protein, causes progressive muscle degeneration, paralysis and death. Corticosteroids are not effective, while novel therapies (gene/stem cells) are on work. Our aim was to assess MABs intra-arterial infusion in 5 dystrophic children, at escalating dose, to preliminarily assess the safety.

METHOD AND MATERIALS
After the approval of our institutional ethical committee and obtaining written informed consent from the children's parents, every 2 months 5 DMD children (5 males, mean age=10 years) at a different disease stage under immunosuppressive treatment (tacrolimus) were submitted to 4 HLA-identical allogeneic MABs intra-arterial infusions each (2 in lower limbs, 2 in lower and upper limbs) at escalating dose. Intra-arterial infusions were performed at the level of the common femoral arteries (lower limbs) and the axillary arteries (upper limbs) using a transfemoral approach (4-Fr catheter): arteriography was performed before and after MABs infusion. Efficacy was assessed every 2 months by quantitative strength measurements (Kin-Com-test), thighs/legs fibro-fatty degeneration/quantification (MRI), and after 8 months by gastrocnemius biopsies (dystrophin restoration).

RESULTS
The 20 intra-arterial MABs infusions were regularly performed with no peri-procedural complications, except for a case of iliac vasospasm successfully treated. The only relevant complication was 1 focal thalamic ischemia of 1-cm (MRI) that occurred 5 hours after the fourth infusion in one child, after sporadic atrial fibrillation (ECG) (Atrial-fibrillation-related-thrombosis? Late vasospasm?), without clinical consequences. Relative stabilization/decrease in disease progression was observed in all the children. At MRI, a stabilization of fibro-fatty degeneration was more evident in a child treated at an earlier disease stage, the only that demonstrated a significant dystrophin restoration at Gastrocnemius biopsy.

CONCLUSION
Our preliminary phase 1 study on MABs intra-arterial transplantation in DMD children was relative safe, partially effective with encouraging perspectives. A larger cohort of children and a longer follow up are needed.

CLINICAL RELEVANCE/APPLICATION
A higher MABs intra-arterial concentration, transplanted exclusively in the lower limbs, at an early disease stage, could determine an increase of dystrophin restoration and a consequent improvement of the clinical outcome.

Clinical Outcomes in Pediatric Patients Who Underwent Catheter-Directed Portal and Mesenteric Vein Thrombolysis
David L. Lamar MD, PhD (Presenter): Nothing to Disclose, Giri Shivaram MD: Nothing to Disclose

PURPOSE
Literature describing transcatheter portomesenteric thrombolysis in pediatric patients is lacking. The purpose of this study is to review our experience with catheter-directed thrombolysis in 8 children with a focus on etiology, presentation, and distribution of portomesenteric vein thrombosis and transcatheter thrombolysis technique, complications, and outcomes.
METHOD AND MATERIALS
Retrospective analysis of 9 cases of catheter-directed portomesenteric vein thrombolysis in 8 patients (6 female, 2 male) performed at a pediatric academic referral-center. Mean age was 15.0 years old (range= 8 to 17 years old) at the time of initial interventions performed between 2005 and 2014. A presumed etiology was determined in 5 of 8 patients and included portal hypertension from various causes (3 patients), splenic torsion, and thromboctysis following splenectomy for idiopathic thrombocytopenic purpura. No patients had hepatic transplants. For all patients, transhepatic portal access was achieved either via direct percutaneous or transjugular-transhepatic routes. Outcomes examined included resolution of symptoms, degree of lysis, complications, and sustained clot resolution at follow-up.

RESULTS
Successful transcatheter thrombolysis was achieved in 7 of 8 patients; one patient (unknown etiology of thrombus) experienced recurrent thrombus and eventual cavernous transformation. Two patients experienced major bleeding complications requiring transfusion (hemothorax and hemoperitoneum) which were successfully treated percutaneously. Three patients required TIPS shunt placement for portal hypertension at the time of PV thrombolysis or subsequent to initial therapy. No patients died or received hepatic transplants during the follow-up interval (mean= 2.3 years, median= 1.8 years, range= 0.1 to 8.5 years).

CONCLUSION
In our experience, percutaneous transhepatic catheter-directed thrombolysis in children is a safe and effective approach to address portomesenteric thrombosis from a variety of causes.

CLINICAL RELEVANCE/APPLICATION
Use of catheter-directed portomesenteric thrombolysis in children is underreported and our experience suggests this minimally invasive therapy is a safe and effective approach.
PURPOSE
The purpose of this study was a comparison between the radiation exposure levels recorded during CVC placement in pediatric patients weighing less than 10 kg, in procedures performed using an image intensifier-based angiographic system (IIDS) and those performed in a flat panel detector-based interventional suite (FPDS).

METHOD AND MATERIALS
A retrospective review of 96 image-guided CVC placements, between January 2008 and October 2013, in 49 pediatric patients weighing less than 10 kg was performed. Mean age was 8.2±4.4 months (range 1 - 22 months). Mean weight was 7.1±2.7 kg (range 2.5 - 9.8 kg). The procedures were classified into 2 categories: non-tunneled and tunneled CVC placement.

RESULTS
Thirty-five procedures were performed with the IIDS (21 non-tunneled CVC, 14 tunneled CVC); 61 procedures were performed with the FPDS (47 non-tunneled CVC, 14 tunneled CVC). For non-tunneled CVC mean DAP was 113.5±126.7 cGy·cm² with the IIDS and 15.9±44.6 cGy·cm² with the FPDS (p< 0.001). For tunneled CVC mean DAP was 84.6±81.2 cGy·cm² with the IIDS and 37.1±33.5 cGy·cm² with the FPDS (p=0.02). The statistically significant differences of DAP between the two angiographic systems adjusted for the effect of the fluoroscopy time was confirmed by using a multiple generalized linear regression model. In all procedures image quality was considered adequate by a different interventional radiologist other than the operator with no trade-off between satisfactory image quality and procedural outcome. Technical success was obtained in all procedures without major complications.

CONCLUSION
The use of flat panel angiographic equipment reduces radiation exposure in small children undergoing image-guided CVC placement.

CLINICAL RELEVANCE/APPLICATION
Our data suggests that the use of flat panel angiographic equipment reduces radiation exposure in small children undergoing image-guided CVC placement and should be considered first line for pediatric interventional radiology procedures. The systematic recording of DAP and fluoroscopy time at the end of every procedure is also an essential step in determining local and/or general radiation exposure reference levels in this particular group of patients.

VSPD31-15  Percutaneous Treatment of Aneurysmal Bone Cysts
William Eugene Shiels DO (Presenter):  President, Mauka Medical Corporation Royalties, Mauka Medical Corporation Patent holder, Mauka Medical Corporation

LEARNING OBJECTIVES
1) Identify 2 sites of aneurysmal bone cyst solid tumor localization for large gauge percutaneous core or scrape biopsy yielding diagnostic histologic tissue. 2) Define 3 mechanisms of action for doxycycline foam as a tumor ablation agent targeting aneurysmal bone cyst as a neoplasm. 3) Describe the role of tricalcium phosphate bone graft substitute in the successful treatment of aneurysmal bone cyst.

VSPA31  Vascular Imaging Series: MR Angiography—Principles and Technique Optimization

Series Courses
AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 4.00
Tue, Dec 2 8:30 AM - 12:00 PM  Location: E351

Participants
Moderator
Dominik Fleischmann MD : Research support, Siemens AG

Sub-Events
VSPA31-01  Contrast-enhanced and Time-resolved MRA
J. Paul Finn MD (Presenter):  Research Grant, Siemens AG Research Grant, Bracco Group

LEARNING OBJECTIVES
1) Understand the general principles of contrast-enhanced and time-resolved MR Angiography. 2) Be familiar with sample clinical applications for time-resolved MR Angiography in several vascular beds. 3) Be aware of the major caveats in contrast enhanced MR Angiography at 1.5T and 3.0T and how to avoid them.
**VSV31-02**

Contrast-enhanced MRA of the Peripheral Arteries at 3T: Comparison of SNR and CNR Gain between Gadoterate Meglumine and Gadobutrol-MRA in a Large European Multicenter Trial

Javier Arnaiz Garcia MD: Nothing to Disclose, Christian Loewe MD: Speaker, Bracco Group Speaker, Guerbet SA Speaker, General Electric Company Speaker, Covidien AG Speaker, Bayer AG Speaker, Siemens AG, Denis Krause MD: Nothing to Disclose, Luis Marti-Bonmati MD, PhD: Nothing to Disclose, Stefan Haneder MD: Nothing to Disclose, Ulrich Kramer MD: Nothing to Disclose, Armando Tartaro MD (Presenter): Nothing to Disclose

**PURPOSE**

This subanalysis of a multicenter trial aimed to compare the SNR and CNR between the gadolinium MR contrast agents gadoterate meglumine and gadobutrol, for contrast-enhanced MRA in peripheral arterial occlusive disease (PAOD).

**METHOD AND MATERIALS**

This multicentre trial including 189 patients was primarily aimed to compare the degrees of agreement in stenosis detection between contrast enhanced-MRA and DSA using two different contrast agents (Dotarem® or Gadovist®). In this subanalysis, quantitative arterial signal intensity and signal/contrast to noise ratios (SNR/CNR) were calculated before and after intravenous gadoterate meglumine (0.1mmol/Kg) and gadobutrol (0.1mmol/Kg). Furthermore, parameters related to stenosis detection and grading, specificity, sensitivity, positive/negative predictive values calculation (accuracy parameters), factors important for treatment planning and patient outcome were investigated. These factors included diagnostic confidence, stenosis length, and vessel diameter. Image data from 156 patients eligible for evaluation (per protocol population) were assessed by two independent readers in a centralized reading.

**RESULTS**

No significant differences for gadoterate meglumine and gadobutrol were found comparing both groups in arterial SI (1167+/−930 vs 1243+/−964, p =0.19), SNR (165+/−200 vs 161+/−201, p=0.72) and CNR (159+/−198 vs 155+/−199, p=0.73). Both contrast agents were well tolerated.

**CONCLUSION**

Contrast media with higher Gd concentration have been proposed to be advantageous as far as efficacy is concerned. However, the present study demonstrated the feasibility of PAOD evaluation at 3T and the lack of superiority of gadobutrol over gadoterate meglumine in terms of diagnostic accuracy.

**CLINICAL RELEVANCE/APPLICATION**

The present study demonstrated the lack of superiority of gadobutrol over gadoterate meglumine in terms of arterial SI, SNR and CNR despite the different Gd-concentrations and T1 relaxivities exhibited by the two contrast agents at 3T in peripheral MRA.

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**VSV31-03**

Patency of Runoff Detected by MR Angiography at 3.0 T with Cuff-compression: A Predictor of Successful Endovascular Recanalization Below the Knee

Jungong Zhao MD (Presenter): Nothing to Disclose

**PURPOSE**

To assess the reliability of distal runoff vessels detected using contrast-enhanced MR angiography (CE-MRA) but were occult on digital subtraction angiography (DSA) for predicting the outcome of endovascular recanalization (ER).

**METHOD AND MATERIALS**

This retrospective analysis included 63 diabetes patients (98 limbs) who underwent ER for below-the-knee infrapopliteal lesions. Before ER, the patients underwent CE-MRA with cuff compression and DSA for arterial disease, their runoff vessels were detected with CE-MRA but not with DSA. The preoperative findings for runoff vessels both on MRA and DSA scans were graded according to the revised version of the ad hoc scoring system. Antegrade intraluminal angioplasty was attempted to recanalize the occlusive lesion; in cases where intraluminal angioplasty failed, subintimal angioplasty as well as retrograde revascularization via the pedal arch loop were performed subsequently. Immediate and follow-up postoperative outcomes were assessed. Univariate analysis was performed to identify the variables associated with successful ER.

**RESULTS**

Successful ER was achieved in 85.7% (84/98) limbs, and the runoff score (5.1 ± 1.1) was significantly smaller than that in the failed limbs (6.2 ± 1.3). Clinical improvement was noted in 85% of the successfully treated limbs. The restenosis and reoclusion rate of the target lesions was 61.1% and 12.6% respectively at 3 months, and 75.9% and 15.6 % respectively at 12 months after ER. The runoff score was associated with a significantly higher likelihood of ER success (odds ratio= 4.096, 95% confidence interval: 2.056, 8.158; P<0.001).

**CONCLUSION**

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Runoff vessels detected using CE-MRA could indicate immediate success and better outcome of ER for infrapopliteal occlusions.

**CLINICAL RELEVANCE/APPLICATION**

CE-MRA was superior to DSA in the detection of patent runoff vessels, and potential runoff vessels detected on CE-MRA could be a predictor for immediate success and better outcomes of ER in occluded infrapopliteal vessels. Therefore, the dynamic CE-MRA protocol with high temporal and spatial resolution could be a meaningful adjunct in patients with extensive infrapopliteal lesions.

**VSVA31-04**

"Novel MR for Peripheral Calcium Score"; Evaluation of Two New MRI Techniques for Visualization of Peripheral Arterial Calcification; Gradient Echo with Flow Compensation and In-phase Echo Time as Well as 3D PETRA with Ultra-short TE

Oisin Jude Flanagan MBBCh, MRCPI (Presenter): Nothing to Disclose, Shivraman Giri PhD: Employee, Siemens AG; Ioannis Koktzoglou PhD: Research support, Siemens AG; David Grodzki: Employee, Siemens AG; Navyash Gupta: Nothing to Disclose

**PURPOSE**

To develop a method of visualizing peripheral arterial calcification without using ionizing radiation so that patients with PAC and renal failure may receive adequate evaluation of their peripheral vessels to guide management.

**METHOD AND MATERIALS**

Following institutional IRB approval, 8 patients (6 male, age 57-78 years, with known peripheral arterial disease on CT angiogram were recruited for a research MRA on a 1.5T system (Avanto, Siemens Technology, Erlangen, Germany). Each underwent (1) gradient echo pulse sequence using flow compensation with in-phase echo time (TE) and (2) 3D pointwise encoding time reduction with radial acquisition (PETRA) with ultra-short TE. Voxel size was 0.52 to 1mm3 Images were assessed for image quality (1-5) and the presence of calcium. Individual calcium plaques were quantitatively assessed for calcium: lumen, calcium: fat and calcium: muscle CNR and SNR.

**RESULTS**

Both the gradient echo and PETRA sequences each showed all the calcific foci present on CT. The two MRI sequences showed image quality of 4.8 (SD 0.2) and 4.0 (SD 0.0) respectively (p=0.038) and calcium: lumen contrast to noise ratio (CNR) of 46.9 (SD 20.0) and 29.5 (SD 11.6), respectively. (p=0.045).

**CONCLUSION**

Both Gradient echo pulse sequence using flow compensation with in-phase TE and PETRA are sensitive for the detection of peripheral vascular calcification. The significant calcium: lumen contrast to noise ratio, combined with high spatial resolution can allow radiologists and clinicians to determine the lumen and calcific plaque morphology.

**CLINICAL RELEVANCE/APPLICATION**

This has significant clinical relevance as many renal patients also have peripheral vascular disease but cannot have contrast enhanced CTA due to contrast induced nephropathy risk. Non-enhanced CT will provide adequate evaluation of the calcium but without luminal evaluation the significance of plaques is limited. Non-enhanced Peripheral MRI, either on its own or combined with nonenhanced peripheral MRA will allow nonenhanced evaluation of both lumen and calcification and provide a growing cohort of vascular patients with satisfactory vascular assessment to guide optimal intervention.

**VSVA31-05**

Magnetic Particle Imaging (MPI): Visualization and Quantification of Vascular Stenosis Phantoms


**PURPOSE**

Purpose of this study was to visualize and quantify different vascular stenosis phantoms using Magnetic Particle Imaging (MPI).

**METHOD AND MATERIALS**

Nine standardized stenosis-phantoms featuring a circular lumen of 10 mm diameter were used. Their lumen narrowed conically to 1 mm diameter (99% stenosis), 2 mm (96 %), 3 mm (91 %), 4 mm (84 %), 5 mm (75 %), 6 mm (64 %), 7 mm (51 %), 8 mm (36 %) or 9mm (19 %), respectively. For MPI, the phantoms were filled with a 1% and 5% dilution of Resovist (Bayer Pharma AG), corresponding to 0.28 and 1.4 mg(Fe)/ml Resovist, respectively. Images were acquired using a pre-clinical MPI-demonstrator (Phillips Research, Hamburg, Germany, field of view 36 x 36 x 20 mm, temporal resolution 46 Volumes per second). Imaging was conducted
in steady state without flow and during manual movement of the phantoms through the field of view of the MPI-demonstrator. The MPI-signal was used for image reconstruction and also for intensity measurements to quantify the grade of stenosis. For comparison, the same stenosis-phantoms were evaluated with contrast-enhanced CT. Acquisition time for the 3D CT, MRI, and MPI scans was 1.2 s, 60 s, and 21 ms, respectively.

RESULTS

With a resulting spatial resolution of about 3 x 3 x 1 mm$^3$, MPI was able to visualize all residual lumina of the stenoses accurately except for the highest grade stenosis. It was possible to quantify the extent of the stenoses down to 6 mm (64%) independently of the Resovist concentration and the rate of movement of the stenosis-phantoms through the field of view. Higher grade stenoses were underestimated, the stenosis of 84% was measured as 74%, 91% as 79%, 96% as 82% and 99% as 88%. CT exhibited the highest spatial resolution, followed by MRI.

CONCLUSION

Direct quantification of vascular stenoses using MPI is possible in phantoms. Due to the high temporal resolution of the system, visualization and quantification is independent of the movement of the probe, which may be beneficial for future clinical applications where respiratory and cardiac motion occur. With current experimental MPI-systems and available tracer materials, the spatial resolution at high imaging speeds is limited, so that high grade stenoses are underestimated systematically due to a partial volume effect.

CLINICAL RELEVANCE/APPLICATION

Quantification of vascular stenosis using the SPIOs signal intensity may prove beneficial in in vivo cardiovascular imaging using MPI.

VSSA31-06  MR Contrast Agents for Vascular Imaging

Tim Leiner MD, PhD (Presenter): Speakers Bureau, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, Bracco Group

LEARNING OBJECTIVES

1) To understand the different classes of contrast agents available for vascular imaging as well as their strengths and weaknesses. 2) To understand both acute and delayed safety concerns associated with administration of MR contrast agents for vascular imaging. 3) To understand proper contrast agent dosing for vascular MR imaging. 4) To understand basic principles underlying successful contrast injection.

VSSA31-07  Non-contrast MRA: TOF and SSFP Based Techniques

James Christopher Carr MD (Presenter): Research Grant, Astellas Group Research support, Siemens AG Speaker, Siemens AG Advisory Board, Guerbet SA

LEARNING OBJECTIVES

1) Understand the technical issues underlying non contrast MRA based on TOF and SSFP. 2) Become familiar indications and guidelines for using non contrast MRA. 3) Illustrate applicability of non contrast MRA in a variety of relevant clinical scenarios.

VSSA31-08  18F-FDG PET/MR Carotid Plaque Imaging: Early Experience

Jeffrey M. Lau MD, PhD (Presenter): Nothing to Disclose, Richard Laforest PhD: Nothing to Disclose, Jie Zheng PhD: Nothing to Disclose, Xingyu Nie BS: Nothing to Disclose, Agus Priatna PhD: Research Consultant, Siemens AG Employee, Siemens AG, Pamela K. Woodard MD: Research support, Siemens AG Research support, Astellas Group Consultant, B&TRONIK GmbH & Co KG, David Duane Faul PhD: Employee, Siemens AG, Robert J. Gropler MD: Advisory Board, Bracco Group Advisory Board, GlaxoSmithKline plc Advisory Board, Pfizer Inc Advisory Board, Bayer AG Research grant, GlaxoSmithKline plc Research grant, Pfizer Inc Research grant, Clinical Data, Inc Research grant, Lantheus Medical Imaging, Inc

PURPOSE

Carotid atherosclerosis is a prevalent disease with significant morbidity and mortality. The current reference standard, carotid ultrasonography, assesses anatomy only, and does not identify whether the lesions are metabolically active. In this pilot study, we investigate the feasibility of carotid atherosclerosis evaluation using simultaneous acquisition Positron Emission Tomography/Magnetic Resonance (PET/MR).

METHOD AND MATERIALS

15 patients undergoing clinical 18F-FDG PET/CT for oncologic purposes were recruited. Carotid PET/MR was performed within 120 mins after 444-703 MBq 18F-FDG injection. Multi-contrast MRI was performed during a 15 minute continuous list-mode acquisition using T1, T2, PD, and gradient-echo (GR) weighted images. The sequences performed were turbo spin-echo (TSE) sequences with an interpolated resolution of 0.25 x 0.25 x 0.8mm. In addition, a SPACE (Sampling Perfection with Application optimized Contrast using different flip angle Evolutions) sequence was used to obtain 3D isotropic (0.8 mm) black blood carotid wall images. PET
attenuation correction μ-map was a dual echo VIBE Dixon sequence. PET images were reconstructed with 3D-OSEM (Ordered Subset Estimation Maximization) with 3 iterations, 21 subsets and post-Gaussian filter of 4 mm. Each patient’s bilateral common carotid arteries and vertebral arteries were divided into 12 segments for scoring for the presence of plaque, lipid pool, hemorrhage, calcification, and 18F-FDG activity. The method of delineating between fibrous plaque, lipid pool, hemorrhage, thrombus, calcification and other vascular pathologies is based on published differential signal patterns on MR T1, T2, and PD sequences.

RESULTS

29/180 (16%) examined segments showed positive PET activity, 48/180 (26%) showed fibrous plaque, and 16/180 (9%) segments showed lipid pool. Positive PET/MR correlation was seen more frequently with lipid pool (10/16, 63%) versus fibrous (22/48, 46%), suggesting that lipid pool lesions are more likely to be metabolically active than fibrous plagues (z=1.16, P=0.12).

CONCLUSION

We demonstrate that a clinical carotid 18F-FDG PET/MR exam is feasible, quick, and has the potential to provide both anatomic and metabolic information about carotid atherosclerotic plaque.

CLINICAL RELEVANCE/APPLICATION

The complementary PET/MR information may prove significant in patient risk-stratification and assignment of medical or procedural intervention.

VSA31-09 Monitoring of Aortic Diameters in Patients with Marfan Syndrome: Intraindividual Comparison of 3D CE-MRA and 2D SSFP Imaging

Simon Veldhoen MD (Presenter): Nothing to Disclose, Cyrus Behzadi : Nothing to Disclose, Thorsten Derlin : Nothing to Disclose, Meike Rybczinsky : Nothing to Disclose, Yskert von Kodolitsch : Nothing to Disclose, Sara Sheikhzadeh : Nothing to Disclose, Frank Oliver Gerhard Henes MD : Nothing to Disclose, Thorsten Alexander Bley MD : Nothing to Disclose, Gerhard B. Adam MD : Nothing to Disclose, Peter Bannas MD : Nothing to Disclose

PURPOSE

Annual imaging of the aortic root is recommended for Marfan patients. Unenhanced MRI allows for avoidance of nephrogenic systemic fibrosis, allergic reactions and contrast paravasation. In this context, we compared non-ECG-gated contrast-enhanced 3D MRA (CE-MRA) and ECG-gated non-contrast 2D steady-state-free precession (SSFP) imaging for monitoring of the aortic diameters in patients with Marfan syndrome (MFS).

METHOD AND MATERIALS

3D CE-MRA and non-contrast 2D SSFP at 1.5T were prospectively performed in 50 patients with confirmed MFS (24 males; age 34.7±13.8). Two readers independently measured aortic diameters at the sinuses of Valsalva, sinutubular junction, ascending aorta, aortic arch and descending aorta. Image quality was assessed on a three-point scale at each level. Aortic root diameters acquired by echocardiography were used as reference standard.

RESULTS

Intra- and interobserver variances of measurements were significantly smaller for 2D SSFP at the sinuses of Valsalva (SSFP, 95% limit of agreement ±0.31cm vs. CE-MRA, ±0.69cm; p=0.002 and SSFP, 95% limit of agreement, ±0.37cm vs. CE-MRA, ±0.59cm; p=0.002 and SSFP, 95% limit of agreement, ±0.37cm vs. CE-MRA, ±0.59cm; p=0.002) and sinutubular junction (p=0.014 and p=0.043). Image quality was rated significantly better for 2D SSFP than for 3D CE-MRA at sinuses of Valsalva (p<0.0001), sinutubular junction (p<0.0001) and ascending aorta (p=0.02). 3D CE-MRA yielded significantly higher diameters than 2D SSFP measurements at the sinuses of Valsalva (mean bias 0.25cm, p<0.0001), and comparison with echocardiography confirmed a higher bias (0.72±0.34cm) for 3D CE-MRA when compared to 2D SSFP (0.47±0.26cm).

CONCLUSION

ECG-gated non-contrast 2D SSFP imaging provides superior image quality with higher reproducibility and validity due to decreased motion artifacts compared to non-ECG-gated contrast-enhanced 3D imaging. Since 3D CE-MRA overestimates the diameter of the aortic root and requires administration of contrast agents with potential adverse effects, 2D SSFP imaging should be preferred for exact and riskless monitoring of aortic diameters in MFS patients.

CLINICAL RELEVANCE/APPLICATION

ECG-gated non-contrast 2D SSFP imaging should be preferred for monitoring of aortic diameters in Marfan patients.

VSA31-10 Non-Enhanced MR Angiography in Critical Limb Ischemia: Comparison of Quiescent-Interval Single-Shot (QISS) and TSE-based Subtraction Techniques to Digital Subtraction Angiography

Mustafa Altaha MBBS (Presenter): Nothing to Disclose, Jeffrey David Jaskolka MD : Nothing to Disclose, Kongteng Tan FRCR : Nothing to Disclose, Manuela Rick : Employee, Siemens AG, Peter Schmitt PhD : Employee, Siemens AG, Ravi Menezes PhD : Nothing to Disclose, Bernd J. Wintersperger MD : Speakers
Bureau, Bayer AG Speakers Bureau, Siemens AG

PURPOSE
To evaluate the diagnostic accuracy of non-enhanced prototype Quiescent-Interval Single-Shot (QISS) and conventional TSE-based subtraction Magnetic Resonance Angiography (MRA) in the assessment of the peripheral arteries in patients with critical limb ischemia.

METHOD AND MATERIALS
In this prospective cohort study, patients (n=20; 70% male, 69.7±10.8 years) referred for treatment of chronic limb ischemia (Rutherford stages 4-6) underwent non-enhanced QISS and TSE-based subtraction MRA at 1.5T (50%) and image quality on a segmental (n=14) and also regional level (femoropopliteal/tibial/pedal). For statistical analysis results were compared to DSA, both on a segmental and regional level.

RESULTS
22 limbs in 20 patients with 295 segments were available for DSA comparison. QISS image quality was rated as good-excellent in 80% (n=245/308) of segments with no non-diagnostic segments. Sensitivity at the segmental level was 93% (95CI:86-96%) with a specificity of 95% (95CI:91-98%). Positive and negative predictive values were 93% (95CI:88-96%) and 95% (95CI:90-97%), respectively. On a regional level sensitivity was 90% (95CI:78-96%) with a specificity of 60% (95CI:20-90%). After exclusion of pedal segments regional specificity improved to 75% (95%CI:24-97%) with no change in segmental/regional sensitivity. Interreader comparison demonstrated fair agreement between readers (Κ=0.393) for QISS. Motion artifacts affected image quality of the TSE-based technique which was rated non-diagnostic in 63% (n=101/156) and poor in 25% (n=39/156) of segments; no further analysis was performed.

CONCLUSION
QISS MRA demonstrates excellent diagnostic performance in patients with critical limb ischemia, particularly at the femoropopliteal and tibial level. In this patient population, QISS MRA was more robust than TSE-based subtraction MRA, which was affected by patient motion.

CLINICAL RELEVANCE/APPLICATION
The low susceptibility of QISS MRA to patient motion provides stable diagnostic information in challenging patients with critical limb ischemia and contra-indication to Gd-based contrast agents.

VSSA31-11

3D-Black-Blood 3T-MRI for the Diagnosis of Thoracic Large Vessel Vasculitis: A Feasibility Study
Tobias Saam MD (Presenter): Research Grant, Diamed Medizintechnik GmbH Research Grant, Bayer AG, Stefan Maurus: Nothing to Disclose, Nora Navina Kammer MD: Nothing to Disclose, Karla Maria Treitl MD: Nothing to Disclose, Hendrik Kooijman: Employee, Koninklijke Philips NV, Eva Maria Coppenrath MD: Nothing to Disclose, Maximilian F. Reiser MD: Nothing to Disclose

PURPOSE
Although 2D-T1w black-blood sequences are able to detect atherosclerotic and inflammatory changes of thoracic vessels they are time extensive and thus offer limited coverage. We sought to evaluate a commercially not available isotropic 3D black-blood T1w-TSE sequence with variable flip angles (3D-T1-BB-VISTA) for the diagnosis of thoracic large vessel vasculitis.

METHOD AND MATERIALS
14 patients with suspected large vessel vasculitis and 14 control patients without any evidence of vascular disease received a standardized protocol with a fat suppressed 3D-T1-BB-VISTA pre- and post contrast (resolution=0.8 mm isotropic, scan time 5-6 minutes) using a navigator and peripheral pulse unit triggering. Ascending and descending aorta, aortic arch, left and right subclavian arteries and pulmonary arteries (168 arterial segments) were evaluated by two experienced readers in consensus decision for the presence of concentric wall thickening and contrast enhancement of the vessel wall.

RESULTS
Acceptable image quality was achieved in 27 out of 28 exams (96.4%). 35 out of 84 (41.7%) arterial segments in patients with suspected vasculitis showed contrast enhancement and 27 out of 84 (32.1%) concentric wall thickening. Both findings were found in 8 distinct patients with clinically confirmed vasculitis. Only one out of 78 (1.3%) arterial segments of the control group showed concentric wall thickening and contrast enhancement. In 2 out of 14 patients with suspected vasculitis effusion and synovialitis were found in the shoulder joints, suggestive of polymyalgia rheumatica. Figure 1 shows images of a 76-year old male (#1) with giant cell arteritis and inflammatory activity in both subclavian arteries and synovialitis in the right shoulder and of a 28 year-old female (#2) with Takayasu arteritis and inflammatory activity in both pulmonary arteries.

CONCLUSION
Free breathing navigated black-blood MRI is feasible in less than 12 minutes scan time and allows to accurately diagnosing thoracic vasculitis. Future studies will be necessary to evaluate the utility of this sequence for monitoring of anti-inflammatory therapies.

CLINICAL RELEVANCE/APPLICATION
Currently PET/CT is used as gold standard to diagnosing vasculitis of the aorta and the pulmonary arteries. Black-blood MRI has the potential to replace PET/CT as a diagnostic tool. This might be particularly useful in
young patients in which ionizing radiation should be used with caution.

**Hemodynamic Changes in the Thoracic Aorta Due to Surgery on Ascending Thoracic Aortic Aneurysms using 4D Flow MRI**

Maximilian Russe MD (Presenter): Nothing to Disclose, Fabian A. Kari: Nothing to Disclose, Nadja Maria Kocher: Nothing to Disclose, Benjamin Fritz MD: Nothing to Disclose, Gregor Pache MD: Nothing to Disclose, Mathias F. J. Langer MD, PhD: Nothing to Disclose

**PURPOSE**

Evaluation of 4D flow MRI to detect alterations in flow parameters in a postoperative setting after ascending aortic aneurysm and/or aortic root repair.

**METHOD AND MATERIALS**

4D flow MRI was performed at 3T MR systems for a prospective study of 12 patients (age 56±13 years) before surgery and of 5 patients within 10 days after surgery. Flow quantification was performed using ECG gated three-directional velocity encoding with full 3D coverage of the thoracic aorta. 4D flow MRI was acquired in a sagittal oblique 3D volume using flip angle of 8°, VENC: 150 cm/s, spatial resolution = (2.0-2.4)³mm³, and temporal resolution: 20-40 ms. Data analysis included 3D blood flow visualization (EnSight, CEI, USA) based on 3D particle traces and 3D streamlines. Time-resolved 2D data was extracted on a plane based queries in the ascending thoracic aorta (TAA) in the aneurysm and the postoperative aortic graft for each dataset. The diameter, net flow, velocity, time to peak (TTP) and percentage of retrograde flow were derived.

**RESULTS**

Following changes were shown between the preoperative ascending aorta and the postoperative graft. Slight increase in net flow (TAA: 65.2 (±31.9) ml; graft: 76.5 (±14.7) ml; +17%; p-value=0.5). Increase in mean velocity (TAA: 4.43 (±1.73) cm/s; graft: 19.4 (±2.25) cm/s; +339%; p-value<0.05). Decrease in percentage of retrograde flow (TAA: 19.1 (±13.3)%; graft: 3.6 (±2.2)%; -81% p-value<0.05). Slight decrease in TTP (TAA: 155 (±65) ms; graft: 111 (±14) ms; -28%; p-value=0.18). The mean internal diameter was measured in the TAA with 48.1 (±4.7) mm and in the graft with 29.7 (±2.8) mm (-38%, p<0.05).

**CONCLUSION**

These preliminary results revealed quantifiable hemodynamic changes after surgery for ascending thoracic aortic aneurysms. Significant changes of velocity and retrograde were observed. Only small changes on net flow and TTP could be demonstrated. Further studies are warranted to investigate the influence of the aortic repair on the whole thoracic aorta and evaluate these parameters as a method for early prediction of long time outcome after aortic repair.

**CLINICAL RELEVANCE/APPLICATION**

These findings in flow parameters after surgery for ascending thoracic aortic aneurysms are additional quantifiable parameters for the evaluation of the postoperative result.

**Assessment of Blood Flow Patterns in Infrarenal Abdominal Aortic Aneurysms— An Approach using 4D Flow MRI**

Maximilian Russe MD (Presenter): Nothing to Disclose, Philipp Blanke MD: Nothing to Disclose, Benjamin Fritz MD: Nothing to Disclose, Gregor Pache MD: Nothing to Disclose, Wulf Euringer: Nothing to Disclose, Mathias F. J. Langer MD, PhD: Nothing to Disclose

**PURPOSE**

Evaluation of alterations in flow pattern in the infrarenal abdominal aortic aneurysm using 4D flow MRI.

**METHOD AND MATERIALS**

4D flow MRI was performed at 3T MR systems for a prospective study of eight male patients (age 70±9 years) with infrarenal aortic aneurysms. Flow quantification was performed using ECG gated three-directional velocity encoding with full 3D coverage of the abdominal aorta. 4D flow MRI was acquired in a coronal oblique 3D volume using flip angle of 15°, VENC: 80 cm/s, spatial resolution = (1.0-2.7)³mm³, and temporal resolution: 39-42 ms. Data analysis included 3D blood flow visualization (EnSight, CEI, USA) based on 3D particle traces and 3D streamlines. Time-resolved 2D data was extracted on plane based queries in the suprarenal abdominal aorta and in the AAA for each dataset; flow and wall parameters were derived: diameter, velocity, percentage of retrograde flow, wall shear stress (WSS) and oscillatory shear index (OSI).

**RESULTS**

Following changes were revealed between the abdominal aorta and the AAA. Decrease in mean velocity (aorta: 8.89 (±4.31) cm/s; AAA: 1.30 (±1.50) cm/s; -85%; p-value<0.01). Increase in percentage of retrograde flow (aorta: 8.1 (±13.2)%; AAA: 24.1 (±13.7)%; +197% p-value<0.01). Decrease in mean WSS (aorta: 116.2 (±46.5) mN/m²; AAA: 23.6 (±15.7) mN/m²; -80% p-value<0.01) and increase in OSI (aorta: 7.2(+ 4.0); AAA: 14.2(±8.4); +96%; p-value=0.13). The mean diameter was measured in the aorta with 21.4 (±1.4) mm and in the AAA with 39.3 (± 8.9) mm (+84%, p<0.01).

**CONCLUSION**

4D flow MRI demonstrates significant quantifiable hemodynamic changes in the infrarenal aortic aneurysm
compared to the non-dilated suprarenal aorta. There is a decrease in mean velocity and an increase in percentage of retrograde flow, WSS and OSI. Follow-up studies are warranted to investigate the influence of these findings on progress of the aneurysm and patient outcome.

**CLINICAL RELEVANCE/APPLICATION**

These findings in wall and flow parameters are additional quantifiable parameters in the abdominal aneurysms and may help for risk stratification and further therapy planning.

**VSV31-14**

**Non-contrast MRA: Phase-contrast MRA**

Scott Brian Reeder MD, PhD (Presenter): Institutional research support, General Electric Company Institutional research support, Bracco Group

**LEARNING OBJECTIVES**

1) Understand the underlying principles of phase velocity MRA. 2) Be familiar with the currently available methods for phase velocity MRA. 3) Be familiar with important applications and examples of phase velocity MRA. 4) Understand current limitations and pitfalls associated with phase velocity MRA.

**ABSTRACT**

1. Understand the underlying principles of phase velocity MRA 2. Be familiar with the currently available methods for phase velocity MRA 3. Be familiar with important applications and examples of phase velocity MRA 4. Understand current limitations and pitfalls associated with phase velocity MRA

**SPCP31**

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**Participants**

- Moderator
  - Bruce B. Forster MD: Investor, Doyen Medical Incorporated
- Moderator
  - Jonathon Avrom Leipsic MD: Speakers Bureau, General Electric Company Speakers Bureau, Edwards Lifesciences Corporation Consultant, Heartflow, Inc Consultant, Circle Cardiovascular Imaging Inc

**LEARNING OBJECTIVES**

1) Discuss recent practice changing cardiovascular imaging trials from across Canada with a focus on clinical outcomes and therapeutic impact. 2) Define novel opportunities for Trans-Canadian collaboration in cardiovascular outcomes research enabled by imaging networks and shared data registries. 3) Review the potential benefits and limitations that the Canadian Healthcare delivery model may have on outcomes focused imaging research.

This session is part of Canada Presents at RSNA 2014.

**Sub-Events**

**SPCP31A**

**Opening Remarks**

RSNA President N. Reed Dunnick MD Nothing to Disclose

**LEARNING OBJECTIVES**

This session is part of Canada Presents at RSNA 2014.

**SPCP31B**

**The Impact of Integration of a Multidetector Computed Tomography Annulus Area Sizing Algorithm on Outcomes of Transcatheter Aortic Valve Replacement: A Prospective, Multicenter, Controlled Trial**

Jonathon Avrom Leipsic MD (Presenter): Speakers Bureau, General Electric Company Speakers Bureau, Edwards Lifesciences Corporation Consultant, Heartflow, Inc Consultant, Circle Cardiovascular Imaging Inc

**LEARNING OBJECTIVES**

1) Discuss historical sizing algorithms for the balloon expandable prostheses. 2) Review the methods for measuring the annulus with MDCT. 3) Define an MDCT area/perimeter based sizing algorithm for balloon expandable TAVR and review the data supporting its integration.

This session is part of Canada Presents at RSNA 2014.
**SPCP31C**

**Refining the Phenotype of Genetic Hypertrophic Cardiomyopathy with Cardiac MRI**

Andrew Michael Dominic Crean MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To understand the histopathologic basis of late gadolinium enhancement in HCM and how best to measure it.
2) To appreciate the added value of late gadolinium enhancement in prognostication in HCM. 3) To learn about several under-appreciated phenotypic signs of HCM that may be present even in so-called "gene-positive phenotype-negative" HCM. This session is part of Canada Presents at RSNA 2014.

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**SPCP31D**

**A New Paradigm for Cardiac CT Imaging: Quantitative Assessment of Perfusion and Late Enhancement**

Ting-Yim Lee MSc, PhD (Presenter): Research Grant, General Electric Company Royalties, General Electric Company

**LEARNING OBJECTIVES**

1) Using quantitative CT perfusion and late enhancement imaging to identify different tissue states in acute myocardial infarction. 2) Technical requirements for generation of these quantitative functional maps with clinical CT scanners. 3) Pitfalls in quantitative CT perfusion and late enhancement imaging. 4) Further applications of quantitative cardiac CT imaging.

This session is part of Canada Presents at RSNA 2014.

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**SPCP31E**

**Modeling of Abdominal Aortic Aneurysm before, during and after Endovascular Repair: Potential Impact on Patient Management**

Gilles P. Soulez MD (Presenter): Speaker, Bracco Group Speaker, Siemens AG Research Grant, Siemens AG Research Grant, Bracco Group Research Grant, Cook Group Incorporated Research Grant, Object Research Systems Inc

**LEARNING OBJECTIVES**

1) Know the risk factors of abdominal aortic aneurysm (AAA) rupture and the role of maximal diameter (D-max) measurement in therapeutic algorithm. 2) Discuss the variability of D-max measurement and the importance of standardized measurement to improve reproducibility. 3) Understand the challenge of AAA segmentation on CT scanner examination before and after endovascular repair (EVAR) and on unenhanced studies. 4) Understand the utility of AAA modeling for automated D-max and AAA volume measurements. 5) Understand the future developments in AAA modeling to predict AAA rupture, improve endovascular repair (EVAR) planning, EVAR rehearsal, and patient follow-up after EVAR.

This session is part of Canada Presents at RSNA 2014.

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**SPCP31F**

**Fast and Furious: Imaging to Recanalization in Acute Stroke**

Mayank Goyal MD, FRCPC (Presenter): Shareholder, Calgary Scientific, Inc Research Grant, Covidien AG Consultant, Covidien AG Shareholder, NoNO Inc Investigator, Covidien AG

**LEARNING OBJECTIVES**

It is clear that in acute ischemic stroke: Time is brain. Also, based on the results of recent trials including IMS3, we as a collective have been unable to show the benefit of endovascular treatment over standard of care. As such many new trials are being designed and/or conducted. In view of the data from recent trials, there need to be strategies that allow for appropriate patient selection for endovascular treatment using imaging that is widely available and not time consuming. Once selected, organization of workflow to rapidly achieve recanalization is going to be the key to success. This talk expands on both these ideas: rapid imaging and patient selection,
rapid workflow and intervention for endovascular recanalization.
This session is part of Canada Presents at RSNA 2014.

ABSTRACT

The topic will be divided into three sub topics:
1. Imaging: balancing information vs time. I would discuss various imaging strategies and their pros and cons.
   Also, I would aim to introduce the basic concepts of Bayesian analysis for decision making
2. Workflow: moving the patient fast through the system including blood work, consent, getting team together
   and reaching the angio suite
3. Fast recanalization: tips and tricks to achieve rapid and good quality recanalization while keeping the
   procedural complication rate low.

SPCP31G

Prevalence of Extracranial Venous Narrowing on Catheter Venography in People with Multiple Sclerosis, Their Siblings, and Unrelated Healthy Controls: A Blinded, Case-control Study

Darren Klass MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the incidence of MS and its impact on healthcare in Canada. 2) Discuss the design of the
   assessor-blinded, case controlled study and the difficult task of ensuring the strict blinding protocol was adhered
   to. 3) Discuss the findings, the strength of the blinding in the study and the impact of the study results on
   future interventional radiology studies related to the subject. 4) Discuss the importance of working in a
   well-functioning interventional radiology team.

This session is part of Canada Presents at RSNA 2014.

ABSTRACT

Background Chronic cerebrospinal venous insufficiency has been proposed as a unique combination of
extracranial venous blockages and haemodynamic flow abnormalities that occur only in patients with multiple
sclerosis and not in healthy people. Initial reports indicated that all patients with multiple sclerosis had chronic
cerebrospinal venous insufficiency. We aimed to establish the prevalence of venous narrowing in people with
multiple sclerosis, unaffected full siblings, and unrelated healthy volunteers. Methods: An assessor-blinded,
case-control, multicentre study of people with multiple sclerosis, unaffected siblings, and unrelated healthy
volunteers was conducted. Study participants were enrolled between January, 2011 and March, 2012, and they
comprised 177 adults: 79 with multiple sclerosis, 55 siblings, and 43 unrelated controls, from three centres in
Canada. Catheter venography data were available for 149 participants and ultrasound data for 171 participants.

Findings: This study revealed a low incidence of chronic cerebrospinal venous insufficiency in all groups; 2% of
people with multiple sclerosis, 2% of siblings and 3% of unrelated controls (p=1·0 for all comparisons). Greater
than 50% narrowing of any major vein was present in 74% of people with multiple sclerosis, 66% of siblings
(p=0·41 for comparison with patients with multiple sclerosis), and 70% of unrelated controls (p=0·82). The
ultrasound criteria were fulfilled in 44% of participants with multiple sclerosis, 31% of siblings (p=0·15 for
comparison with patients with multiple sclerosis) and 45% of unrelated controls (p=0·98). Conclusions: Chronic
cerebrospinal venous insufficiency occurs rarely in both patients with multiple sclerosis and in healthy people.
Extracranial venous narrowing of greater than 50% is a frequent finding. The significance of venous narrowing
to multiple sclerosis symptomatology remains unknown.

SPCP31H

Panel Discussion

Jonathon Avrom Leipsic MD (Presenter): Speakers Bureau, General Electric Company Speakers Bureau,
Edwards Lifesciences Corporation Consultant, Heartflow, Inc Consultant, Circle Cardiovascular Imaging Inc.,
Andrew Michael Dominic Crean MD (Presenter): Nothing to Disclose, Ting-Yim Lee MSC, PhD (Presenter):
Research Grant, General Electric Company Royalties, General Electric Company, Gilles P. Soulez MD
(Presenter): Speaker, Bracco Group Speaker, Siemens AG Research Grant, Siemens AG Research Grant, Bracco
Group Research Grant, Cook Group Incorporated Research Grant, Object Research Systems Inc, Mayank
Goyal MD, FRCP (Presenter): Shareholder, Calgary Scientific, Inc Research Grant, Covidien AG Consultant,
Covidien AG Shareholder, NoNO Inc Investigator, Covidien AG, Darren Klass MD, PhD (Presenter): Nothing
to Disclose

LEARNING OBJECTIVES

This session is part of Canada Presents at RSNA 2014.

SPCP31I

Closing Remarks

James P. Borgstede MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

This session is part of Canada Presents at RSNA 2014.
**Protection Against Radiation-induced Brain Tumors in Interventional Professionals (Station #1)**

**VIS235**

**Presenter:** Luke Anthony Byers DO  
**Consultants:** William Werner Orrison MD, Peter Cartwright BS

**PURPOSE**

Individuals involved in interventional procedures are chronically exposed to ionizing radiation, the only unequivocal risk factor for developing intracranial neoplasms. A recent report identified 31 interventionalists who developed brain cancer with the concern that physicians performing interventional procedures have disproportionate left-sided brain tumors. This study was designed to evaluate the effectiveness of using a novel personal cranial radiation protection surgical cap as a means of reducing the risk of radiation induced cerebral neoplasms.

**METHOD AND MATERIALS**

Following IRB waiver disposable surgical caps containing various levels of protective lead-free radiation shielding (No Brainer - RAPAD, Kansas City, KS) were used to protect the cranium in one interventionalist and one assistant during multiple fluoroscopic procedures. Radiation monitoring during the fluoroscopic procedures was accomplished using real-time radiation detectors (UNFORS, Billdal, Sweden). Simultaneous monitor recordings were performed with radiation detectors positioned identically above and below the protective material at the level of the anterior left cranium (above the left eye). Four levels of radiation protection were tested (lead equivalency at 90 kVp): 1) Red - 0.375 mm, 2) Orange - 0.25 mm, 3) Yellow - 0.125 mm and 4) Blue - 0.07 mm.

**RESULTS**

A total of 34 patient procedures were completed. Average distance from the calvarium to the Image intensifier was approximately 1 meter. The interventionalist and the assistant reported that the surgical caps were minimally different from those typically worn for interventional procedures and there was no reported discomfort even after multiple hours (day long) wearing. Dose reductions for the procedures are as follows: Overall (92%), Red (100%), Orange (100%), Yellow (96%) and Blue (78%).

**CONCLUSION**

The "No Brainer" is aptly named, as this simple inexpensive approach to cranium protection is easy to use, comfortable and highly effective at decreasing brain radiation exposure. This device should stem the increasing number of interventionalists reported with cerebral malignancies.

**CLINICAL RELEVANCE/APPLICATION**

Comfortable disposable surgical caps containing a lead-free radiation protection barrier can serve as a means of reducing the risk of radiation induced cerebral neoplasms.

**Incidence of Significant Non-vascular Findings (Neoplastic and Non-neoplastic) in Patients Who Have Undergone Endovascular Aortic Aneurysm Repair (EVAR) (Station #2)**

**VIS236**

**Presenters:** Mark Quentin Smith MD, W. Brian Hyslop MD, PhD, Louise Michelle Henderson, Hyeon Yu MD, Julia R. Fielding MD

**PURPOSE**

To determine the incidence of clinically significant non-vascular findings on contrast-enhanced CT angiography in patients who have undergone EVAR.

**METHOD AND MATERIALS**

We retrospectively reviewed the radiology reports of the initial abdominopelvic contrast-enhanced 64-slice MDCT scans in 1000 patients who presented with an abdominal aortic aneurysm between January 1, 2008 and December 31, 2011. We followed the imaging results for a minimum of two years to determine the significance of each finding. Incidental findings that were benign or unlikely to undergo follow-up were placed into the low significance group. Benign findings that had the potential to warrant medical or surgical intervention were classified as having moderate importance. Findings that required specialized imaging, biopsy or therapeutic intervention as well as indeterminate findings were placed within the high significance category. We examined the proportion of incidental findings in each of these categories by age and location and calculated the 95% confidence intervals to assess differences among subgroups.
RESULTS

There were a total of 2374 incidental findings in 847 patients: 1877 were of low significance, 357 were of moderate significance, and 140 were grouped in the high significance category. There were no differences in the proportion within each category of incidental findings by age group (<65 versus 65+). Of the high significance findings, 32 incidental malignancies (3.2%, 95% CI: 2.3-4.5%) were found, with renal cell carcinoma being the most common (n=11), followed by metastatic disease (n=5). 22 of the 32 patients had NO M0 disease at initial staging.

CONCLUSION

Our rate of incidental cancers found on abdominopelvic imaging of 3.2% is low, but is greater than the 0.56-1.25% reported in virtual colonoscopy studies. This may be secondary to the older mean age of this population. In addition, contrast-enhanced scans allow for definitive diagnosis of malignant lesions.

CLINICAL RELEVANCE/APPLICATION

The presence of incidental cancers on endovascular CT angiography highlights the need for careful radiologic review of all vascular imaging studies.

VIS237

Realizing Radiation and Iodine Dose Reduction in Coronary CT Angiography by Using Adaptive Statistical Iterative Reconstruction (Station #3)


PURPOSE

To investigate the feasibility of low kVp and low iodine scan protocol in coronary computed tomography angiography (CCTA) to reduce radiation dose without undermining image quality.

METHOD AND MATERIALS

200 consecutive patients with body mass index (BMI) 20-25 kg/m2 undergoing prospectively electrocardiogram-triggered CCTA were randomized into four groups at 4 sites. Group A: using 80kVp and iodixanol 270 mgI/mL with 60% adaptive statistical iterative reconstruction (ASiR); group B: using 100kVp and iodixanol 270 mgI/mL with 30-40% ASiR; group C: using 100kVp and iodixanol 320 mgI/mL with 30-40% ASiR; group D: using 120kVp and iopromide 370 mgI/mL with filtered back projection. 60 ml contrast was given at 5 ml/s intravenously. CT values of 18 coronary artery segments were measured. Image quality was assessed by 2 experienced radiologists blinded to examination, using a 4-point scale (1-4: nondiagnostic-excellent). An assigned score of 1 in any segments was graded the image as nondiagnostic. Noise, contrast-to-noise (CNR), signal-to-noise ratio (SNR) and size-specific dose estimate (SSDE) were also calculated.

RESULTS

163 subjects completed study. CT values of all segments in all groups met clinical diagnostic requirement. There was no significant difference in image quality among the four groups (3.4 ± 0.7, 3.5 ± 0.5, 3.6 ± 0.4, 3.6 ± 0.3 respectively). The average CT value in group A (n=37) was higher than that in group B (n=45), C (n=40) and D (n=41) (all p < 0.05). Noise in group A (40.6 ± 8.5 HU) was significantly higher than that in group B (28.8 ± 6.7 HU), C (28.5 ± 4.6 HU) and D (29.1 ± 4.8 HU) (all p < 0.001), while CNR and SNR in group A was lower than that in group C and D (both p < 0.001). Compared with group D, the mean SSDE was reduced by 56.2%, 34.7%, and 34.3% in group A, B, C respectively.

CONCLUSION

All low kVp scans achieved a good image quality with significantly reduced radiation dose. 80 kVp with iodixanol 270 mgI/mL in prospectively electrocardiogram-triggered CCTA for patients with a normal BMI is practicable.

CLINICAL RELEVANCE/APPLICATION

With a prospective comparison, the study result has solidified the use of low tube voltage and low iodine enhancement in CCTA. It is time to promote 80 kVp CCTA protocol in clinical to benefit patients from 50% reduction of radiation dose.

VIS234

Prophylactic Temporary IVC Filter Retrieval following Major Spinal Reconstruction Surgery: Comparison between Scoliosis and Non-scoliosis Patients (Station #5)

Hilary A. Brazeal MD (Presenter): Nothing to Disclose, Jay Desai MD: Nothing to Disclose, Carlos Javier Guevara MD: Nothing to Disclose, Seung Kwon Kim MD: Nothing to Disclose

PURPOSE

Prophylactic IVC (inferior vena cava) filter placement was initiated for all ‘high-risk’ spinal surgery patients after a pilot study demonstrated decreased VTE-related morbidity and mortality. Given increased angulation of the IVC filter in patients with scoliosis, there is higher chance of IVC filter tilting, leading to increased difficulty of
IVC filter retrieval. The purpose of this study is to compare filter retrieval between scoliosis and non-scoliosis patients who had temporary IVC filter placement before major spinal reconstructive surgery.

**METHOD AND MATERIALS**

Patients were identified by a computerized search of the radiology information system for prophylactic temporary IVC filter placement before major spinal reconstructive surgery and filter retrieval after surgery from 2005 to Jan 2014. These patients were divided into two groups: a scoliosis surgery (SS) group and a non-scoliosis surgery (NSS) group. Type of filter, attempted filter retrieval, indwelling time of filter, sedation time of the filter retrieval procedure, and success of attempted filter retrieval were compared between the two groups.

**RESULTS**

From 2005 to Jan 2014, 134 IVC filters were placed prior to spine surgery. 116 (84.9%) of those were retrievable filters. Retrieval was attempted on 53 (45.7%) of the retrievable filters. Retrieval was successful in 45/53 (84.9%) of those attempts, including a single case that was successful on the second attempt. Indwelling time of IVC filter at time of attempted retrieval was significantly higher in the SS group (SS group = 59.4 days, NSS group = 31 days) (p=0.006). Success rate of attempted filter retrieval in the SS group (78.1% (25/32)) was lower than the NSS group (95.2% (20/21)) (p=0.13). Average retrieval sedation time of a successful retrieval in the SS group (44.8 minutes) was higher than the NSS group (28.2 minutes) (p= 0.15).

Type of filters in failed retrievals were Günther Tulip (4/25) and Option (4/17).

**CONCLUSION**

IVC filter retrieval requires increased procedure time and has decreased success rates in the SS group compared with the NSS group.

**CLINICAL RELEVANCE/APPLICATION**

Longer IVC filter indwelling time in scoliosis surgery patients leads to increased difficulty and decreased success of IVC filter retrieval.

**Purposes and Methods**

**Vis238**

**Transarterial Chemoembolization (TACE) as a Palliative Treatments Option for Liver Metastases from Lung Cancer: Indications, Outcomes and Role in Patient’s Management (Station #6)**

*Tatjana Gruber-Rouh (Presenter): Nothing to Disclose, Nagy Naguib Naem Naguib MD, MSc: Nothing to Disclose, Nour-Eldin Abdelrehim Nour-Eldin MD, MSc: Nothing to Disclose, Martin Beeres MD: Nothing to Disclose, Julian Lukas Wichmann MD: Nothing to Disclose, Stefan Zangos MD: Nothing to Disclose, Thomas Josef Vogl MD, PhD: Nothing to Disclose*

**PURPOSE**

To evaluate local tumor control and survival data after TACE with three different chemotherapeutic protocols in the palliative treatment of patients with liver metastases from lung cancer

**METHOD AND MATERIALS**

The study protocol was approved by the ethical committee, and informed consent was obtained from all patients prior to treatment. A total of 44 patients (mean age, 55.2 years; range, 42-78 years) with unresectable liver metastases of lung cancer who did not respond to systemic therapy were repeatedly treated with TACE in 4-week intervals. In total, 176 chemoembolization procedures were performed (mean, 4 sessions per patient; range, 3-6 sessions). The local chemotherapy protocol consisted of mitomycin alone (22.7%; n=10), mitomycin with gemcitabine (22.7%; n=10) or mitomycin, gemcitabine and cisplatin (54.6%, n=24). Embolization was performed with lipiodol and degradable starch microspheres. Local tumor response was evaluated by MRI according to the RECIST criteria. Survival data were calculated according to the Kaplan-Meier method.

**RESULTS**

The local tumor control was: partial response (PR) in 15.9% (n=7), stable disease (SD) in 56.8% (n=25) and progressive disease (PD) in 27.3% (n=12) of patients. The 1-year survival rate after chemoembolization was 70%, and the 2-year survival rate was 38%. The median and mean survival times from the start of TACE treatment were 20 and 31.8 months. There was no statistically significant difference between the three treatment protocols.

**CONCLUSION**

Chemoembolization is a potentially palliative treatment option in achieving local control in selected patients with liver metastases from lung cancer.

**CLINICAL RELEVANCE/APPLICATION**

Chemoembolization is a potentially palliative treatment option in achieving local control in selected patients with liver metastases from lung cancer.

**Vie125**

Popliteal Artery Entrapment Syndrome (PAES): Types and Dynamic Imaging Protocol (Station #7)
TEACHING POINTS

1. To describe normal anatomy of the popliteal fossa.
3. To assess weaknesses and strengths of different imaging modalities.
4. Discuss emerging role of dynamic contrast enhanced CTA for diagnosing PAES.

TABLE OF CONTENTS/OUTLINE

Normal anatomy of the popliteal fossa
Anatomic versus functional popliteal entrapment
Radiographic evaluation of PAES with Ultrasound, MRI/MRA and Angiography
Dynamic CTA for suspected PAES: - Advantages - how we do dynamic scanning on CT
Clinical cases
Summary

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Selective Internal Radiation Therapy (SIRT) – A Review on the Principle, Work-up and Overview of Published Data in Selective Internal Radiation Therapy with Yttrium-90 Microspheres (Station #8)

Henry Ho Ching Tam MBBS (Presenter): Nothing to Disclose, Ying Chen MBBS: Nothing to Disclose, Dow-Mu Koh MD, FRCR: Nothing to Disclose, Adil Al-Nahhas: Nothing to Disclose

TEACHING POINTS

The incidence of both primary and secondary liver malignancies is increasing. Although surgery or minimally invasive intervention e.g. radiofrequency ablation results in the best outcomes, these approaches are limited by the burden and site of disease. Selective internal radiation therapy (SIRT) is a promising technique in patients deemed unsuitable for surgery. Despite its increasing popularity, radiologists may not be familiar with this treatment. Review the principle of SIRT with yttrium-90 (90Y) microspheres Review the literature with regards to treatment outcomes. Although morphological imaging is usually used to assess disease burden and treatment response, the potential for functional imaging techniques is discussed.

TABLE OF CONTENTS/OUTLINE

Physics and biological basis of SIRT with yttrium-90
Comparison of the properties of SIR-spheres with Theraspheres
Patient selection/contraindications
Patient preparation: visceral angiography (Fig. 1); hepatopulmonary shunt (Fig. 2 and 3); dosimetry
Adverse reactions and complications
Special consideration in patients with portal vein thrombosis and malignant biliary obstruction
Morphologic and functional imaging techniques for response assessment and prediction (Fig. 4 and 5)
Review of published data supporting use of 90Y-SIRT: response rate and long-term outcome

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Ultrasound Guided Percutaneous Thrombin Injection for Treating Femoral Artery Pseudoaneurysms: When and How to Do it; When Not to Do it (hardcopy backboard)

Eleni Antypa: Nothing to Disclose, Demosthenes D. Cokkinos MD (Presenter): Nothing to Disclose, Konstantinos Iosifidis MD: Nothing to Disclose, Kallipoi Melaki: Nothing to Disclose, Despina Kriketou MSc, MD: Nothing to Disclose, Ploutarhos A Piperopoulos MD, PhD: Nothing to Disclose

TEACHING POINTS

To present a guide to ultrasound (US) guided percutaneous injection of thrombin for the treatment of femoral artery pseudoaneurysms. To review the indications, technique, possible complications and limitations. To assess relevant guidelines in order to seek alternative treatment when this technique fails.

TABLE OF CONTENTS/OUTLINE

Description of predisposing factors for femoral artery pseudoaneurysm formation, clinical features and Doppler US diagnosis. Meticulous description of the technique, including step by step US guided femoral artery catheterisation, thrombin preparation and administration, variation of the procedure according to the size, form and number of the pseudoanurysm's lobes. Specific points that should be kept in mind in order to maximise success rates and avoid complications. Outline of post procedure follow up, need for possible repetition of treatment and guideline flowchart in order to abandon the technique for surgical repair when needed are also explained. US images from our Institution's experience.
VIS242

Troubling TAVR Studies: Incidental Findings in Patients Undergoing CT Angiography for Transcatheter Aortic Valve Replacement (Station #2)

Phil Wu (Presenter): Nothing to Disclose, Farhood Saremi MD: Nothing to Disclose, Christopher Lee MD: Nothing to Disclose

PURPOSE

To determine the prevalence of significant incidental findings (SIFs) on CT angiography (CTA) in patients undergoing evaluation for transcatheter aortic valve replacement (TAVR). To evaluate the implications of SIFs on clinical practice.

METHOD AND MATERIALS

181 patients underwent CTA of the chest, abdomen, and pelvis for TAVR evaluation between January 2011 and January 2014. CTA’s were retrospectively reviewed for concerning imaging findings (CIFs). Electronic medical records were reviewed to determine which CIFs represented SIFs, with SIF defined as: (a) no clinical or imaging history of CIF prior to CTA and (b) no follow-up disproving the imaging finding. SIFs were assigned to the following categories: possible malignancy, cardiovascular, non-malignant thoracic, non-malignant gastrointestinal, and non-malignant genitourinary.

RESULTS

112 of 181 patients (61.9%) were men; the mean age was 82.7±8.8 years. 90.6% (164/181) of patients had at least one CIF. 4.5% of CIF’s had clinical follow-up, surveillance imaging, or other diagnostic studies. Of the CIF’s that were followed-up, 42.2% resulted in new diagnoses or therapeutic interventions. 11% of CIF’s were known prior to CTA or were disproven on follow-up. 84.5% of CIF’s were not followed-up at our institution for the following reasons: immediate follow-up was not deemed clinically necessary as severe aortic valve disease was the primary determinant of patient prognosis, patients were often referred to our institution solely for TAVR, and 16 patients died within 3 months of CTA. Possible malignancy SIF’s were present in 54.7% (99/181), cardiovascular SIF’s in 52.5% (95/181), non-malignant thoracic SIF’s in 17.7% (32/181), non-malignant GI SIF’s in 22.7% (41/181), and non-malignant GU SIF’s in 6.6% (12/181) of patients. Attached table summarizes findings.

CONCLUSION

Although CTA evaluation of TAVR candidates is primarily utilized to characterize the anatomy of the aortic root and aortoiliofemoral arteries for candidate selection and procedural planning, CTA frequently reveals SIF’s that may alter the pre- or post-procedural management of TAVR candidates. Even if management is not altered per se, SIF’s can result in new diagnoses with implications on overall prognosis.
As SIF’s can alter patient management and prognosis, radiologists should carefully examine preoperative CTA’s for CIF’s.

**VIS243**

**Kinetic Assessment of the Intimal Flap in Acute or Chronic Aortic Dissection Using Cine CPR and MPR Images Acquired by ECG-gated CT (Station #3)**

Noritaka Kamei (Presenter): Nothing to Disclose, Norio Hongo: Nothing to Disclose, Shinji Miyamoto: Nothing to Disclose, Rieko Shuto MD: Nothing to Disclose, Junuro Matsumoto MD: Nothing to Disclose, Satomi Ide: Nothing to Disclose, Mika Okahara: Nothing to Disclose, Shinya Ueda: Nothing to Disclose, Hiro Kiyosue MD: Nothing to Disclose, Hiromu Mori MD: Nothing to Disclose

**PURPOSE**

Our purpose is to assess the 4D data acquired from retrospective electrocardiographically (ECG) gated computed tomography (CT) using cine multiplanar reformation (cine MPR), and to characterize and define the kinetics of the intimal flap in acute or chronic aortic dissections.

**METHOD AND MATERIALS**

Twenty-eight consecutive cases with Debakey III aortic dissection without prominent intramural thrombus who underwent ECG-gated CT from January 2010 to September 2013 were included in this study. Each CT scan was retrospectively reconstructed into sequential 10 axial datasets. Cine cross-sectional MPR images of the whole descending aorta were created. The maximum (Dmax) and minimum (Dmin) diameter of the true lumen at all time points was measured at each anatomic level. Maximum diameter change was calculated using the following formula: (Dmax-Dmin)/Dmax.

**RESULTS**

The Dmax in the proximal descending aorta reached its peak in early systole. There was a gradual and delayed wave-like movement of the peak toward the distal abdominal aorta. Dmax in the lower abdominal aorta was seen in diastolic phase. In an acute dissection group, the maximum diameter change, with collapse of the true lumen, was most frequently seen at the level of third lumbar vertebral body in systole. That was more prominent in the cases having no re-entry lower than the level of third lumbar spine, which included two cases with limb ischemia. There was less motion of the intimal in the chronic group than in the acute group.

**CONCLUSION**

Assessments of cine MPR images of the whole descending aorta acquired by ECG-gated CT revealed the complicated dynamic movement of the intimal flap in acute and chronic aortic dissections.

**CLINICAL RELEVANCE/APPLICATION**

This research addresses the unknown dynamic behavior of the septum in acute and chronic aortic dissections. The assessment of the motion of the intimal flap and the location of the re-entry described using CT may inform our clinical management of patients with Debakey III dissection.

**VIS239**

**Proximal vs. Distal Occlusion of the Internal Iliac Artery Prior EVAR: Evaluation of Efficacy and Clinical Outcome (Station #4)**

Alexander Dierks MD (Presenter): Nothing to Disclose, Alexander Sauer MD: Nothing to Disclose, Franziska Wolfschmidt MD: Nothing to Disclose, Nicole Hassold MD: Nothing to Disclose, Thorsten Alexander Bley MD: Nothing to Disclose, Ralph Kickuth MD: Nothing to Disclose

**PURPOSE**

Prior to endovascular aortoiliac aneurysm repair (EVAR) occlusion of the internal iliac artery (IIA) may be necessary to prevent an endoleak type II. We compared efficacy and clinical outcome after proximal occlusion of an unaffected IIA (ProxEmbx) using the Amplatz vascular plug I (AVP) vs. distal occlusion of aneurysmatic IIA with coils and plugs (DistEmbx).

**METHOD AND MATERIALS**

Between 04/2009 and 12/2012, 22 patients (mean age 74±8 years) underwent EVAR. In 9 patients with an unaffected IIA occlusion was performed by a single AVP. In 13 patients with aneurysmotic IIA more distal embolization was conducted by using several coils and additional AVPs. The follow-up (mean 15±12.4 months) was based on clinical and radiological examinations (CTA and CEUS). Retrospectively, technical success, clinical outcome and complications were evaluated.

**RESULTS**

Embolization of the IIA was successful in all patients. Three patients with more distal embolization of aneurysmotic IIAs suffered from new onset sexual dysfunction after occlusion without statistically significant difference (p>0.05). Transient buttock claudication was observed in three patients in each group. Bowel ischemia did not occur. The procedure time in the ProxEmbx group was significantly lower (43±20 vs. 73±29 minutes; p=0.013). Fluoroscopy time for the ProxEmbx was also lower (14.6±4 vs. 29.2±7 minutes; p=0.038). There was no significant difference concerning radiation exposure (p>0.05), which was related to different BMI in both groups. There was no difference in the amount of contrast media (p>0.05).

**CONCLUSION**
CLINICAL RELEVANCE/APPLICATION

Proximal occlusion of an unaffected IIA as well as more distal occlusion of an aneurysmatic IIA prior to EVAR have both the same technical and clinical outcome. However, proximal plug embolization has a significant lower procedure and fluoroscopy time.

Optional IVC Filter Quality Improvement Project: Using the Electronic Medical Record (EMR) “Problems” List to Increase Retrieval Rates and Decrease Time to Filter Retrieval (Station #5)

Melissa Chittle MS (Presenter): Nothing to Disclose, Stephan Wicky van Doyer MD: Nothing to Disclose, George Rachid De Oliveira MD: Nothing to Disclose, Suvarnu Ganguli MD: Research Grant, Merit Medical Systems, Inc Consultant, Boston Scientific Corporation, Raymond W. Liu MD: Nothing to Disclose, Rahmi Oklu MD, PhD: Nothing to Disclose, Zubin Irani MD: Nothing to Disclose, Thomas Gregory Walker MD: Nothing to Disclose, Gloria Maria Martinez Salazar MD: Nothing to Disclose

PURPOSE

To compare retrieval rates and number of days to retrieval in patients with optional IVC filters before and after adding the notation "Retrievable IVC Filter" to the patients electronic medical record "Problems" list

METHOD AND MATERIALS

In this IRB-approved retrospective study, 314 patients (age 11 - 96 years; 142 females, 171 males) who underwent IVC filter placement for temporary indications between 01/11/2011 and 03/10/2014 were studied. Our study group (n=154) consisted of patients in whom a notation was made to the EMR Problems list following filter implantation that stated: "Retrievable IVC filter: This should be retrieved when no longer indicated for PE protection". The control group (n=160) had no such notation. All patients' demographics, filter placement indications, procedure dates (filter placement/retrieval), complications, days to retrieval, retrieval rates and referral rates (patients who were referred by a clinician to IR for filter retrieval) were recorded. Statistical analysis was performed using a Fischer's exact test and unpaired t test.

RESULTS

There were no significant differences in demographics and filter placement indications between the control (n=160) and study groups (n=154). IVC filter retrieval rates in the study group (69/154; 42%) were significantly higher (p=0.0001) than the control group (31/160;19%). Direct patient referrals from clinicians for filter retrieval increased significantly in the study group (27/154; 18%;p=0.0001), as compared to the control group (5/160;3%). The number of days from insertion to filter retrieval in the study group (Mean 132.2, SD 98.786, SEM 7.96) was significantly less (p=0.001) than in the control group (Mean 237.75 days, SD 189.8, SEM 15.00)

CONCLUSION

In this study, adding the notation "Retrievable IVC Filter" to the patients' electronic medical record "Problems" list significantly increased patient referral to IR for filter retrieval, increased the overall filter retrieval rates and decreased the number of days to filter retrieval.

CLINICAL RELEVANCE/APPLICATION

There are complications secondary to indwelling IVC filters (migration, fracture and DVT) in patients with optional filters. Therefore, continuous monitoring is paramount to ensure timely filter retrieval.

Dual-phase Cone Beam CT Improves Identification of Cholangiocarcinoma Lesions during Trans-arterial Chemoembolization (Station #6)

Ruediger Egbert Scherntaner MD (Presenter): Nothing to Disclose, MingDe Lin PhD: Employee, Koninklijke Philips NV, Rafael Duran MD : Nothing to Disclose, Julius Chapiro MD : Nothing to Disclose, Zhijun Wang MD : Nothing to Disclose, Jean-Francois H. Geschwind MD : Consultant, BTG International Ltd Consultant, Bayer AG Consultant, Guerbet SA Consultant, Nordion, Inc Grant, BTG International Ltd Grant, F. Hoffmann-La Roche Ltd Grant, Bayer AG Grant, Koninklijke Philips NV Grant, Nordion, Inc Grant, ContextVision AB Grant, Celonova BioSciences, Inc Founder, PreScience Labs, LLC CEO, PreScience Labs, LLC

PURPOSE

To evaluate the impact of dual-phase cone-beam CT (CBCT) on the identification of cholangiocarcinoma (CCC) lesions during transarterial chemoembolization (TACE) compared to conventional DSA, in relation to pre-interventional contrast-enhanced magnetic resonance imaging (CE-MRI) of the liver.

METHOD AND MATERIALS

This retrospective study included 17 consecutive patients (10 men, 7 women; mean age 64) with CCC who underwent pre-interventional CE-MRI of the liver and intra-procedural dual-phase (early and delayed arterial) CBCT just before the chemotherapeutic drug delivery. The degree of visibility of each CCC lesion was graded on a three rank scale (complete, partial and none) on dual-phase CBCT and DSA images and compared to CE-MRI. Lesions < 5 mm diameter or outside the CBCT's field of view were excluded from evaluation. Statistical analysis was performed with Wilcoxon signed-rank test and Friedman test.

RESULTS

At total of 61 CCC lesions was included. The sensitivity of DSA for the complete or partial depiction of CCC
lesions was only 45.9%, whereas early and delayed arterial phase CBCT had significantly higher sensitivity of 73.8% and 93.4%, respectively (p<0.01). There was only one lesion (1.6%) that was depicted by DSA, but not by dual-phase CBCT due to severe streak artifacts caused by a mitral valve replacement. Conversely, out of the 33 lesions not visible on DSA, 18 (54.5%) and 30 (90.9%) were revealed on early and delayed arterial phase CBCT images, respectively. Early arterial phase CBCT showed no additional lesions compared to delayed arterial phase CBCT. Delayed arterial phase CBCT identified significantly more lesions (n=12, 19.7%, p<0.01) than early arterial phase CBCT. Especially with regard to the complete delineation of lesions, delayed arterial phase CBCT yielded significantly higher sensitivity (78.7%) compared to early-phase CBCT (31.1%) and DSA (21.3%)(p<0.01).

CONCLUSION

Dual-phase CBCT significantly improved the identification of CCC lesions during TACE. Delayed arterial phase CBCT yielded the highest sensitivity for the complete delineation of CCC lesions. Dual-phase CBCT should be used as standard imaging technique during TACE in CCC patients.

CLINICAL RELEVANCE/APPLICATION

Dual-phase CBCT can help to identify CCC lesions during TACE thus preventing some lesions to be overlooked for optimal treatment.

VIE174

Radiation Cataractogenesis in Interventional Radiology: A Review for the Interventional Physician
(Station #7)

Kevin Frederick Seals MD (Presenter): Nothing to Disclose, Ramsey al-Hakim MD: Nothing to Disclose, Christopher H. Cagnon PhD: Nothing to Disclose, Stephen Thomas Kee MD: Nothing to Disclose, Edward Wolfgang Lee MD, PhD: Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is:
1. To provide a comprehensive overview of radiation cataractogenesis in interventional radiology
2. To review the operator lens doses seen in common IR procedures and the data linking cataract development with interventional work
3. To describe optimal lens protection for the IR physician and strengths and weaknesses of each protection technique

TABLE OF CONTENTS/OUTLINE

Background
- ICRP threshold guidelines, data motivating the 2011 threshold change [Figure 1]
- Mechanistic basis of radiation cataract, including the role of radiation genotoxicity
- Assessment of the stochastic versus deterministic nature of radiation cataractogenesis [Figure 2]

Data linking radiation exposure and cataract development in interventional physicians [Figure 3]
- Multiple studies showing a statistically significant increase in cataract risk in interventionists
- Factors modulating this risk

Lens dose in common IR procedures [Figure 4]
- Physician lens dose in TIPS, CT guided biopsy and drainage, vertebroplasty, chemoembolization, neurointerventional techniques, etc.

Critical analysis of lens protection strategies [Figure 5]
- Leaded eyeglasses
- Ceiling-suspended shields
- Complex commercial shielding devices
- Real-time dosimetry
- Radiation education

SSJ06

Emergency Radiology (Chest Emergencies)

Scientific Papers

AMA PRA Category 1 Credits™: 1.00
ARRT Category A+ Credit: 1.00

Tue, Dec 2 3:00 PM - 4:00 PM Location: N229

Participants

Moderator
Jamlik-Omari Johnson MD : Nothing to Disclose

Moderator
Dual-source CT of Chest in Blunt Thoracic Trauma: Reduced Aortic Motion Using a Novel Iterative Temporal Resolution Optimization Algorithm

Teresa I-Han Liang MD (Presenter): Nothing to Disclose, Patrick McLaughlin FFR(RCSI): Nothing to Disclose, Shamir Rai BSc: Nothing to Disclose, Darra Thomas Murphy MD, FRCP: Nothing to Disclose, Luck Jan-Luck Louis MD: Nothing to Disclose, Tim O’Connell MD, Meng: President, Resolve Radiologic Ltd, Ana-Maria Bilawich MD: Nothing to Disclose, John R. Mayo MD: Speaker, Siemens AG, Savvas Nicolaou MD: Nothing to Disclose

PURPOSE
Motion artifacts commonly reduce diagnostic confidence in patients with suspected blunt aortic injury. In this study we evaluate a novel iterative temporal resolution optimization (TRO) algorithm in patients with blunt chest trauma undergoing contrast enhanced ultra high pitch dual source CT.

METHOD AND MATERIALS
Twenty-two patients who presented to a level one trauma centre between February 18 to March 25, 2014 with blunt thoracic trauma were included. All patients were scanned using a standardized ultra high pitch dual source CT protocol (UHP) using a single CT system. Aortic Motion artifact was scored using a five-point Likert scale modified from CCTA literature at multiple locations of the heart and aorta by two readers (Score of 1 = absence of motion artifacts or noise-related blurring in any vessels; score of 5 = severe or circumferential motion artifact, prominent mural discontinuity). Mean and standard deviation of CT values within aorta, muscle and air were recorded and signal to noise (SNR) and contrast to noise (CNR) ratios were generated as a quantitative index of image quality. Student t-test and Wilcoxon rank sum test were used for statistical analysis and p<0.05 was considered significant.

RESULTS
Aortic motion scores were significantly lower on UHP-TRO as compared with UHP images for both readers (Aortic valve 3.5±3 vs 5±2; Aortic sinus 1±1 vs 4±3; Sinotubular junction 1±1 vs 4±2; Ascending aorta 1±1 vs 3±2; p<0.0001). Motion scores were not significantly different at the aortic arch, isthmus and descending aorta on UHP-TRO as compared with UHP images (Arch 1±0 vs 1±0.75; Isthmus 1±0 vs 1±0.75; Descending aorta 1±0 vs 1±0.75). Mean SNR was 19.5% higher on UHP as compared with UHP-TRO (26.42 vs 21.27, p=0.01) and mean CNR scores were 27.7% higher on UHP images (13.4 vs 9.65, p=0.002).

CONCLUSION
Temporal Resolution optimized reconstruction of ultra high pitch dual-Source CT of the chest significantly improves motion artifact of the aorta in blunt thoracic trauma at the sacrifice of a mild reduction in SNR and CNR.

CLINICAL RELEVANCE/APPLICATION
Iterative temporal resolution optimized reconstruction of ultra high pitch Dual-Source CT images of the chest qualitatively improves motion artifact in blunt thoracic trauma patients facilitating more accurate assessment of the aorta.

Motion Artifact Reduction from High-pitch Dual-source CT Pulmonary Angiography

Paul Michael Bunch MD (Presenter): Nothing to Disclose, Urvi Pravin Fulwadhva MD: Nothing to Disclose, Jeremy Robert Wortman MD: Nothing to Disclose, Andrew Primak PhD: Employee, Siemens AG, Aaron D. Sodickson MD, PhD: Research Grant, Siemens AG

PURPOSE
To compare quantitative measures of cardiac pulsation and respiratory motion artifact in CT pulmonary angiograms (CTPA) performed using a high-pitch dual-source protocol and a single-source protocol.

METHOD AND MATERIALS
In this retrospective, IRB-approved, HIPAA-compliant study, 50 CTPA exams were included using each of two protocols: 1) a high-pitch dual-source (DS) protocol and 2) a routine single-source (SS) protocol. Neither protocol used ECG gating. Inclusion criteria were patient age >18 years, both arms elevated above the scan region, and no prior lobectomy or pneumonectomy. All scans were performed in the Emergency Department on a Siemens Definition Flash scanner. Each scan was evaluated for motion artifact producing a “double image” appearance, and when present, the greatest anatomic overlap interval was measured perpendicular to the axis of the ascending aorta, left ventricular lateral wall, and diaphragm. Measurements were performed on axial images for aortic and cardiac motion and on coronal reformatted images for diaphragmatic motion. Statistical analysis was performed using one way ANOVA.

RESULTS
There was no statistically significant difference in patient gender, age, or effective diameter between the two cohorts. High-pitch DS CTPA scans used a mean pitch of 2.9 (range 1.6-3.0), resulting in a mean scan duration of 0.8 seconds (range 0.6-1.7). Routine SS technique used pitch 0.75 for a mean scan duration of 4.6 seconds (range 3.6-5.8). DS outperformed SS technique with respect to quantitative measures of ascending aortic,
cardiac, and diaphragmatic motion. Mean distances between motion-artifact double images were reduced at the ascending aorta from 4.1 mm with SS to 0.3 mm with DS, at the left ventricular lateral wall from 5.3 mm with SS to 1.2 mm with DS, and at the diaphragm from 2.2 mm with SS to 0.1 mm with DS, all with p<0.001.

CONCLUSION

High-pitch dual-source CTPA is an effective means to significantly reduce artifacts resulting from ascending aortic, cardiac, and diaphragmatic motion.

CLINICAL RELEVANCE/APPLICATION

High-pitch dual-source CTPA significantly reduces cardiac and respiratory motion artifact without the need for ECG synchronization, which may result in increased diagnostic confidence during evaluation for pulmonary embolus as well as cardiac and aortic causes of chest pain.

SSJ06-03

Dual Source, Ultra High Pitch CT Pulmonary Angiography (CTPA) Reduces Motion and Allows for Accurate Evaluation of the Proximal Coronary Arteries in Approximately 50% of Patients Imaged for Suspected Pulmonary Embolism


PURPOSE

As rotation time, coverage and pitch increase, modern CT systems are more likely able to produce motion free images of the coronary arteries during CTPA scans. The purpose of this study was to compare coronary artery motion and diagnostic acceptability between dual source ultra high pitch (UHP), single source (SS) and dual source dual energy (DE) CTPA studies.

METHOD AND MATERIALS

362 consecutive patients underwent CTPA scans for suspected pulmonary embolism between Sept 1, 2013 and Jan 31, 2014. 238 UHP, including 194 at 100kV (UHP-100kV) and 44 at 120kV (UHP-120kV), 57 SS scans, and 37 DE scans were analyzed. Coronary arteries were separated into nine segments, and coronary artery motion was qualitatively scored using a scale from 1-4 (non-interpretable to diagnostic with no motion artifacts) to assess the quality of each protocol for visualization of the coronary arteries. CTDI and DLP values were collected for each scan to determine the effective radiation dose. Signal intensity, noise, and signal to noise ratio (SNR) of the aorta, main pulmonary artery, and paraspinal muscles were also assessed.

RESULTS

The UHP-120kV and UHP-100kV scans had the lowest amount of motion, with 38.8% and 30.1% of coronary segments being evaluable compared to 4.2% of SS segments. Proximal coronaries were more diagnostic than distal coronaries UHP-120kV (53.5% vs 24%, median score 2 vs 1, p<0.05), and both were higher than the UHP-100kV group (20.04 vs 15.80, p<0.05). Proximal coronaries were more diagnostic than distal coronaries UHP-120kV (53.5% vs 24%, median score 2 vs 1, p<0.05), and both were higher than the UHP-100kV group (20.04 vs 15.80, p<0.05).

CONCLUSION

UHP-120kV CTPA significantly reduced coronary artery motion and allows for accurate evaluation of the proximal coronary arteries compared to SS CTPA, without a statistically significant impact on SNR. UHP-100kV resulted in 77.2% less radiation exposure than SS although it came at the expense of an 18.8% reduction in average SNR.

CLINICAL RELEVANCE/APPLICATION

UHP CTPA protocols can be used to assess the proximal coronary arteries while maintaining the ability to rule in or out pulmonary embolism in patients with chest pain.

SSJ06-04

CTA in the ED: Impact of Contrast Timing Technique on Scan Duration

Martin Lee David Gunn MBChB (Presenter): Medical Advisor, TransformativeMed, Inc Spouse, Consultant, Wolters Kluwer nv Grant, Koninklijke Philips NV, Bruce E. Lehnert MD : Nothing to Disclose, Anda Maria Cornea MD, PhD : Nothing to Disclose, Christopher Allen Potter MD : Nothing to Disclose

PURPOSE

To compare the impact of contrast timing technique on scan duration and arterial enhancement for thoracic CT angiography.

METHOD AND MATERIALS

Retrospective, single center, IRB approved study that evaluated consecutive patients who had undergone single pass CT angiography of the thorax on a GE LightSpeed 16 CT scanner using 3 contrast timing techniques. Group A consisted of 86 patients who underwent CT pulmonary angiography (CTPA) using a timing bolus. Group B consisted of 74 patients who underwent a fixed-delay biphasic non-gated ‘double rule out’ CTPA and aortic CTA protocol. Group C consisted of 58 patients who underwent thoracic aortic CTA using a bolus triggering (tracking) technique. The primary endpoint was comparing the duration (in seconds) between the acquisition time of the last scout image and the first axial post-contrast image in all three groups. The secondary endpoint was vascular enhancement (HU) of the main pulmonary artery (MPA) and thoracic aorta. Statistical techniques included a 3-way ANOVA for three group analysis and t-tests to compare specific protocols. p < 0.05 was considered statistically significant.
RESULTS
There was a statistically significant (p<0.0001) difference in the average delay between the last scout image and axial acquisition in the three groups: group A (timing) 330 seconds (CI 302-358), group B (triggering) 250 seconds (CI 221-279), and group C (fixed delay) 160 seconds (CI 136-184); group A vs B (p=0.002), B vs C (p<0.0001), and A vs C (p<0.0001). Comparing MPA enhancement between group A (416HU, CI 388-444) and group C (442HU, CI 411-473) yielded no statistically significant difference (p=0.207). Comparing aortic enhancement between group B (363HU, CI 338-389) and group C (425HU, CI 399-451) yielded a significant difference (p=0.001), with greater enhancement in group C. Similar volumes of contrast were used in the three groups.

CONCLUSION
CTA using a fixed delay contrast enhancement technique is almost 3 minutes faster to perform than a timing bolus, with no impairment in vascular enhancement. This appears to be due to time taken by the technologists to perform the necessary steps. Three minutes is about 10% of the average CT scan slot duration.

CLINICAL RELEVANCE/APPLICATION
Choosing a bolus triggering or a fixed delay could shorten the scan duration for urgent ED CTAs and allow for more patients, and potentially less stable patients, to get scanned.

SSJ06-05

Exponentially Decelerated Contrast Media Injection Rate Combined with A Novel Patient-specific Contrast Formula Reduces Contrast Volume Administration During Computed Tomography Pulmonary Angiography
Charbel Saade MS (Presenter): Nothing to Disclose, Hussain Al-Mohiy: Nothing to Disclose, Mukbil Hourani MD: Nothing to Disclose

PURPOSE
To investigate opacification of the pulmonary vasculature during CTPA using a patient-specific contrast formula and exponentially decelerated contrast media injection rate.

METHOD AND MATERIALS
CTPA was performed on 150 patients with suspected PE using a 256 channel computed tomography scanner and a dual barrel contrast injector. Patients were randomly assigned to two equal protocol groups: protocol A, the department’s conventional protocol, employed a patient-specific contrast formula based on measured patient cardiovascular dynamics. Protocol B involved the use of a patient-specific contrast formula combined with exponentially decelerated contrast media injection rate. Both protocols used a 50 mL saline flush at 4.5 mL/s and a craniocaudal scan direction. Patient age and gender were equally distributed across both groups. The mean cross-sectional opacification profile of eight central and eleven peripheral pulmonary arteries and veins were measured for each patient and arteriovenous contrast ratio (AVCR) calculated for each lung segment. Protocols were compared using Mann-Whitney U non-parametric statistics. Jackknife alternative free-response receiver operating characteristic (JAFROC) analyses were used to assess diagnostic efficacy. Inter-observer variations were investigated using Kappa methods.

RESULTS
A number of pulmonary arteries demonstrated increases in opacification (p<0.02) for protocol B compared with A whilst opacification in the heart and all veins was reduced in protocol B (p<0.03). Subsequently, increased AVCR in protocol B compared with A was observed at all anatomic locations (p<0.0002) where this ratio could be calculated. An increase in JAFROC figure of merit (p<0.0002) and inter-observer variation was observed with protocol B compared with A with the latter metric increasing from (κ = 0.3) to (κ = 0.73) respectively. Mean contrast volume was reduced in protocol B (29±4 mL) compared to A (33±9 mL).

CONCLUSION
Significant improvements in visualisation of the pulmonary vasculature can be achieved with a low contrast volume CT acquisition using an exponentially decelerated contrast media injection rate and a patient-specific contrast formula.

CLINICAL RELEVANCE/APPLICATION
Matching contrast injection timing with vessel dynamics significantly improves vessel opacification and reduces contrast dose in the assessment of pulmonary embolism during computed tomography pulmonary angiography.

SSJ06-06

Alexi Otrakji MD (Presenter): Nothing to Disclose, Efren Jesus Flores MD: Nothing to Disclose, Roberto Lo Gullo MD: Nothing to Disclose, Jo-Anne O. Shepard MD: Consultant, Agfa-Gevaert Group, Mannudeep K. S. Kalra MD: Nothing to Disclose, Subba Rao Digumarthy MD: Nothing to Disclose, Margaret Kave BS, RT: Nothing to Disclose

PURPOSE
To assess if “contrast enhanced routine chest dual energy CT protocol” (DECT-RC) can provide acceptable vascular enhancement and additional parenchymal information compared to “single energy CT pulmonary
**METHOD AND MATERIALS**

Our IRB approved retrospective study included 200 adult patients who underwent either DECT-RC (n= 100 patients, M: F 47:53, mean age 62±15years, mean weight 76±19kg) or SECT-PA (n=100 patients, M:F 43:57, mean age 59±17years, mean weight 84±24kg). All CT examinations were performed on dual source MDCT (Siemens Definition Flash) or single source 64-row MDCT (GE 750HD Discovery). For DECT-RC, we generated images 60keV, pulmonary blood volume images (PBV) and virtual non-contrast images (VNC) images in transverse plane at 2.5mm thickness. Transverse SECT-PA images were reconstructed at both 1.25 and 2.5mm thicknesses. Two thoracic radiologists assessed main, lobar, segmental and subsegmental pulmonary arterial enhancement and filling defects in addition to diagnostic confidence, pulmonary and mediastinal abnormalities on 60 keV, PBV and VNC images. CTDI vol, and DLP were recorded for each patient.

**RESULTS**

Radiation dose for DECT-RC (7.2 ± 2.1mGy,260.4 ± 83.2 mGy.cm,3.6 ± 1.2 mSv) was significantly lower than SECT-PA protocol (15 ± 7.9 mGy,499.3±276.4 mGy.cm,7 ± 3.9 mSv) (p=0.0040). Optimal to excellent enhancement in pulmonary arteries was noted with DECT-PA (85%, 85/100 patients) and in 82% of SECT-PA (82/100 patients) (p>0.05). Limited to unacceptable pulmonary arterial enhancement was noted in % (15/100 patients) with DECT-RC and % (18/100 patients) with SECT-PA protocols. PBV images were deemed to provide helpful incremental value in making the diagnosis in 72% of patients (72/100) mostly in patients with perfusion defects from air trapping (better seen on PBV), consolidation, atelectasis, and pulmonary embolism. The incremental value of VNC images were helpful in 4/100 patients only with high attenuation lung nodules (n=1) and mediastinal lymph nodes (n=3).

**CONCLUSION**

Contrast enhanced routine chest protocol with DECT has the potential to replace SECT pulmonary angiography protocol for providing required pulmonary arterial enhancement as well as helpful additional information for evaluation of lung lesions.

**CLINICAL RELEVANCE/APPLICATION**

Routine chest CT with DECT can provide similar or better information compared to single energy CT pulmonary angiography without incurring any radiation penalty.

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**SSJ25**

**Vascular/Interventional (IR: Aortic Imaging and Intervention)**

**Scientific Papers**

**AMA PRA Category 1 Credits™: 1.00**

**ARRT Category A+ Credit: 1.00**

**Tue, Dec 2 3:00 PM - 4:00 PM  Location: E352**

**Participants**

Moderator
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Moderator
Charles Yoon Kim MD : Consultant, CareFusion Corporation Research Grant, Galil Medical Ltd Consultant, Kimberly-Clark Corporation Consultant, CryoLife, Inc

**Sub-Events**

**SSJ25-01**

**Endovascular Renal Chimney Stent-graft Technique in Patient with Hostile Proximal Neck: Technique and Acute/Mid-term Results**

Vladimir Gavrilovic MD : Nothing to Disclose , Gianluca Piccoli MD (Presenter): Nothing to Disclose , Massimo Sponza : Nothing to Disclose , Alessandro Vit : Nothing to Disclose , Massimo Bazzocchi MD : Nothing to Disclose , Daniele Gasparini : Nothing to Disclose

**PURPOSE**

To evaluate feasibility, safety and efficacy of Chimney-EVAR (Ch-EVAR) technique in patient with hostile proximal neck for standard EVAR.

**METHOD AND MATERIALS**

From March 2009 until December 2013, 43 patients considered at high surgical risk underwent Ch-EVAR. Balloon-expandable or self-expandable stent-graft were implanted in the renal arteries, of which 10 bilaterally and 33 unilaterally. In all 43 patients 6-15 ml of fibrin glue were injected into the sac using a 5F catheter to obtain complete thrombosis and reduce the risk of late type-2 leak. The results of the Ch-EVAR procedure were evaluated at 1, 6 and 12 months and annually by CT angiography (CTA), and clinically (serum creatinine) at 24h, 1 month and 6 months and annually thereafter.

**RESULTS**
Ch-EVAR technique was feasible in all patients. Final angiogram proved the exclusion of the sac, and no type 1 endoleaks. Mean follow-up was 16 (1-38) months. Average serum creatinine before the procedure and at 1, 6 and 12 months follow-up (FU) was respectively 1.4, 1.9, 1.5 and 1.3 ml/dl. In five patients creatinine increased significantly within 24h post-procedure, and a CT angiogram showed renal stent thrombosis; three patients were revascularized successfully whereas the two were considered not revascularizable. Eight patients died during the follow-up (non aortic death); all other patient were alive in stable clinical condition at FU.

CONCLUSION

According to our preliminary experience, Ch-EVAR technique is feasible, safe, and effective to treat patients with hostile proximal neck in AAA. Acute stent thrombosis is quite rare but possible complication, dayli serum creatinine monitoring is mandatory in the postoperative period.

CLINICAL RELEVANCE/APPLICATION

Ch-EVAR technique is good option for non-surgical, and AAA patients with hostile proximal neck. It is complex and high skills demanded procedure. The most frequent complication is acute stent thrombosis.

Impact of Thoracic Endografting on the Native Aortic Haemodynamics: Quantitative Comparative Analysis of the Functional Assessments by CT-computational Fluid Dynamics (CFD) Imaging before and after the Device Implantation

Marco Midulla MD, PhD (Presenter): Nothing to Disclose, Ramiro Moreno MS : Nothing to Disclose, Stephan Haulon : Nothing to Disclose, Franc Nicoud : Nothing to Disclose, Christophe Demattei : Nothing to Disclose, Jean-Paul Beregi MD : Nothing to Disclose, Anne Negre-Salvayre : Nothing to Disclose, Jean-Pierre Pruvo MD, PhD : Nothing to Disclose, Herve Pierre Rousseau MD : Nothing to Disclose

PURPOSE

Endovascular repair has dramatically changed the physicians approach to the thoracic aortic pathology. Although the advancements in clinical experience, little is known about the impact of the implantation on the native aortic functional status. The aim of this study is to evaluate the haemodynamic modifications before and after the endografting by proposing a comparative analysis of the quantitative assessments by a CT-based Computational Fluid Dynamics Imaging.

METHOD AND MATERIALS

40 patient-specific aortic geometries were obtained from an image dataset of pre and postoperative angio CT acquisitions in 20 consecutive patients treated by thoracic endografting for different aortic pathologies (11 TAA, 5 False Aneurysms, 3 Penetrating Ulcers, 1 ATAR). After image processing, a commercially available software system (XFlow, Next Limit Technologies) using a particle-based meshless approach was adopted to obtain the numerical simulations of the flow behaviour. WSS (Pa) and vorticity (Hz) values were measured at the proximal and distal landing zones and the median pre-postoperative ratios were registered.

RESULTS

Haemodynamic simulations were obtained for all the patients and quantitative analyses were accomplished (technical success 100%). Median WSS ratios respectively at the proximal and distal landing zone were: 0.96 (median values 4.19, 4.90 Pa) and 0.83 (median values 1.66, 2.06). Concerning the vorticity, median ratios were respectively 1.01 (proximal zone; median values 40.38, 39.17 Hz) and 0.80 (distal zone; median values 15.16, 17.22). Statistical analysis showed a difference in WSS (P=0.02) and vorticity (P=0.03) at the proximal landing zone depending on the specific anatomical implantation site (Z2-Z4).

CONCLUSION

A CT-based CFD approach is a promising imaging tool to obtain haemodynamic simulations of the thoracic aortic environment. The approach adopted in this experience allowed to accomplish a preliminary quantitative analysis comparing the pre and postoperative functional status which encourages next larger studies to gain better understanding of the impact of the endovascular treatment on the native vessel.

CLINICAL RELEVANCE/APPLICATION

To provide an imaging tool for the investigation of the thoracic aorta haemodynamics in order to weigh up the functional impact of endografting on the native vessel.

Additional Value of Venous Phase to Whole-body CT Angiography in Patients with Aortic Aneurysm

Yukichi Tanahashi MD (Presenter): Nothing to Disclose, Satoshi Goshima MD, PhD : Nothing to Disclose, Hiroshi Kondo MD : Nothing to Disclose, Yoshifumi Noda MD : Nothing to Disclose, Nobuyuki Kawai MD : Nothing to Disclose, Hiroshi Kawada MD : Nothing to Disclose, Haruo Watanabe MD : Nothing to Disclose, Kota Sakurai : Nothing to Disclose, Masayuki Kanematsu MD : Nothing to Disclose

PURPOSE

SSJ25-02

SSJ25-03
To evaluate the diagnostic performance of added venous phase for the detection and characterization of incidentaloma in patients with aortic aneurysm.

**METHOD AND MATERIALS**

IRB approval and written informed consent was obtained. Consecutive 243 patients (209 men, 34 women; mean age, 75.6 years) underwent whole-body contrast-enhanced CT in arterial- and venous- phase, following unenhanced image, for the assessment of aortic aneurysm. Two observers independently and randomly reviewed images in two separate image set; 1st, unenhanced and arterial phase images, and 2nd, unenhanced, arterial-, and venous-phase images, for the evaluation of incidentaloma. Incidentalomas were scored by a five-point rating scale for the confidence level of malignancy probability. Sensitivity, specificity and areas under the receiver operating characteristic curve (AUC) for the detection of visceral malignant lesion between two image sets were evaluated.

**RESULTS**

Diagnosis of visceral malignant tumors in 15 patients were established pathologically (n = 10) and diagnostic imaging (n = 14). The sensitivity and specificity for the detection of visceral malignant tumor were significantly higher in 2nd image set (80% and 94%) than those in 1st image set (60% and 77%) in observers overall. AUCs for Observer 1 and 2 were significantly higher in 2nd image set (0.93 and 0.95) than in 1st image set (0.83 and 0.81) (P = 0.03 and 0.01).

**CONCLUSION**

Diagnostic performance of incidental visceral malignancy was significantly improved by adding venous-phase to whole-body CT angiography.

**CLINICAL RELEVANCE/APPLICATION**

The prevalence rate of malignancy in the patients with aortic aneurysms was higher because they are commonly at an old age. Our result demonstrated the additional value of venous-phase to whole-body CT angiography for the detection and characterization of incidentaloma. This information might be beneficial for the assessment of these patients.

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**Incidence and CT Angiographic Characteristics of Aortic Re-Dissection: A 10-Year Single Center Experience**

Anne Shu-Lei Chin MD (Presenter): Nothing to Disclose

**PURPOSE**

Patients with prior aortic dissection remain at risk for repeat events, particularly those with hereditary aortopathy. CT angiographic (CTA) findings of acute aortic lesions superimposed on prior chronic dissection may be difficult to interpret. Our aim is to evaluate the incidence of aortic re-dissection in the clinical setting of acute aortic syndrome (AAS), and describe CTA imaging characteristics and clinical outcomes.

**METHOD AND MATERIALS**

CTAs from Jan 1, 2003 - Dec 31, 2012 in 497 patients presenting to a single institution with AAS were retrospectively reviewed by two cardiovascular radiologists. Aortic re-dissection was defined as an acute aortic lesion occurring in the same aortic segment affected by a prior aortic dissection, greater than 30 days after the initial aortic event. Patients with age-indeterminant lesions were excluded.

**RESULTS**

A total of 513 AAS occurred over the 10-year study period. The incidence of aortic re-dissection was 2.3% (12/513). The time interval between the historic event and the acute re-dissection ranged from 38-1777 days. The mean age of patients with re-dissection was 55.2 years (range 43-68 years); a third had a history of Marfan's syndrome. There were 7 new classic aortic dissection (AD) and 5 intramural hematoma (IMH) re-dissections. There were 2 type A and 10 type B lesions. One re-dissection was complicated by aortic rupture. AD re-dissections had the unique CTA characteristic of 2 intimal-medial flaps and 3 flow lumens, typically involving the original false lumen. IMH re-dissections had acute extensive intramural hemorrhage within the false lumen of prior chronic AD. Both type A and 4/10 type B lesions underwent surgical repair.

**CONCLUSION**

Aortic re-dissection within a chronic dissection is rare, but can present with AAS indistinguishable from the first event. CTA imaging characteristics are unique given persistent findings of the initial dissection, but can confirm the presence of a new acute aortic lesion. The false lumen of re-dissections often expands quickly, and urgent treatment is required. While the true incidence of rupture and death from re-dissection remains unknown, these lesions tend to be unstable requiring surgical repair.

**CLINICAL RELEVANCE/APPLICATION**

Aortic re-dissection is rare but can present as an acute aortic syndrome. CTA can confirm the presence of a new acute aortic lesion in the same aortic segment, despite persistence of the prior chronic dissection.
SSJ25-05
To Assess the Feasibility and Value of Multiphasic Dynamic Scan Protocol in Aortic Dissection
Yike Diao (Presenter): Nothing to Disclose, Chun-Yan Lu: Nothing to Disclose, Xiaohui Zhang: Employee, Siemens AG, Zhenlin Li MD: Nothing to Disclose

PURPOSE
To assess feasibility and additional diagnostic value of low dose multiphasic CT dynamic protocols (Shuttle mode and Flash-4D mode) in aortic dissection (AD) compared to a standard tri-phase protocol on a dual source CT (DSCT) scanner.

METHOD AND MATERIALS
54 consecutive patients with known or suspected AD (age range: 30-77 years) referred for aortic CTA were randomly, equally assigned into three groups and scanned on a DSCT scanner (SOMATOM Definition Flash, Siemens). For group A, a shuttle mode (Siemens) of multiphasic image acquisition (range: 48cm, time resolution 6s, 4 phase, 80kV, 125mAs/rot), for group B a high-pitch (pitch=3.0) mode of multiphasic image acquisition (range from the entrance of bony thorax to the plane of symphysis pubis, time resolution 12s, 4 phases, CARE kV, ref 80kV, 100mAs/rot), for group C the standard tri- phasic acquisition (range from the entrance of bony thorax to the plane of symphysis pubis, 100kV, 210mAs/rot) was used. Radiation dose were recorded. One-way ANOVA was used for statistical analysis.

RESULTS
In all 54 cases CTA can exactly display the true and false lumen, intimal flap, the entry tear and the involvement of branches of AD. Compared to standard tri-phasic protocol (un-enhanced, arterial and portal scans), additional diagnostic information was obtained by multiphasic CT dynamic protocols as followed: the enhancement delay between the true and false lumen (group A=18; group B=18); the degree of membrane oscillation (group A=8; group B=14); dynamic ejection of contrast material from the true into the false lumen (group A=6; group B=7). Mean effective radiation dose (group A: 8.08±0.12mSv, group B: 11.60±0.3mSv, group C: 23.86±1.31mSv) of the three groups were shown statistically different (P<0.05). Scan length range of Flash-4D CTA is approximately 62.63±4.44 cm, longer than shuttle mode (fixed 48cm).

CONCLUSION
Multiphasic dynamic CTA covering the entire aorta is feasible. Compared to standard tri-phasic protocol, both multiphasic scan protocols can provide more reveal pathological and anatomical features of AD with relative low radiation dose. In Flash-4D mode larger scan range can be provided, however, shuttle mode has a better time-resolution.

CLINICAL RELEVANCE/APPLICATION
Multiphasic protocols can exactly reveal pathological and anatomical features of AD with relative low radiation dose and offer more diagnostic information for surgical operation.

SSJ25-06
Treatment of Native Coarctation of the Aorta in Adult and Adolescents Using Covered-Stent Implantation
Xiaoyong Huang (Presenter): Nothing to Disclose, Jiaqing Fu: Nothing to Disclose, Lianjun Huang: Nothing to Disclose, XI GUO: Nothing to Disclose, Xin Pu: Nothing to Disclose

PURPOSE
Coarctation of the aorta (CoA) is a common congenital malformation leading to a life expectancy of about 35 years unless corrected. This study was to investigate the safety and effectiveness of treatment of native CoA in adults and adolescents using covered-stent implantation.

METHOD AND MATERIALS
A retrospective analysis was performed in 33 patients (mean age: 21.3±9.1 years, mean weight: 52.7±8.3 kg) diagnosed with native CoA by CT angiography and who accepted stent implantation from April 2005 to June 2012. Mean CoA diameter was 4.2±1.8 mm and mean length was 14.63±4.64 mm. Blood pressure monitoring, and CT angiography were performed 6, 12 and 24 months after surgery.

RESULTS
The procedures were successful in all cases, without major complications. Peak systolic pressure gradient decreased from 63.8±17.6 mmHg to 6.5±2.1 mmHg (P=0.005). Mean CoA diameter increased from 4.2±1.8 mm to 18.9±1.9mm (P=0.001). Eight patients with patent ductus arteriosus had no persistent left-to-right shunt after covered Cheatham-Platinum stent implantation. Pressure gradient was still present after implantation in one case with combined aortic arch dysplasia, and a longer bare stent was implanted to overlap the Cheatham-Platinum stent. Mean follow-up was 37.4±21.9 months. During this period, one patient with sustained hypertension needed medical control, without retraction observed on CT angiography. All other patients had improved symptoms and good hypertension control. There was no significant difference in peak systolic pressure between upper and lower extremities (P>0.05).

CONCLUSION
Covered-stent implantation in adults and adolescents with native CoA is efficient and safe, with good intermediate result.

CLINICAL RELEVANCE/APPLICATION
Covered-stent implantation is an efficient and safe method in the treatment of native CoA in adults and
adolescents, with a good intermediate result.

SSJ26

Vascular/Interventional (IR: Venous Disease and Intervention)

Scientific Papers

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Participants

Moderator
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Moderator
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Sub-Events

SSJ26-01

Feasibility and Safety of Image-guided Percutaneous Ablation for Treatment of Symptomatic Vascular Malformations Following Failed Percutaneous Sclerotherapy

Scott M. Thompson BA (Presenter) : Nothing to Disclose, Matthew Raymond Callstrom MD, PhD : Research Grant, Thermedical, Inc Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Galil Medical Ltd, Michael A. McKusick MD : Nothing to Disclose, David Arthur Woodrum MD, PhD : Nothing to Disclose

PURPOSE

To determine the feasibility and safety of image-guided percutaneous ablation for treatment of symptomatic vascular malformations

METHOD AND MATERIALS

An IRB-approved retrospective review was undertaken of all patients who underwent image-guided percutaneous ablation of symptomatic vascular malformations (VMs) that failed percutaneous Sotradecol or ethanol sclerotherapy. Ablations were performed under general anesthesia with US/CT or MRI-guided cryoablation or MRI-guided laser ablation. Cryoprobes or laser fibers were placed under intermittent CT or MR imaging. Intraprocedural monitoring was performed with intermittent CT or MRI during cryoablation to monitor ice-ball formation or with proton-resonance frequency MR thermometry every seven seconds during laser ablation to monitor thermal changes. Post-ablation monitoring varied between observation or hospital admission. Clinical follow-up began at one month post-ablation.

RESULTS

Seven patients (ages 10 to 48; 4 female) with eight VMs (N=7 intramuscular; N=1 subcutaneous) were treated with US/CT (N=3) or MRI-guided cryoablation or MRI-guided laser ablation (N=3) for pain (N=6) or diffuse bleeding secondary to hemangioma-thrombocytopenia syndrome (N=1). The median (range) of the maximal diameter was 9 cm (6.5 to 11.1 cm) for VMs undergoing cryoablation and 2.5cm (2.3 to 5.3 cm) for laser ablation. Seven VMs were ablated in one session and one in a planned two-stage session. Two laser fibers and 3 to 10 cryoprobes were used per ablation session. The number of hospital days ranged from 1 to 3 for cryoablation and 0 to 1 for laser ablation. Minor complications included a small hematoma, which did not require further intervention (laser) and numbness of the dorsal aspect of first toe (cryoablation). There were no major complications. There was no recurrence of bleeding at four years post ablation in the patient with hemangioma-thrombocytopenia syndrome and 5 of 6 patients with painful VMs reported symptomatic pain relief beginning as early as one month post ablation.

CONCLUSION

Image-guided percutaneous ablation of symptomatic vascular malformations is feasible and safe in patients who have failed percutaneous sclerotherapy and provides symptomatic relief for the majority of patients at short-term follow-up.

CLINICAL RELEVANCE/APPLICATION

Image-guided percutaneous ablation warrants further investigation as a therapeutic modality for treatment of symptomatic vascular malformations.

SSJ26-02

Complications Related to Inferior Vena Cava Filters: A Retrospective Analysis Utilizing Computed Tomography

Dominic Semaan MD, JD (Presenter): Nothing to Disclose, Matthew Osher MD : Nothing to Disclose, Ashish Vyas MD : Nothing to Disclose, Aaron Joseph Burgin MD : Nothing to Disclose, Roger L. Gonda
The purpose of our review is to determine the incidence of complications related to IVC filter placement, as well as to determine which type of IVC filters have the greatest incidence of complications, utilizing subsequent post-deployment computed tomography.

RESULTS

A total of 188 filters were reviewed. Of those, 88 (36.2%) had caval penetration, 3 migrated from original placement, 3 filters had a fractured strut. Major caval penetration into adjacent viscera/aorta was seen in 6 of the filters deployed. Incidentally, 3 patients developed caval thrombosis. Chi-square analysis demonstrated a statically significant difference in the incidence of caval penetration between the various filters deployed ($p$ < .001). Of the various types of filters utilized by our institution (Günther Tulip N=28, Celect N=47, Option N=97, Trapese N=10, Eclipse N=2), the Günther Tulip demonstrated the greatest incidence of caval penetration at 71.4%. While only 32.0% of Option filters demonstrated caval penetration, two filters had struts penetrate into the adjacent aorta. The Option demonstrated the highest incidence of migration, with 2 (2.1%) filters averaging 2.4 cm of cephalic migration. Two Celect and one Trapese filter had fractured struts, which could potentially serve as a source of future embolism.

CONCLUSION

Interventional radiologists must be evermore cognizant of potential risks of filter deployment. IVC filter placement is not a benign procedure and carries risk to the patient, both intra- and post-procedural. Patients and referring physicians should be educated regarding these risks and the decision to implant an IVC filter, often for the remainder of the patient’s life, is not one that should be taken lightly.

CLINICAL RELEVANCE/APPLICATION

IVC filter placement must be carefully evaluated prior to filter placement, to determine if the risks (including caval penetration) are outweighed by the benefits.

Pharmacomechanical Catheter-directed Thrombolysis in Patients with IVC Filters

John Peter Karageorgiou MD (Presenter): Nothing to Disclose, Kathryn Jane Fowler MD: Research support, Bracco Group, Suresh Vedantham MD: Research support, Covidien AG Research support, Bayer AG Research support, F. Hoffmann-La Roche Ltd Research support, BSN medical GmbH, Nael El Said Saad MBBCh: Research Consultant, Veran Medical Technologies, Inc Proctor, Sirtex Medical Ltd

PURPOSE

To evaluate the authors’ experience with pharmacomechanical catheter-directed thrombolysis (PCDT) in patients with inferior vena cava (IVC) filters.

METHOD AND MATERIALS

Retrospectively queried radiology reports from 1/2005-2/2014 identified patients with IVC filters undergoing PCDT (catheter-directed thrombolysis, mechanical thrombectomy, balloon maceration, angioplasty and stenting). Patient electronic medical records were reviewed for: demographic, anticoagulation, symptoms, extremities involved, extent of thrombosis, therapies received, number of sessions, technical and clinical success, complications, need for subsequent lysis and long-term status. Statistical analyses were performed using SPSS software.

RESULTS

Eighty-two patients met criteria (53yrs; range 18-96, M:66%). The most common indication for PCDT was lower extremity pain and edema (68%) with ulceration, phlegmasia, and compartment syndrome, combined accounting for 16% and pulmonary embolism for 12% of patients. Of the 80 patients with lower extremity symptoms, 60% were bilateral, resulting in 129 extremities at risk. Catheter venography demonstrated IVC thrombus in 89% with extension above the filter in 22% of patients. Thrombus was confined to extremities in 5%, while IVC with both iliac vessel involvement was identified in 64% of patients. Treatment mostly involved combined mechanical and lytic therapy with angioplasty and stenting in 57% and 50% of patients, respectively. PCDT was technically successful in restoring flow in 88% and clinically successful in improving symptoms in 80%. IVC filters remained functional in 70%. By SIR criteria, 85% had no or minor complications. There were 2 deaths from intracranial hemorrhage. On follow up (458 days avg; 0-3011D), 6% of patients died from thrombosis related events, 17% underwent repeat lysis procedures within our hospital system and 54% of patients had resolved/improved symptoms. The complication rates in the patients with single versus bilateral lower extremity involvement were similar. Long-term thrombosis related death was 17% in patients with thrombus extending above the filter vs. 3% in patients with no thrombus extension above the filter.

CONCLUSION

Pharmacomechanical catheter-directed thrombolysis is an effective and safe treatment in patients with pre-existing IVC filters.
Effectiveness of Simulation-based IVC Filter Placement Training for Radiology Residents: A Pilot Study

Ji Young Buehne MD (Presenter): Nothing to Disclose, Nicholas L. Fulton MD: Nothing to Disclose, Daniel R. Gans MD: Nothing to Disclose, Stephen E. Dreyer MD: Nothing to Disclose, Jon Davidson MD: Nothing to Disclose, Mark Richard Robbin MD: Nothing to Disclose

PURPOSE

To assess whether high-fidelity simulation-based training is more effective than standard didactics to train radiology residents in IVC filter placement and the perceptive validity of simulation-based training.

METHOD AND MATERIALS

This is an IRB approved prospective pilot study using a high-fidelity endovascular simulator. Between 9/1/13-3/1/14, 20 radiology residents (R1-R4) were randomized into a simulation group (SG, n=10) vs a control group (CG, n=10). All underwent a pretest including procedure simulation and written knowledge test. Both groups received didactic resources on IVC filter placement, but only SG underwent 3 simulation training sessions. Both groups underwent a posttest simulation, written test, and a subjective questionnaire. Simulation tests were evaluated by a blinded board certified interventional radiologist using a task-specific checklist and a 5 point Likert scale technical competence score. Total procedure time, fluoroscopy time, and written test scores were also recorded. Non-parametric tests and unpaired t test were used to compare performance outcomes between two groups.

RESULTS

The SG demonstrated significant improvement in all parameters including technical competence (mean 2.1 points; P<0.01), procedure time (-8.08 min; P<0.01), fluoroscopy time (-1.03 min; P=0.04), and written test score (+26%; P<0.01). The CG demonstrated significant improvement in the procedure time (-7.21 min; P=0.02) and written test score (+18%; P=0.01). Only the difference in technical competence score between the groups reached a statistical significance (P<0.01). Mean survey scores (SG,CG) were as follows: simulation realism(4.7,3.6), confidence after study completion(4.8,3.5), overall utility of simulation-based IVC filter training (4.8,4.2), benefit of simulation training in IR procedures(4.9,4.7). Self-confidence in IVC filter placement significantly improved in SG compared to CG (P<0.01).

CONCLUSION

Simulation based IVC filter placement training can be more effective than conventional teaching in gaining technical proficiency and self-confidence among radiology residents. This pilot study provides evidence to support further investigation of simulation-based IR training in clinical practice.

CLINICAL RELEVANCE/APPLICATION

Simulation-based IR training may improve procedural skills, physician confidence, decrease procedure time and fluoroscopic time without patient morbidity or trainee radiation exposure.

Cost Analysis of Chest Port Insertion: Interventional Radiology vs. Surgical Placement


PURPOSE

In the face of changing health care reimbursements toward bundled care, the issue of minimizing cost is pertinent. While there has been a 20,510% increase in the number of chest ports (CP) placed by interventional radiologists from 1992-2011, surgery continues to dominate in placement of long term central venous access devices. This study compares the cost of CP insertions performed by interventional radiology (IR) vs. surgical implantation (OR) at a single institution.

METHOD AND MATERIALS

Cost data on 100 IR and 49 OR consecutive Medicare outpatients that had isolated chest port insertions between 3/2012-2/2013 was obtained for both the operative services (IR suite vs OR) and pharmacy. The costs incurred by the hospital were divided into variable labor, supplies, room, and fixed costs for each case. Each cost was summarized as mean and standard deviation. Non-parametric tests for heterogeneity were performed using Kruskal-wallis method. Alpha was fixed at 0.05 for statistical significance.

RESULTS

Overall mean charges to place a CP were significantly higher in the OR, both in room and pharmacy costs (p < 0.0001). The overall average cost to place chest ports in an OR setting was almost twice that of placement in the IR suite. There was not a single identifiable cause for this difference. Rather, every category of cost (labor, supply, variable and fixed room cost) was higher in the OR (see Figure 1). Furthermore, the costs in each category varied minimally between IR cases but demonstrated a much greater variance between OR cases.
This pattern also holds true for pharmacy costs. Again, the pharmacy costs were greater and varied more for OR cases in every cost category except for pharmacy labor.

CONCLUSION

Cost incurred to the hospital demonstrated significant differences between surgeons and interventional radiologists. Given that our prior work shows that complication rates in CP insertions in these two services are similar, it can be concluded that IR services are more cost effective for chest port insertion. 1 LaRoy J, et al. Morbidity Analysis of Chest Port Insertion: Interventional Radiology vs. Surgical Placement. J Vasc Interv Radiol 2014;25(3S):S100.

CLINICAL RELEVANCE/APPLICATION

Our findings suggest that there is a significantly lower cost associated with chest port placement performed in the IR suite.

Flouroquinolone Based Surface Modifying Molecules Reduce Venous Thrombosis Rates Associated with PICC Lines


PURPOSE

To compare thrombosis rates between flouroquinolone surface modified polyurethane PICCs and polyurethane PICCs

METHOD AND MATERIALS

From 11/6/2012 through 2/6/2013, 1203 consecutive patients had 890 PICCs (642 Polyurethane [PU] and 246 Surface Modified Polyurethane [SM]) and 485 Midline catheters (481 PU and 5 SM). Catheter type was determined by preference of the placing nurse. In 10 patients, the type of PICC used was not recorded so these were excluded. Using multivariable logistic regression, rate of venous thrombosis associated with the catheter was compared between the two groups and correlated with variables such as age, gender, side of catheter placement, size of catheter, # of lumens, vein used, catheter length, whether the vein reached its desired target (SVC in PICC and Axillary Vein in Midlines), and an ICD-9 cancer diagnosis. Central Line Associated Bacterial Systemic Infections (CLABSI) were also collected.

RESULTS

In univariate analysis of PICCs, left side of insertion and cancer diagnosis were predictors of thrombosis (5.5% v. 2.1% for left v. right p=0.008 and 50% v. 2.5% p<0.0001 for cancer). In multiple-variable analysis correcting for age, side of placement and cancer diagnosis, there were 24 thromboses in 642 PU PICCs while there were only 3 in 248 SM PICCs 3.7% v. 1.2% with an odds ratio of 6.2 (p=0.01). In 5 F catheters, the odds ratio was 5.0 (p=0.012). When 179 5F SM catheters were compared to 387 4F PU catheters the thrombosis rates were similar (p=0.272). There was no difference between 4F and 5F SM catheters. Thrombosis rate in PU midline catheters was higher than in PU PICCs (5.4% v. 3.7%). Side of placement was not a predictor of thrombosis. Shorter catheter length (p=0.014) and cancer diagnosis (p=0.002) were predictors of thrombosis in midlines. While no SM midlines thrombosed, the sample size was too small (n=5) for a generalizable comparison of midline catheters. There were no CLABSI events in either group.

CONCLUSION

Surface modification of PICCs reduces thrombosis by a factor of 6.2 overall and by a factor of 5 in 5F PICCs. Left sided PICC placement and cancer diagnosis increase the risk of venous thrombosis. Midline PU catheters have a higher associated thrombosis rate than PU PICC lines and while side of placement is not an independent risk factor for thrombosis, shorter length and cancer diagnosis are.

CLINICAL RELEVANCE/APPLICATION

Surface modified PICC lines have lower thrombosis rates which will improve patient safety.

Renal Ultrasound and Doppler (An Interactive Session)

Refresher/Informatics

VA US GU

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Tue, Dec 24 4:30 PM - 6:00 PM Location: E450B

Sub-Events

Masses and Parenchymal Diseases
LEARNING OBJECTIVES

1) Identify the imaging features of a variety of etiologies of renal masses and understand the potential overlap between malignancy, non-malignant mass-like lesions and pseudomasses. 2) Recognize the potential limitations of ultrasound in the identification of renal masses and learn to maximize technique. 3) Demonstrate the wide range of appearances of parenchymal diseases on ultrasound and develop an approach to evaluation.

ABSTRACT

Renal masses are a common finding on ultrasound. While the vast majority are cysts, solid appearing lesions are also frequently encountered. Not all 'masses' are cancer and there are numerous mimickers of malignancy on renal ultrasound. Numerous cases will be shown of various malignant and non-malignant etiologies of renal masses. Factors impacting the sensitivity of renal ultrasound for detection of masses will be reinforced. Finally, renal parenchymal diseases can demonstrate a wide variety of sonographic appearances. Multiple examples will be shown as well as the importance of developing a systematic evaluation of the patient with parenchymal disease.

Renal Doppler

John Stephen Pellerito MD (Presenter):  Nothing to Disclose

LEARNING OBJECTIVES

1) Learn techniques and protocols for Doppler evaluation of the renal arteries. 2) Optimize abdominal Doppler studies. 3) Recognize the role of Doppler in evaluation of renal stents.

ABSTRACT

Evaluation of the renal arteries and kidneys is an integral component of the workup of renal insufficiency and hypertension. Doppler ultrasound examination is proven valuable in the detection of renal artery stenosis and occlusion. Doppler ultrasound has multiple advantages over CT or MR angiography: noninvasive, no radiation and does not require administration of contrast material. This program will discuss the techniques and protocols needed for successful renal artery evaluation with Doppler ultrasound. Tips to optimize the examination will be provided. There will also be a discussion of the evaluation of renal artery stents.

Renal Transplants

Deborah J. Rubens MD (Presenter):  Nothing to Disclose

LEARNING OBJECTIVES

1) Review the normal parenchymal and vascular anatomy of renal transplants including their normal Doppler parameters. 2) Identify the most common causes of renal transplant complications and criteria for their diagnosis. 3) Outline some of the pitfalls in transplant ultrasound imaging and when to use CT, MR and/or angiography in addition to ultrasound.

ABSTRACT

This lecture will review the anatomy and pathophysiology of renal transplants. The role of ultrasound imaging in assessment of acute as well as chronic renal transplant dysfunction will be elucidated. The performance of Doppler ultrasound will be highlighted regarding vascular stenosis and occlusion, parenchymal perfusion, and planning and assessing organ biopsy. Doppler techniques to avoid false negative and false positive studies will be emphasized. Controversial parameters will be stressed, in particular the use of absolute velocities versus ratios in the diagnosis of renal artery stenosis. Surgical emergencies will be highlighted, and the role of correlative imaging with CT, MR and/or angiography will be addressed.

Active Handout


Thoracic Aorta: Key Concepts (An Interactive Session)

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Tue, Dec 2 4:30 PM - 6:00 PM  Location: S402AB

Sub-Events

Transcatheter Aortic Valve Replacement (TARV)
LEARNING OBJECTIVES

1) Discuss Pathophysiology and Prevalence of Symptomatic Severe Aortic Stenosis. 2) Discuss Transcatheter Treatment Options (TAVR). 3) Discuss Critical Role of Imaging in the Context of TAVR.

ABSTRACT

If left untreated, symptomatic, severe aortic stenosis (AS) is associated with a dismal prognosis. Open-heart surgical valve replacement is the treatment of choice and is associated with excellent short and long-term outcome. However, many older patients with multiple co-morbidities and anticipated increased surgical risk are excluded from surgical intervention. For these patients, transcatheter aortic valve implantation (TAVI) is emerging as a viable treatment alternative. Transcatheter valvular heart procedures are characterized by lack of exposure and visualization of the operative field, therefore relying on image guidance, both for patient selection and preparation and the implantation procedure itself. This article describes the role of multi-detector row computed tomography (MDCT) for detailed assessment of the aortic valve, aortic root, and iliac arteries in the context of TAVI.

URL's

http://www.thecdt.org/article/view/1583/3023

Handout: Paul Schoenhagen
http://media.rsna.org/media/abstract/2014/13011995/TAVR cloud.pdf
**Session**

**Refresher/Informatics**

**VA PD**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Tue, Dec 2 4:30 PM - 6:00 PM   Location: E353B

**Participants**

S. Bruce Greenberg MD (Presenter): Nothing to Disclose
Cynthia Karfias Rigsby MD (Presenter): Nothing to Disclose
Taylor Chung MD (Presenter): Speaker, Koninklijke Philips NV

**LEARNING OBJECTIVES**

1) Understand the morphology, treatment, and long term complications of treated and untreated congenital heart disease via an interactive mentored-case approach with audience response system. 2) Highlight appropriateness of MRI and CT with regard to technique, pitfalls, indications and critical imaging findings that affect management for common imaging scenarios, including vascular rings and slings, coarctation, aortopathy, coronary anomalies, and congenital pulmonary arterial and venous anomalies. 3) Provide an opportunity for general radiologists, pediatric radiologists and cardiac imagers who have limited exposure to this area in their workplace an opportunity to refresh their pediatric cardiovascular imaging skills in a focused manner.

**RC512**

**Imaging and Endografts**

**Refresher/Informatics**

**IR VA**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Wed, Dec 3 8:30 AM - 10:00 AM   Location: E353A

**Sub-Events**

**RC512A**

**TEVAR Indications and Outcomes**


**LEARNING OBJECTIVES**

1) Understand the current applications of thoracic endografts for management of thoracic aortic pathologies. 2) Recognize the benefits and existing limitations of current endograft technologies for treatment of different aortic lesions. 3) Identify the complications and failure modes of TEVAR. 4) Know the current outcome metrics typically evaluated after TEVAR treatment of thoracic aneurysms and aortic dissections. 5) List the important imaging findings and criteria currently used to assess the suitability of aortic anatomy for TEVAR.

**RC512B**

**New Endografts for AAA**

Constantino Santiago Pena MD (Presenter): Speakers Bureau, W. L. Gore & Associates, Inc Speakers Bureau, Cook Group Incorporated Speakers Bureau, Koninklijke Philips NV Advisory Board, C. R. Bard, Inc Advisory Board, Boston Scientific Corporation Advisory Board, Guerbet SA

**LEARNING OBJECTIVES**

1) Discuss the status of established AAA endografts. 2) Discuss new endografts for the treatment of AAA. Particularly discuss areas of improvement over established endografts. 3) Present data on novel endografts being developed.

**RC512C**

**Post Endograft Essentials**


**LEARNING OBJECTIVES**

1) To better select the best imaging modality for assessing stent-grafts. 2) To assure that CT acquisition technique is optimized for endoleak detection. 3) To learn how to identify structural failures in endografts.

**SSK25**
Sub-Events

Tariq Arshad Hameed MD (Presenter): Research Grant, Koninklijke Philips NV, Radya Gamal Eldin Osman MBBS, MD: Nothing to Disclose, Aashish A. Patel MD: Nothing to Disclose

PURPOSE
To assess if magnetic resonance (MR) imaging using albumin binding gadolinium based blood pool agent is superior to standard contrast agent or non-contrast techniques in the assessment of deep veins of the abdomen and pelvis.

METHOD AND MATERIALS
Retrospective review of MR venography of abdomen and pelvis with gadofosveset and equal number of consecutive cases utilizing gadobenate dimeglumine was performed. These examinations also included pre-contrast Axial 2-D Time of flight (ToF) and TrueFISP (True fast imaging with steady state free precession) techniques. Post contrast examination included time resolved multiphase coronal T1W examination to optimize timing for maximum enhancement of deep veins with subtraction and axial thin section T1 weighted post contrast images. Quantitative analysis was performed by measuring signal intensity in the IVC or iliac veins. Contrast to noise ratio (CNR) was calculated by obtaining signal intensity in muscle and standard deviation in air. Qualitative evaluation of image quality was performed by two radiologists on a 4 point Likert scale. Presence or absence of suspected low signal artifacts or thrombus was recorded.

RESULTS
24 MR examinations with Gadofosveset (15 females, 9 males, mean age 47 years) compared with 24 examinations with gadobenate meglumine (16 females, 8 males, mean age 50 years). ToF and TrueFISP sequences for all 48 examinations were compared. The CNR for TrueFISP (469) and ToF (313) was significantly higher compared to CNR of gadofosveset (90) as well as CNR of gadobenate meglumine (66.8) with P value < 0.001. CNR of gadofosveset was higher compared to gadobenate (P 0.472). On qualitative evaluation mean score was 3.5 for TrueFISP, 3.3 for ToF, 3.5 and 3.6 for gadofosveset on time-resolved non subtracted and subtraction images respectively compared with 2.7 and 3.7 for gadobenate meglumine. Low signal artifacts were noted in TrueFISP and ToF (ToF > TrueFISP).

CONCLUSION
A combination of non contrast techniques provides diagnostic quality comparable to contrast enhanced studies. Contrast enhanced examinations with blood pool agents provide better image quality compared to standard contrast agents.

CLINICAL RELEVANCE/APPLICATION
Diagnostic quality MR venography can be performed without intravenous contrast. Contrast enhanced examinations may be obtained as problem solving in case of suspected artifacts or to evaluate for collateral flow pattern in case of occlusion.

SSK25-02  Three-dimensional T1- and T2-weighted Turbo Spin-echo Technique: A Viable Alternative to Contrast-enhanced MRI for the Diagnosis of Deep Vein Thrombosis

Karla Maria Treitl MD (Presenter): Nothing to Disclose, Marcus Treitl MD: Nothing to Disclose, Nora Navina Kammer MD: Nothing to Disclose, Eva Maria Coppenrath MD: Nothing to Disclose, Nora Suderland: Nothing to Disclose, Maximilian F. Reiser MD: Nothing to Disclose, Tobias Saam MD: Research Grant, Diamed Medizintechnik GmbH Research Grant, Bayer AG

PURPOSE
To evaluate the feasibility of a novel T1w three-dimensional (3D) isotropic-resolution turbo spin-echo (TSE) technique for the diagnosis of deep vein thrombosis (DVT) in comparison to contrast-enhanced magnetic resonance imaging (CE-MRI).

METHOD AND MATERIALS
Nine consecutive patients with proven DVT in compression duplex ultrasound (CDUS) and 2 patients with pulmonary embolism and suspicion for DVT (6 male, 17-93 years) were imaged at 3.0 T using 0.75-mm isotropic-resolution TSE (3D) Volumetric Isotropic TSE Acquisition (VISTA) using standard body coils. Thrombus...
signal (SNRthrombus) and thrombus signal-to-noise-ratio (SNRthrombus), sensitivity (SE), specificity (SP), positive and negative predictive values (PPV, NPV), Cohen’s kappa ($\kappa$) and accuracy of VISTA-MRI were calculated using contrast-enhanced MRI (CE-MRI) as a standard of reference. Image quality and diagnostic confidence were assessed on a four-point scale.

RESULTS

The image quality of CE-MRI was significantly better than VISTA-MRI ($3.56 \pm 0.55$ vs. $3.64 \pm 0.57$, $P<0.013$); the diagnostic confidence level did not differ significantly ($3.87 \pm 0.37$ vs. $3.83 \pm 0.50$, $P=0.06$). VISTA-MRI provided 26.8% and 17.3% improvement in Strombus and SNRthrombus. Using CE-MRI as gold standard, there was high agreement with 3D- VISTA images for the detection of DVT, with $\kappa=0.99$ for reader I and $\kappa=0.97$ for reader II (both $P<0.001$). This resulted in SE, SP, PPV, NPV and accuracy of 100.0%, 99.6%, 97.6%, 100.0% and 99.7% for reader I and 97.6%, 96.6%, 97.6%, 99.6% and 99.3% for reader II.

Comparing CDUS and VISTA-MRI there was less agreement with $\kappa=0.78$ ($P<0.001$) and 81.0%, 95.4%, 87.9%, 92.2% and 91.1% for both readers after a spare time of 4,1 (0-10) days.

CONCLUSION

3D-T1w-VISTA-MRI is able to diagnose DVT with excellent agreement compared to CE-MRI and good agreement compared to CDUS and might be useful when use of contrast media is prohibited and in patients with suspected thrombosis of the iliac veins, which can be hard to detect in sonography.

CLINICAL RELEVANCE/APPLICATION

- Black blood MRI using a high-resolution T1-weighted 3D-VISTA sequence allows the diagnosis of deep vein thrombosis.
- Black blood MRI allows the diagnosis of deep vein thrombosis without the application of contrast medium.
- Black blood MR could be a valid alternative in pregnant patients, in patients with renal insufficiency or in patients / vessels, which cannot be examined with sufficient quality in duplex sonography.

SSK25-04

MRI with a Weak Albumin Binding Contrast Agent has Additional Value for the Detection of Endoleaks in Patients with Enlarging Aneurysm after Endovascular Repair

Jesse Habets MD (Presenter): Nothing to Disclose, Herman J.A. Zandvoort : Nothing to Disclose, Frans L. Moll MD, PhD : Nothing to Disclose, Lambertus W. Bartels PhD : Nothing to Disclose, Evert-Jan Venken MD, PhD : Nothing to Disclose, Joost van Herwaarden MD, PhD : Research Consultant, Koninklijke Philips NV , Tim Leiner MD, PhD : Speakers Bureau, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, Bracco Group

PURPOSE

The purpose of this study was to examine the additional diagnostic value of Magnetic Resonance Imaging (MRI) after administration of a weak albumin-binding contrast agent in post-EVAR patients with aneurysm growth.

METHOD AND MATERIALS

MR imaging was performed in all patients with AAA growth >=5 mm after EVAR and no or uncertain endoleak on CTA in the period between April 2011 and August 2013. All MRI scans were performed on a 1.5-T clinical MRI scanner after administration of the weak albumin-binding contrast agent gadobenate dimeglumine. The presence of endoleaks was assessed by visually comparing pre-contrast and post-contrast T1-weighted fat-saturated images. Post-contrast images were acquired 5 and 15 minutes after contrast administration.

RESULTS

Endoleaks were observed in 25/29 patients (86%) on the post-contrast MRI images. Sixteen (55%) patients had a type II endoleak visualized by MRI and occur on delayed CT images. In 6/22 patients (27%, Figure 1), both MRI and delayed CT imaging revealed a type II endoleak. However, MRI had also complementary value in these 5/6 patients (83%) by visualizing more feeding lumbar arteries (n=3) (important for treatment purposes) and by improving the visualization of the extent of the endoleak (n=3). In one patient, MRI detected a type II endoleak originating from the inferior mesenteric artery (IMA) in addition to the type 2 endoleak from a lumbar artery also detected by CTA. Three (10%) patients had additional type III/IV endoleaks at the level of the aneurysm sac (n=1) and iliac legs (n=2).

CONCLUSION

In patients with enlarging aneurysms of unknown origin after EVAR, MRI with a weak albumin binding contrast agent has additional diagnostic value for both the detection and determination of the origin of the endoleak. This can have important (interventional) treatment implications.

CLINICAL RELEVANCE/APPLICATION

Endoleak is a common complication in patients after endovascular treatment of an abdominal aortic aneurysm (EVAR). In patients with aneurysm growth, the detection of endoleaks can have important clinical implications. CT angiography including delayed phase imaging can fail to detect endoleaks in patients with aneurysm growth (endotension). MRI after administration of an albumin-binding contrast agent can detect additional endoleaks in these patients and can guide interventional treatment.

SSK25-05

Non-contrast Quiescent Interval Single Shot Arterial Spin Labeled MRA: Feasibility for Pedal Artery Imaging in Diabetic Patients with Symptomatic Peripheral Arterial Disease

PURPOSE
To assess feasibility of non-contrast quiescent interval single shot arterial spin labeled MRA (QISS-ASL MRA) for pedal artery evaluation.

METHOD AND MATERIALS
5 subjects, comprising 1 healthy (67y) volunteer and 4 diabetic patients (mean 81y) with symptomatic peripheral arterial disease (PAD) were prospectively recruited for bilateral foot QISS-ASL MRA at 1.5T. Imaging was performed using a head-coil with two consecutive QISS acquisitions: a) slice-selective saturation to suppress non-arterial signal, and b) non-selective saturation. Subsequently, subtraction of the two datasets (a-b) was performed. Total imaging time was approximately 8 minutes. Two radiologists independently analysed anonymized source and subtraction datasets for: image quality (IQ), 1=non-diagnostic, 3=sufficient for diagnosis, 5=excellent; and, presence of hemodynamically significant (≥50%) stenosis in defined arterial segments, including the dorsalis pedis and plantar arteries. Weighted kappa statistics were performed to evaluate inter-rater agreement for stenosis assessment. DSA correlation of stenosis assessment was performed where available.

RESULTS
All subjects completed QISS-ASL MRA. 64 segments were identified in 10 feet. 60/64 segments and 53/64 segments were diagnostic for readers 1 and 2 respectively, with susceptibility artifact from orthopaedic hardware and image noise degrading image quality in the remainder. Mean IQ scores were 3.8±0.6 and 3.0±0.7 for readers 1 and 2 respectively. Inter-rater agreement for hemodynamically significant stenosis was 0.54. DSA was available in 19 segments (n=2 patients) with 17/19 demonstrating hemodynamically significant stenosis at the reference standard. MRA concordance in identifying hemodynamically significant stenosis was 14/19 and 15/19 for readers 1 and 2 respectively.

CONCLUSION
QISS-ASL MRA is feasible for visualisation of pedal segments in diabetic patients with severe PAD. It provides a potential alternative to contrast-enhanced techniques, which are challenging and carry associated risk in renal impairment. Further evaluation in a larger clinical population is required to assess accuracy and effectiveness of the technique.

CLINICAL RELEVANCE/APPLICATION
QISS-ASL MRA is a safe, feasible non-contrast alternative for analysis of distal bypass targets in diabetic patients with symptomatic peripheral arterial disease.

SSK25-06
MR Imaging of Intraplaque Vasa Vasorum during Lipid-Lowering Therapy to Carotid Plaque with Thin Fibrous Caps: A Prospective Study in Chinese Patients
Bao Cui (Presenter): Nothing to Disclose, Lu Ma : Nothing to Disclose, Ruixue Du : Nothing to Disclose, Xu Han : Nothing to Disclose, Ping Ye : Nothing to Disclose, Jianming Cai : Nothing to Disclose

PURPOSE
To evaluate whether the intensive lipid therapy could reduce the intraplaque vasa vasorum perfusion in the carotid plaque overlaid thin fibrous caps by the dynamic contrast-enhanced (DCE) MRI.

METHOD AND MATERIALS
Study Population: Between March 2009 and March 2012, the prospective study, Rosuvastatin Evaluation of Atherosclerotic Chinese Patients (REACH Study, NCT 00885872), recruited 32 subjects with advanced lesions(≥3 mm thickness without >50% calcification), matched MRI scans and acceptable image quality. All subjects received rosuvastatin 5~20 mg/d to lower low-density lipoprotein cholesterol levels to < 80 mg/dl over the 24-month follow-up period. MR Imaging Protocol: Carotid standardized protocol and DCE-MRI were underwent at baseline and 3, 12 , 24 months at a 3.0T MR scanner. DCE-MRI using double inversion recovery technique was performed on six selected axial slices chosen from T1W imaging set at 15 times separated by a repetition interval of 16 seconds. The acquisition of the forth time was coincident with the initiation of the intravenous injection of 0.2 mmol/kg gadolinium-based contrast agent at a rate of 2 ml/sec through a power injector. Data analysis: The analysis of intraplaque vasa vasorum perfusion was performed using the population arterial input function and Patlak model to calculate pharmacokinetic parameters Ktrans and Vp based on its temporal changes in intensity on the ≥3 mm thick slice.

RESULTS
In total, 6 cases had thin fibrous caps without intraplaque hemorrhage. After 12 and 24 months of treatment, there was an obvious reduction was found in mean plaque Ktrans (0.0486 ± 0.0149[standard deviation] to 0.0422 ± 0.0166, 0.0370 ± 0.0179), no statistically significant trend between baseline and 3 months(0.0486 ± 0.0149). The thinning of fibrous caps might be gradually thickening within the first one year after treatment.

CONCLUSION
In conclusion, evaluation of effects of lipid-lowering therapy on atherosclerotic plaque with thinning fibrous caps should be focused on inflammatory activity rather than plaque burden. Intraplaque pharmacokinetic parameters of DCE-MRI has the most possibility to become the biomarker in vivo, noninvasively.

CLINICAL RELEVANCE/APPLICATION
Imaging markers of inflammation by the DCE-MRI may monitor the early response of the beneficial therapy to
carotid plaque overlaid thin fibrous caps, in vivo.

**SSK25-07**

**Vessel Wall Changes in Patients with Systemic Lupus Erythematosus Compared to Controls: A Preliminary MR Imaging Study in Carotid Artery**

Wei Zhang (Presenter): Nothing to Disclose, Jie Sun: Nothing to Disclose, Bin Zhou: Nothing to Disclose, Jianrong Xu: Nothing to Disclose, Chun Yuan PhD: Research Grant, Koninklijke Philips NV Consultant, Bristol-Myers Squibb Company Consultant, Koninklijke Philips NV

**PURPOSE**

Patients with systemic lupus erythematosus (SLE) have markedly increased risk of cardiovascular events. In this preliminary study, we sought to use MR imaging to examine any abnormalities in fine structures of carotid vessel wall in patients with SLE by comparing them to age- and sex-matched controls.

**METHOD AND MATERIALS**

We evaluated bilateral carotid arteries of 43 SLE subjects and 18 controls, who were without documented cardiovascular disease, using a 3T scanner and carotid surface coils. Black-blood vessel wall imaging, including non-contrast T1-, T2- and proton-density-weighted sequences as well as a T1-weighted dynamic contrast-enhanced sequence (in 28 SLE subjects and 12 controls with contrast injection), was performed to detect: 1) any focal or diffuse wall thickening in the segment (3.2 cm) around carotid bifurcation; and 2) vessel wall enhancement in the common carotid artery. Per-slice measurements from control subjects were used to establish the 95% upper limits of maximum wall thickness and maximum-to-minimum wall thickness ratio for each of the three sub-segments (common carotid, carotid bulb, internal carotid), which were subsequently used as reference to define wall thickening in all subjects. Percent wall enhancement at a given time point (180 seconds after contrast injection) was calculated using signal intensity measurements on post- and pre-contrast images.

**RESULTS**

Any wall thickening (in common carotid, carotid bulb or internal carotid; in left or right carotid) defined using segment-specific thresholds of absolute wall thickness or wall thickness ratio was found in 18 (41.9%) subjects with SLE compared to 2 (11.1%) in the control group (p=0.02). In the subset of study sample with contrast injection, substantial wall enhancement was observed in subjects with SLE but not in controls (p=0.012).

**CONCLUSION**

This represents one of the first attempts that use novel cardiovascular imaging approaches to understand the pathological basis of increased cardiovascular risk in patients with SLE.

**CLINICAL RELEVANCE/APPLICATION**

MR imaging, as a useful way in detecting early premature atherosclerosis, can guide the therapy in clinic and improve survival in SLE patients.

**SSK25-08**

**Competing with the Gold-standard: Ultra-high-Resolution TOF MRA at 7T versus DSA for Assessment of Arteriovenous Malformations**

Lale Umutlu MD (Presenter): Consultant, Bayer AG, Karsten Wrede: Nothing to Disclose, Christoph Moenninghoff MD: Nothing to Disclose, Philipp Dammann: Nothing to Disclose, Soren Johst: Nothing to Disclose, Michael Forsting MD: Nothing to Disclose, Marc U. Schlamann: Nothing to Disclose

**PURPOSE**

With digital subtraction angiography remaining to be the gold-standard, 1.5 Tesla TOF MRA is known to offer high-quality, non-invasive assessment of AVM. Nevertheless, 1.5 TOF MRA shows limitations due to its restricted spatial resolution. Hence, the aim of this trial was to compare the diagnostic competence of ultra-high-resolution 7 Tesla TOF MRA with digital subtraction angiography (DSA) for assessment of AVM.

**METHOD AND MATERIALS**

17 patients with known AVM underwent pretreatment DSA and a 7T MR examination (Magnetom 7T, Siemens Healthcare) obtaining an ultra-high-resolution TOF MRA (voxel size of 0.2 x 0.2 x 0.2 mm³). Two readers in consensus evaluated the delineation of the AVM regarding the (1) nidus, (2) feeder, (3) drainer, (4) relationship between AVM and the adjacent brain structures, (5) vessel-tissue contrast as well as (6) artifact impairment for both datasets using a 5-point scoring system. Wilcoxon rank test was applied for assessment of statistical significance.

**RESULTS**

Both imaging modalities provided high-quality vessel delineation, showing comparably high ratings for the assessed features (DSA: mean nidus = 4.7; 7T: mean nidus = 4.6 / DSA: mean feeder vessel = 4.9; 7T mean feeder = 4.8). Furthermore, 7T TOF MRA allowed for high-quality assessment of the relationship between AVM and adjacent brain structures. Signal variations led to minor non-significant impairments of TOF MRA (mean 4.5).
CONCLUSION

Based on high vessel-tissue contrast and high spatial resolution, 7T TOF MRA bears the potential to be an equivalent non-invasive alternative to DSA with the benefit of sparing ionizing radiation and the application of contrast agent. Furthermore, it offers additional diagnostics of the relationship between AVM and adjacent brain structures.

CLINICAL RELEVANCE/APPLICATION

7T TOF MRA may serve as a high-quality non-invasive alternative for assessment, pretherapeutic planning and follow-up of AVM, sparing ionizing radiation and the application of iodinated contrast agent.

Utility of TWIST Magnetic Resonance Angiography for Pre-ablation Planning in Patients with Atrial Fibrillation: Comparison with Traditional Techniques


PURPOSE

Bolus timing is critical to optimal magnetic resonance angiography (MRA) acquisitions but can be challenging in some patients. Our purpose was to evaluate whether contrast-enhanced time-resolved interleaved stochastic trajectories (TWIST), a dynamic multiphase sequence that does not rely on bolus timing, is a viable alternative method to three-dimensional fast-long angle shot (FLASH) in patients with atrial fibrillation.

METHOD AND MATERIALS

Coronal subtracted MRA images from 20 patients with TWIST MRA performed for vascular mapping prior to atrial fibrillation ablation were compared to 20 patients with 3D FLASH MRA. The default TWIST protocol was modified to maximize spatial resolution at the expense of temporal resolution (7.4 sec). In-plane spatial resolution for both TWIST and FLASH was 1.0 x 1.0 mm. TWIST slice thickness was 1.5 mm; FLASH was 1.2 mm. Contrast dose was 0.2 mmol/kg, injected at 5 mL/sec for TWIST and 2 mL/sec for FLASH MRA. Left atrial signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were measured for the FLASH MRA and for the phase of the TWIST MRA demonstrating the best atrial enhancement. Quality was assessed in a blinded fashion on a 1-5 scale for relative left atrial opacification, left atrial contrast uniformity and overall study quality.

RESULTS

TWIST SNR was significantly higher than that of 3D FLASH MRA (13.7 ± 3.3 vs 8.5 ± 2.1, p<0.001). TWIST CNR was not different than that of 3D FLASH MRA (p=0.08). Qualitative uniformity of left atrial enhancement was significantly higher with TWIST than FLASH MRA (4.8 ± 0.4 vs 4.2 ± 0.4, p<0.001), whereas relative atrial opacification (4.7 ± 0.5 vs 4.1 ± 1.3, p=0.06) and overall study quality were not different between TWIST and FLASH MRA (p=0.17).

CONCLUSION

TWIST modified to maximize spatial resolution offers an alternative method for performing high quality MRA examinations in patients with atrial fibrillation. TWIST offers greater signal-to-noise ratio and improved left atrial enhancement compared to traditional FLASH MRA techniques, without the challenges of proper bolus timing.

CLINICAL RELEVANCE/APPLICATION

TWIST can be used instead of traditional 3D MRA to image patients undergoing vascular mapping prior to atrial fibrillation ablation. Without the need for proper bolus timing, TWIST offers a straightforward push-button method for capturing optimal left atrial opacification due to its dynamic multiphase acquisition.
**PURPOSE**

To investigate the optimal energy level of monochromatic images (MIs) for CT angiography (CTA) of mesenteric vasculature by single-source dual-energy CT (ssDECT) with fast kVp switching.

**METHOD AND MATERIALS**

In 38 consecutive patients (20 men, 18 women; mean age, 64 ± 15 years; mean body mass index, 22.8 ± 3.1 kg/m²) undergoing CTA during the arterial phase by ssDECT (tube voltage: 80 and 140 kVp, switched during a single projection in as little as 0.25 msec; helical pitch: 1.375; collimation: 64 × 0.625 mm; noise index: 10 HU for 5-mm reconstruction; contrast medium dose: 600 mg I/kg; injection time: 30 sec), we measured averaged CT value of the abdominal aorta and its proximal branches (CT1) and the psoas muscles (CT2), standard deviation of CT value in the psoas muscles as objective noise (SD), and signal-to-noise ratio (SNR) as CT1 / SD and contrast-to-noise ratio (CNR) as (CT1 - CT2) / SD between the arteries and muscles on MIs at 40-90 keV. Two radiologists independently graded from one (poor) to five (excellent) the delineation of distal branches of the superior mesenteric artery, artifacts, and overall noise on maximal intensity projection CTA at 40, 55, 60, 70, and 85 keV. We compared those results among different energy levels using Tukey-Kramer test. We quantified inter-reader agreement regarding the subjective results using Cohen’s κ-statistics.

**RESULTS**

The CT value (CT1) steadily increased to 40 keV (1034.9 ± 264.5 HU); objective noise (SD) showed a trough at 71 keV (13.8 ± 2.1 HU) and increased to 40 keV (38.0 ± 6.0 HU); SNR was highest at 40 (27.7 ± 8.0) and 65 keV (27.2 ± 8.2) and CNR, at 40 (25.2 ± 8.2) and 61 keV (23.1 ± 8.1). The averaged subjective branch delineation was significantly higher at 40 (4.7 ± 0.6) than 60-85 keV (2.6 ± 0.8-4.3 ± 0.7); artifacts and noise improved significantly from 40 (3.8 ± 0.5; 3.6 ± 0.5, respectively) to 55 (4.4 ± 0.6; 4.6 ± 0.5) to 60-85 keV (4.9 ± 0.3; 4.9 ± 0.3-5.0 ± 0.2). The inter-reader agreement was substantial to excellent (kappa = 0.77-1.00).

**CONCLUSION**

The optimal energy level for CTA in the evaluation of mesenteric vasculature by ssDECT is 40 or approximately 60 keV.

**CLINICAL RELEVANCE/APPLICATION**

In CTA of mesenteric vasculature by ssDECT, MIs at 40 keV should be used to depict small peripheral branches and diseases; otherwise, approximately 60 keV, as the standard of choice.

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**CT Angiography of Profunda Artery Perforating Arteries before Free Flap Breast Reconstruction (Station #2)**

Daniel Rodriguez Bejarano MD (Presenter): Nothing to Disclose, Jose Antonio Narvaez MD: Nothing to Disclose, Javier Hernandez Ganan: Nothing to Disclose, Anna Lopez Ojeda: Nothing to Disclose, Tiago Gomes Rodrigues: Nothing to Disclose

**PURPOSE**

Profunda Artery Perforator (PAP) flap is a new therapeutic alternative in autologous breast reconstruction. Is an excellent option in patients with surgical contraindications to abdominal tissue transfer (previous abdominoplasty), thinness or patient’s wish. Our purpose is to describe the imaging features of these branches and their correlation to suitable perforants intraoperatively.

**METHOD AND MATERIALS**

Since the introduction of this new surgical technique in our hospital, a preoperative CTA was done in all cases. In 38 consecutive patients (20 men, 18 women; mean age, 64 ± 15 years; mean body mass index, 22.8 ± 3.1 kg/m²) undergoing CTA during the arterial phase by ssDECT (tube voltage: 80 and 140 kVp, switched during a single projection in as little as 0.25 msec; helical pitch: 1.375; collimation: 64 × 0.625 mm; noise index: 10 HU for 5-mm reconstruction; contrast medium dose: 600 mg I/kg; injection time: 30 sec), we measured averaged CT value of the abdominal aorta and its proximal branches (CT1) and the psoas muscles (CT2), standard deviation of CT value in the psoas muscles as objective noise (SD), and signal-to-noise ratio (SNR) as CT1 / SD and contrast-to-noise ratio (CNR) as (CT1 - CT2) / SD between the arteries and muscles on MIs at 40-90 keV. Two radiologists independently graded from one (poor) to five (excellent) the delineation of distal branches of the superior mesenteric artery, artifacts, and overall noise on maximal intensity projection CTA at 40, 55, 60, 70, and 85 keV. We compared those results among different energy levels using Tukey-Kramer test. We quantified inter-reader agreement regarding the subjective results using Cohen’s κ-statistics.

**RESULTS**

The CT value (CT1) steadily increased to 40 keV (1034.9 ± 264.5 HU); objective noise (SD) showed a trough at 71 keV (13.8 ± 2.1 HU) and increased to 40 keV (38.0 ± 6.0 HU); SNR was highest at 40 (27.7 ± 8.0) and 65 keV (27.2 ± 8.2) and CNR, at 40 (25.2 ± 8.2) and 61 keV (23.1 ± 8.1). The averaged subjective branch delineation was significantly higher at 40 (4.7 ± 0.6) than 60-85 keV (2.6 ± 0.8-4.3 ± 0.7); artifacts and noise improved significantly from 40 (3.8 ± 0.5; 3.6 ± 0.5, respectively) to 55 (4.4 ± 0.6; 4.6 ± 0.5) to 60-85 keV (4.9 ± 0.3; 4.9 ± 0.3-5.0 ± 0.2). The inter-reader agreement was substantial to excellent (kappa = 0.77-1.00).

**CONCLUSION**

The optimal energy level for CTA in the evaluation of mesenteric vasculature by ssDECT is 40 or approximately 60 keV.

**CLINICAL RELEVANCE/APPLICATION**

In CTA of mesenteric vasculature by ssDECT, MIs at 40 keV should be used to depict small peripheral branches and diseases; otherwise, approximately 60 keV, as the standard of choice.
Evaluation of Vascular Images Using with MDCT (Multi Detector Computed Tomography) Reconstructed by Multi-Phase Volume Interpolation Technology (Station #3)

Hiroichi Yokoyama MS (Presenter): Nothing to Disclose, Kensuke Fujita RA: Nothing to Disclose, Toru Kimura RT: Nothing to Disclose, Satoshi Fujita: Nothing to Disclose, Shinzo Nishi MD, PhD: Nothing to Disclose

PURPOSE

Reconstruction of Computed Tomography (CT) Cine mode images are not established yet, otherwise Magnetic Resonance (MR) images which has high quality of contrast, and/or Echo images with real time can be seen, are very useful for clinical examination. The quality of thoracic aortic fourth dimensional (4D) images with ECG-gated are not so enough, because of the radiation exposure. So we have reconstructed the blood flow CT images using with the new algorithm, Multi-Phase Volume Interpolation Technology (MVIT), then evaluated with the original images and new technical images.

METHOD AND MATERIALS

MVIT has two purposes for the images, a non-rigid registration based algorithm, 4D volumetric imaging simply presents the volume grid of voxels and fades from one phase to the next to show apparent motion. This voxel-to-voxel mapping of information enables the employment of additional algorithms that reduce noise, improve motion coherence, and measure function. First, we have studied the image quality of noise, using with the water phantom, standard deviation (SD) values were evaluated the original and the MVIT images. The results were mean SD values, 35.3/20.1 (original/MVIT), and with clinical CT images of the thoracic aortic aneurysm with dissection, which parts of the cardiac muscle, left ventricle and descending aortic artery. The results were 40.3, 38.1, 33.6/34.3, 30.8, 24.5 (original/MVIT). We have evaluated the quality of 4D images of thoracic aortic aneurysm with dissection, reconstructed the enhanced CT examination with the ECG-gated images from 0% to 90% phases, total 10 phases axial images. The 3D/4D blood flow images was evaluated with these axial images, using with the algorithm of 4D motion analysis which quantifies regional displacement and velocity color mapping of blood flow of thoracic aortic aneurysm with dissection.

RESULTS

MVIT can improve the image quality by reducing noise, and 3D/4D images reveal very reality and with clearly visible view. Furthermore we have demonstrated functional blood flow with aortic dissection.

CONCLUSION

This algorithm suggestions that may be widely applied in near future.

CLINICAL RELEVANCE/APPLICATION

Using with the algorithm of MVIT, it could be made the visualization of turbulence flow image by MDCT.

Combined Therapy of TACE and RFA for Medium-sized Hepatocellular Carcinoma: Is Treatment Efficacy Affected by Amount of Lipiodol Uptake within the Tumor? (Station #4)

Jin Woong Kim MD (Presenter): Nothing to Disclose, Sang Soo Shin MD: Nothing to Disclose, Suk Hee Heo MD: Nothing to Disclose, Hyo Soon Lim MD: Nothing to Disclose, Yong-Yeon Jeong MD: Nothing to Disclose, Heoung-Keun Kang MD: Nothing to Disclose

PURPOSE

To evaluate the effect of the amount of lipiodol uptake within HCC, which were infused during TACE before RFA, on treatment efficacy when performing combined therapy of TACE and RFA for medium-sized HCC.

METHOD AND MATERIALS

A total of 106 consecutive patients (mean age, 63 years) with 124 HCCs (mean ± SD, 3 cm ± 0.8), who underwent combined therapy of TACE and RFA for HCCs, were included in this study. All patients had single (n=88) or two (n=18) HCCs ranging between 2 cm and 5 cm. According to amount of lipiodol uptake within HCC, which was evaluated on angiographic CT images, patients were classified into 3 groups [compact (>75%), defective (25% ~ 75%), faint or no uptake (<25%)]. Patients were followed up for 1.1 ~ 68.6 months (mean ± SD, 26.1 ± 13.4). Among 3 groups, technical success, technical effectiveness and rates of local tumor progression were compared according to per-lesion-based analyses. Three groups were compared regarding incidence of complications, rates of recurrence-free survival and overall survival rates based on per-patient-based analyses. Statistical analyses were conducted with Chi-square test, one-way ANOVA statistics and Kaplan-Meier method.

RESULTS

Regarding amount of lipiodol uptake, 106 patients and 124 HCCs were classified as compact (n=59 and 67, respectively), defective (n=35 and 43, respectively), faint or no uptake (n=12 and 14, respectively) group. There were no significant differences in patients' demographics and characteristics of HCCs among 3 groups (P > 0.05). The technical success and effectiveness were achieved in 124 (100%) and 122 (98.4%), respectively, of 124 HCCs. The local tumor progression occurred in 8 (7.5%) of 67 HCCs with compact uptake, 6 (14%) of 43 HCCs with defective uptake, and 1 (7.1%) of 14 HCCs with faint or no uptake (P > 0.05). There were no statistically significant differences among 3 groups regarding incidence of complications, rates of recurrence-free survival and overall survival rates (P > 0.05).
CONCLUSION

The amount of lipiodol uptake within HCC played little role in terms of treatment efficacy when performing combined therapy of TACE and RFA for medium-sized HCC.

CLINICAL RELEVANCE/APPLICATION

Synergistic effects of combined therapy of TACE and RFA for medium-sized HCC appear to root from decreased arterial blood flow induced by TACE, irrespective of the amount of lipiodol uptake within the tumor.

VIS246

Diagnostic Accuracy of Contrast-enhanced T1 Free-breathing Gradient Echo Sequences in the Assessment of Aortic Disease: Comparison with Standard T1 Breath-hold Gradient Echo 3D Angiographic Sequences (Station #5)

Camillo Roberto Giovanni Leopoldo Talei Franzesi (Presenter): Nothing to Disclose, Davide Ippolito MD: Nothing to Disclose, Pietro Andrea Bonaffini MD: Nothing to Disclose, Davide Fior MD: Nothing to Disclose, Andrea Nasatti: Nothing to Disclose, Sandro Sironi MD: Nothing to Disclose

PURPOSE

To compare the diagnostic performance of contrast-enhanced T1 free-breathing gradient echo sequences with standard MR-angiographic sequences in the assessment of aortic disease.

METHOD AND MATERIALS

From January 2012 to December 2013, 41 patients (16 women; 25 men; mean age 60.1; range, 31-80 years) with known or clinical suspicion of aortic disease were evaluated. All patients underwent an MR angiography (MRA) study of aorta on a 1.5T magnet (Achieva, Philips), using a phased array multi-coil, after the intravenous injection of 0.1mL*Kg of gadobutrol, with standard protocol and acquiring 3D-angiographic T1 gradient-echo fat-suppressed (3D-HR) sequences. Moreover, multiplanar T1 free-breathing gradient-echo fat-suppressed (THRIVE-FB) sequences were also performed. For each patient, two blinded radiologists independently compared the diagnostic quality of the different angiographic sequences, in terms of aortic wall and lumen and main branches visualization. The vascular diameters at different aortic levels were also calculated, compared and statistically analyzed between the different sequences. The interobserver agreement was then evaluated using the Intraclass Correlation Coefficient (ICC).

RESULTS

The THRIVE-FB sequences showed high diagnostic accuracy in the evaluation of vascular diameter and walls, with a significant higher sensitivity and specificity in the assessment of vascular plaques, thrombus and adjacent structures, in comparison with 3D-HR. The 3D-HR sequences better visualized the vascular lumen with lower flow artifacts, than THRIVE-FB sequences. Not significant differences were obtained in terms of diagnostic quality between 3D-HR and THRIVE-FB sequences and a high interobserver agreement was found, with an ICC of 0.97.

CONCLUSION

Contrast-enhanced T1 free-breathing gradient-echo fat-suppressed sequences (THRIVE-FB) were able to correctly visualize and evaluate the aorta and its major branches, with no significant differences in comparison with standard breath-hold angiographic sequences, allowing to cover large volume, even in not compliant patients.

CLINICAL RELEVANCE/APPLICATION

Free-breathing angiographic protocol permits to correctly evaluate thoracic and abdominal arteries, without any significant breathing artifacts, representing a useful tool in not compliant patients.

VIS248

Can Patient Radiation Dose Be Drastically Reduced for Monitoring CT Guided Catheter Placement? (Station #6)

Yasir Andrabi MD, MPH (Presenter): Nothing to Disclose, Jorge Mario Fuentes MD: Nothing to Disclose, Mukta Dilipkumar Agrawal MBBS, MD: Nothing to Disclose, Dushyant V. Sahani MD: Research Grant, General Electric Company

PURPOSE

Increased utilization of image guided catheter placement especially for no-cancer indications has increased concerns for radiation exposure. Image quality (IQ) expectations in follow up (F/U) exams are much lower than initial diagnostic exam. We investigated the performance of low dose follow up CT exams for IQ and radiation doses compared to baseline abdomen-pelvic CT exams in patients undergoing CT guided catheter placement.

METHOD AND MATERIALS

Between December 2012 to December 2013, 264 patients (M:F=135:129; BW=77.5kg, Age=61.5) had initial
and F/U CT exams performed for CT guided catheter placement on 2 GE Healthcare scanners [LightSpeed Pro-16 (FBP=133) and Discovery 750HD(ASiR=130)]. The scanning parameters for F/U exams included weight based kVp (FBP:100/120, IR: 80/100), low mA(75-350) and NI(FBP:25, IR:30) Patient demographics and radiation dose (CTDI, SSDE, DLP, Effective dose(ICRP 103), dose per organs) were retrieved using an automated dose tracking software (eXposure, Radimetrics) and were compared with the baseline CT exam. Subjective IQ assessment of F/U exams to determine diagnostic acceptability was done.

RESULTS
The overall IQ was acceptable for interpretation in F/U exams. Mean SSDE for F/U exams were 3.8 mGy compared to 9.4 mGy for baseline CT exams corresponding to nearly 65% dose reduction (p<0.0001). Mean radiation doses (SSDE) were 73% lower in F/U exams performed with ASiR technique compared to 48% with FBP technique (mGy, ASiR=2.6, FBP=4.9; p<0.0001). Doses are nearly 80% lower than ACR reported doses for routine abdomen CT exams.

CONCLUSION
Customizing scan protocols for F/U indications enables substantial dose reduction (65%) compared to baseline diagnostic CT exams. These dose reduction benefits are more drastic in scanners with IR algorithms (73%) compared to FBP exams (48%).

CLINICAL RELEVANCE/APPLICATION
Continuous protocol optimization based on image quality expectations and clinical indications is integral for adherence to ALARA principle. These are especially true for indications with lower IQ expectations and exams needing repeated follow ups.

VIS247
Nonenhanced Peripheral 3D-TSE-MR-Angiography: Optimizing Resolution and Trigger Delays (Station #7)
Thomas Josef Vogl MD, PhD (Presenter): Nothing to Disclose, Carl Hormes : Nothing to Disclose, Adel Maataoui MD : Nothing to Disclose, Frank Hubner MS : Nothing to Disclose, Martin Beeres MD : Nothing to Disclose

PURPOSE
To optimize resolution and trigger delays in a nonenhanced electrocardiogram (ECG)-triggered flow sensitive 3D-TSE sequence for the distal lower extremities in healthy subjects.

METHOD AND MATERIALS
120 MR angiographies of 20 healthy volunteers (10 males, 10 females; mean: 33 years) were assessed with six different acquisition setups in a 1.5 T MRI scanner (Siemens Avanto). Setups consisted of the combination of a specific isovolumetric voxel size (A = 0.9 mm3, B = 1.25 mm3, C = 1.5 mm3) with a particular trigger delay (1 = peak - 30ms, 2 = beginning of the peak). Images were rated using a 5-point-scale by two experienced radiologists in 6 anatomical regions of each leg (A. poplitea III, outlet A. tibialis ant., A tibialis ant., outlet A. tibialis post., A. tibialis post., A. fibularis). Signal-to-noise (SNR) ratio was evaluated.

RESULTS
Intraclass correlation (0.755) was taken to show interrater reliability between the two readers. Evaluation of the setups indicated a significant difference (p<0.000). Setup combination B.1. showed best image quality: none or minor venous overlay in 95% and none or minor artifacts in 85%. Combination B.1 showed significant improvement in comparison to the other combinations A.2. (p<0.000), C.2. (p<0.000) , and B.2. (p 0.017). SNR evaluation underlined these results.

CONCLUSION
Non-enhanced 3D-TSE-MR angiography is a good imaging modality for the lower extremities and showed good results in healthy volunteers. Combination setup B.1. demonstrated a significant superiority over the other evaluated setups with a solid robustness against venous overlay and image artifacts.

CLINICAL RELEVANCE/APPLICATION
3D-TSE MR sequence allows a precise visualization of pathologies of distal lower extremities.

VIS252
Evaluation of In-situ Nanocarbon-Assisted Microwave Therapy (NAMT) Causing Cytotoxic Thermal Ablation of Human Prostate Tumor Cells in Nude Mice (Station #8)

PURPOSE
Evaluation of long term toxicity of a spherical nanocarbon (Grafex) injected into known Human Prostatic carcinoma. It is known that NAMT increases the absorption of microwave energy, specifically into tumor cells. This study evaluated the use of NAMT as primary treatment in human prostate tumor. Additionally, we assessed the toxic burden of nanocarbon used during treatment.
METHOD AND MATERIALS

10 Nude nu/nu isolated mice were injected with DU145 (ATC#HTB-81) 1x 10^7 Human Prostate carcinoma cells introduced into the dermis and allowed to grow to >1cm. Afterwards, 8 mice received treatment with the microwave and 292 molar concentration of nanocarbon, 1 control received no treatment, and 1 control received only an injection of 292 nanocarbon. In the ‘treatment’ group, nanocarbon and viscous carrier were injected into the tumors. Medwave generators with microwave probes were used for thermal ablation, with short cycle power using 10 watts at 15 sec as baseline settings. Target temperature within the tumor was 60°C.

RESULTS

5/8 (62.5%) of the treated mice were alive at 18 months with no signs of toxicity or tumor recurrence. One mouse had a non-treated skin ulcer from the non-cooled microwave probe during the treatment process and was euthanized, but was responding to treatment. 2/8 (25%) were alive at 22 months, which is well above their expected life span of 6 months to 1 year. The control non-treated mouse was euthanized due to metastatic prostate cancer 3 weeks after initial injection. The mouse which received only nanocarbon treatment had no change in tumor size. The treated mice were observed to have no toxic effects from the nanocarbon.

CONCLUSION

NAMT maximizes energy transfer, with the conversion of microwave energy causing thermal ablation of cancer cells. By using shorter treatment times and lower power output of the microwave generator, NAMT reduces heat sink effect and surrounding tissue damage. Grafex NAMT appears to be not only successful in treatment of human prostate carcinoma, but also nontoxic in this small animal study. A larger study is under way.

CLINICAL RELEVANCE/APPLICATION

Nanocarbon-assisted microwave therapy provides increased thermal energy transfer, shorter treatment times and non-toxic treatment of human prostate tumor cells, and may represent a powerful new tool in cancer therapy.

VIS-WEB

Vascular/Interventional Wednesday Poster Discussions

**Scientific Posters**

**IR**

VA

AMA PRA Category 1 Credits ™: .50

**Wed, Dec 3 12:45 PM - 1:15 PM  Location: VI Community, Learning Center**

**Sub-Events**

**VIS257**

Dual-Energy CT Angiography for the Assessment of Lower Extremity Peripheral Arterial Disease (Station #1)

Torel Ogur MD (Presenter): Nothing to Disclose, Patrick T. Norton MD: Nothing to Disclose, Klaus D. Hagspiel MD: Research Grant, Siemens AG

**PURPOSE**

To evaluate the effect of automatic bone and plaque removal on image quality and grading of stenoocclusive lesions in peripheral arterial disease (PAD) patients undergoing dual energy CT angiography (DE-CTA) of the lower extremity (LE) and to compare with digital subtraction angiography (DSA) as the reference standard.

**METHOD AND MATERIALS**

Twenty one PAD patients underwent both DE-CTA and DSA (13 men, 8 women, mean age 62.8 years; range 40-91). DE-CTA (Siemens Somatom Definition Flash, Siemens Medical Solutions, Forchheim, Germany) was performed within a month of the intraarterial DSA (Axiom Artis Siemens Medical Systems, Forchheim, Germany). We compared the results of image interpretation based on axial source images and MPR images without (SIMPR) and with dual energy bone and plaque removal (DEBPR) with DSA. Fifteen arterial segments per lower extremity were analyzed with the segments classified into 3 groups - inflow, outflow and runoff. The sensitivity (SE), specificity (SP) and diagnostic accuracy (ACC) for the detection of relevant stenosis (>69%) or occlusions for each set of images were calculated against DSA findings as the reference standard.

**RESULTS**

A total of 323 segments for 21 patients (25 LE arteries) were evaluated. For inflow vessels; SE, SP, and ACC were 83.33%, 96.18% and 96.72%, respectively for SIMPR, and 100% for all three for DEBPR. For outflow vessels SE, SP, and ACC were 76.19%, 94.12% and 89.88% for SIMPR, and 100%, 91.18% and 93.25% for DEBPR. For runoff vessels we found 67.24%, 80.87% and 76.30% for SIMPR, and 91.38%, 70.43% and 77.45% for DEBPR.

**CONCLUSION**

DECT based plaque and bone removal improves the sensitivity, specificity and accuracy of lower extremity CTA, particularly for the inflow and outflow vessels. The automated plaque removal tool improves luminal assessment and the automated bone removal tool allows reliable segmentation of bone.
Dual energy based automated bone and plaque subtraction allows to improve the sensitivity, specificity and accuracy of lower extremity CTA over conventional CTA, particularly in the iliofemoral and popliteal arteries.

**Depiction of Transplant Renal Vascular Anatomy and Complications: Un-enhanced MR Angiography by Using Spatial Labeling with Multiple Inversion Pulses (Station #2)**

**Hao Tang (Presenter):** Nothing to Disclose, **Zi Wang:** Nothing to Disclose, **Xiaoyan Meng MD:** Nothing to Disclose

**PURPOSE**

To evaluate ability to depict anatomy and complications of renal vascular transplant with unenhanced magnetic resonance (MR) angiography with spatial labeling with multiple inversion pulses (SLEEK), and to compare the results with color Doppler (CD) ultrasonography (US), digital subtraction angiography (DSA), and intraoperative findings.

**METHOD AND MATERIALS**

This study was approved by the institutional review board and written informed consent was received before examination. Seventy-five patients who underwent renal transplant were examined with unenhanced MR angiography with SLEEK and CD US. DSA was performed in 15 patients. Surgery was performed in eight patients. The ability of SLEEK to show transplant renal vascular anatomy and complications was evaluated by two experienced radiologists who compared the results with CD US, DSA, and intraoperative findings.

**RESULTS**

Patients successfully underwent SLEEK MR angiography. Transplant renal vascular anatomy was assessed in 87 arteries and 78 veins. Twenty-three patients were diagnosed with renal vascular complications from transplantation, which included 14 with arterial stenosis, three with arterial kinking, two with arteriovenous fistulas, two with venous stenosis, one with pseudoaneurysms, and one with fibromuscular dysplasia. Three patients had two renal transplants and nine patients had nine accessory renal arteries. More accessory renal arteries were detected with SLEEK than with CD US. Correlation was excellent between the stenosis degree with SLEEK and DSA ($r= 0.96; P$)

**CONCLUSION**

Unenhanced MR angiography with SLEEK preliminarily proved to be a reliable diagnostic method for depiction of anatomy and complications of renal vascular transplant. It may be used for evaluation of patients with renal transplantation, and in particular for those with renal insufficiency.

**Unenhanced MR Angiography by using SLEEK may be a reliable diagnostic method for depiction of transplant renal vascular anatomy and complications; furthermore, it does not carry the risk of nephrogenic systemic fibrosis and contrast-induced nephropathy in patients with renal insufficiency.**

**Intra-individual Comparison of Gadofosveset Trisodium and Gadobenate Dimeglumine for Contrast-enhanced MRA of Pancreas Transplants at 3T (Station #3)**

**Lucia Flors MD (Presenter):** Nothing to Disclose, **Marta Gonzalez MD:** Nothing to Disclose, **Patrick T. Norton MD:** Nothing to Disclose, **James Patrie MS:** Nothing to Disclose, **Klaus D. Hagspiel MD:** Research Grant, Siemens AG

**PURPOSE**

To compare the image quality and diagnostic performance of gadofosveset trisodium (GT) and gadobenate dimeglumine (GD) for contrast-enhanced MRA of pancreas transplants on first pass (FPI) and very high-spatial resolution steady state imaging (SSI) at 3T

**METHOD AND MATERIALS**

18 patients (11 men; 43.4±7 years) were studied with both agents; a total of 42 studies -21 intraindividual comparison pairs- were available for review. SNR and CNR were measured on FPI and SSI images for pancreatic parenchyma, arteries and veins. Results were adjusted for patient weight, voxel volume and delay time. Two independent readers subjectively assessed the overall image quality, the presence of artifact due to respiratory motion or peristalsis, and the quality of the bolus timing using a 4-point scale. Highest order visible side branch, vessel patency (5-point scale) and level of confidence (4-point scale) were recorded. In case of disagreement, the diagnosis was reached by consensus. Inter-reader agreement was calculated.

**RESULTS**

Pancreatic parenchyma, aorta and pancreatic artery SNRs were higher for GD on FPI ($p<0.08$), and did not differ on SSI ($p>0.1$). Pancreatic vein, IVC and muscle SNRs were comparable for FPI and SSI ($p>0.1$). Pancreatic artery CNR was higher for GD ($p=0.030$) on FPI, whereas GD and GT were comparable ($p=0.35$) on SSI. Pancreatic vein CNR was comparable for FPI and SSI ($p>0.11$). There was no difference between the two agents in image quality, presence of artifacts and bolus timing ($p>0.2$) for both FPI and SSI. Highest order of side branches and vessel patency ($p=0.167$ and $p>0.13$) did also not differ, with the exception of splenic vein patency ($p=0.04$; $2\pm 1.3$ GT vs $1.3\pm 1.1$ GD). Level of confidence did not differ ($p=0.139$) and there was also no significant difference in the odds of reader agreement between contrast agents.

**CONCLUSION**
GT and GD delivered overall similar image quality, but CNR and SNR were greater with GD on arterial-phase CLINICAL RELEVANCE/APPLICATION

Despite the potential benefits of the intravascular contrast agent GT, CNR and SNR in FP ce-MRA of pancreas transplants are higher with GD and they are comparable for both GD and GT on SSI. Therefore, the use of the more expensive contrast agent GT for ceMRA of pancreas allografts is not justified.

**Evaluation of Fluorescent Stains as Real-time Assessment of Incomplete Ablation of Colon Cancer Liver Metastases (Station #4)**


PURPOSE

To evaluate live cell fluorescent assessment as an immediate biomarker of complete ablation of colorectal cancer liver metastases (CLMs).

METHOD AND MATERIALS

This NIH-supported IRB-approved prospective study analyzed live tissue collected from the center and the margin of the percutaneous ablation zone of CLMs. 18-20 gauge core biopsy specimens collected from the ablation zone underwent fluorescence staining that generated composite images of nuclear Hoechst and MitoTracker Red stains within 30 minutes from radio frequency ablation. Subsequently, the exact same tissue samples were fixed and stained with standard Hematoxylin and Eosin morphologic stains. A blinded pathologist classified the composite fluorescent images into viable tumor vs. coagulation necrosis and normal liver cells. These were correlated with the blinded interpretation of the standard Hematoxylin and Eosin morphologic stain.

RESULTS

Initial results from 25 collected specimens in 14 patients with 15 ablated CLMs demonstrated a concordance rate of 88% (22/25) when assessing for the presence of tumor cells. Fluorescent stain sensitivity was 80% (4/5) for specimens positive on standard Hematoxylin and Eosin for tumor cells; Specificity was 90% (18/20).

CONCLUSION

Given the documented prognostic value of tissue characteristics on local tumor progression-free and overall survival in patients with CLMs, ablation zone evaluation with fluorescent stains may provide an immediate assessment of the ablation success and guide immediate or future additional therapies.

CLINICAL RELEVANCE/APPLICATION

Fluorescence imaging of liver tissue from the ablation zone may provide intra-procedural assessment of technical failure and guide decisions for additional therapy.

**CT-angiography with Low kV and Low Contrast Medium Volume Using a 256 Multi-detector CT Scanner in the Evaluation of Thoracic and Abdominal Aorta Disease: Diagnostic Efficacy and Radiation Dose Reduction (Station #5)**

Cammillo Roberto Giovanni Leopoldo Talei Franceschi (Presenter): Nothing to Disclose, Davide Ippolito MD: Nothing to Disclose, Pietro Andrea Bonaffini MD: Nothing to Disclose, Davide Fior MD: Nothing to Disclose, Pietro Allegranza MD: Nothing to Disclose, Sandro Sironi MD: Nothing to Disclose

PURPOSE

To assess the diagnostic quality and the radiation dose exposure of low-kV CT angiography study (100kV), by using ultra low contrast medium volume (40mL), for thoracic and abdominal aorta disease.

METHOD AND MATERIALS

From July 2011 to November 2013, 89 patients (33 women; mean age 65.7 years; range, 35-83 years; BMI<30), with thoracic or abdominal aortic disease, were prospectively examined with 256-MDCT scan (Brilliance iCT; Philips) using low-dose protocol (100kV; automated tube current modulation) and ultra low-contrast volume (40mL; 4mL/s; 350mgI/mL). For the evaluation of ascending aorta, an ECG-gated retrospective protocol was performed. A control group of 61 patients (21 women; mean age 66.4 years; range, 34-86 years), who underwent on the same scanner standard CT-angiography protocol (120kV; 350mAs), with standard contrast volume (80mL), was also evaluated. Density measurements were performed manually drawing a region of interest (ROI) on lumen of ascending aorta, arch, descending and abdominal aorta, renal arteries and common iliac arteries. The radiation dose exposure (dose-length product, DLP) was also calculated for both groups. Then, the obtained data were compared and statistically analyzed.

RESULTS
In all patients we could correctly visualize and evaluate lumen and walls of thoracic and abdominal aorta and main arterial branches. No significant difference of density measurements was achieved between low-kV group (mean attenuation value of thoracic aorta 321HU, abdominal aorta 332HU and renal arteries 338HU) and control group (mean value of thoracic aorta 316HU, abdominal aorta 327HU and renal arteries 307HU). The radiation dose exposure was significantly lower (p<0.05) in low-kV protocol (mean DLP thoracic 490mGy*cm; abdominal 335mGy*cm) than in control group (mean DLP thoracic 820mGy*cm; abdominal 952mGy*cm), with an overall reduction of 41% in the thoracic and 65% for abdominal study.

CONCLUSION

Low-kV CT angiography protocol maintain a high diagnostic performance similar to standard protocol, with a significant decrease of the radiation dose exposure as well as the contrast material volume, reducing also the risk of contrast-induced nephropathy.

CLINICAL RELEVANCE/APPLICATION

Low-kV and low-contrast volume CT-angiography allows to significant reduce the radiation exposure, maintaining high diagnostic quality and reducing the risk of renal impairment.

VIS254

Impact of Low Dose Protocols on Cumulative Radiation Dose in Patients Undergoing Repetitive Follow Up CT Exams for Image Guided Catheter Placement: Impact of Dose Modified Protocols on the Cumulative Radiation Dose in Patients Undergoing Repeat Abdomen (Station #6)

Yasir Andrabi MD, MPH (Presenter): Nothing to Disclose, Jorge Mario Fuentes MD: Nothing to Disclose, Koichi Hayano MD: Nothing to Disclose, Manuel Patino MD: Nothing to Disclose, Mukta Dilipkumar Agrawal MBBS, MD: Nothing to Disclose, Dushyant V. Sahani MD: Research Grant, General Electric Company

PURPOSE

Repeat CT exams following image guided catheter placement in the abdomen can result in substantial increase in cumulative radiation dose (CRD) exposure to patients. We have introduced dose modified protocols (DMP) to evaluate the success of IR catheter. We investigated the impact DMP on CRD in patients undergoing repeated catheter F/U exams.

METHOD AND MATERIALS

Between December 2012 to December 2013, 130 patients (M:F=68:62, BW=78.5 Kgs, Age= 59 Years) underwent F/U CT exams for image guided catheter placement on 64-slice GE Healthcare scanner (Discover CT750 HD). The scanning parameters for F/U exams included weight based kVp (80/100), low mA (75-350) and NI=30, while for baseline Abd-Pelvis CT exams included kVp=120, mA=(75-450), NI=18-22. Patient demographics, number of repeated exams and CRD were retrieved using an automated dose tracking software (eXposure, Radimetrics).

RESULTS

On an average, 3 F/U CT exams were performed per patient (Range 1-5) while average number of CT exams per patient/year was 6.5 (range: 1-26 exams). The mean CRD was 4888.8 mGy-cm (range: 232-26,200) with a linearity in number of CT exams and CRD (R2 =0.82, P<0.0001). With the increase in the number of CT exams performed per patient, an exponential decrease (R2=0.77) in the impact of DMP CT on CRD was noted (mean dose reduction=13%, Range: 5-80%, p=xx). A substantial impact DMP on CRD was noted for less than four CT exams performed per patient (33% reduction).

CONCLUSION

Using dose modified protocols in F/U CT exams can serve its intended purpose while lowering the cumulative radiation dose in patients undergoing repeated exams for image guided catheter placement followup. These dose reduction benefits are considerable for <4 repeated CT exams performed per patient.

CLINICAL RELEVANCE/APPLICATION

Repeated CT exams are associated with considerable CRD and significant radiation related side effects. Customizing protocols based on the clinical indication can significantly lower CRD especially in less complicated patients undergoing repeated CT exams for non-cancer indications.

VIS256

Dynamic CT Scanning and Enhancing Parameters’ Impact on Contrast Bolus Geometry during First-pass Arterial Enhancement: Well-controlled in Vitro Evaluation Using a Pulsatile Flow Model (Station #7)

Jongmin John Lee MD, PhD (Presenter): Nothing to Disclose, Ju-Young Kwon BSC: Nothing to Disclose, Jongmin Park: Nothing to Disclose, Jihoon Hong: Nothing to Disclose, Eun-Ju Kang: Nothing to Disclose, Sung Won Youn MD: Nothing to Disclose

PURPOSE

For compounder-less evaluation of the impact by scanning and enhancing parameters on the first-pass contrast bolus geometry during dynamically enhanced CT angiography
METHOD AND MATERIALS

A self-made closed-circuit pulsatile flow system was used for simulating pulmonary-aortic circulation. Heart rate setting ranged from 50 to 90bpm. The other flow parameters were set to be constant. Contrast injection rate was 1-5ml/sec and injection duration was fixed to 2 seconds. After bolus enhancement, at scanning module in flow system, 0.45-sec interval, single slice 16-channel CT scan repeated for 90 seconds. A time-HU curve was plotted on aortic lumen at every data set. Time-HU curve parameters were compared with input variables using a step-wise multiple regression analysis.

RESULTS

Total 135 data sets were acquired. The peak enhancement increased mainly by faster iodine deliver rate (IDR) and additionally by lower tube voltage (R2=0.816 and 0.919, p<0.001). Whereas, iodine concentration of contrast media and heart rate showed no incremental impact on peak enhancement. The time-to-peak enhancement was shortened by higher heart rate and additionally by faster IDR (R2=0.860 and 0.900, p<0.001). This influence increased by sequentially adding IDR and iodine concentration. Significantly influencing factors to the maximum ascending and descending gradients were IDR, tube voltage, and heart rate (p<0.001). Recirculation density was influenced by IDR, tube voltage, heart rate, and iodine concentration (p<0.022).

CONCLUSION

Among four input variables in this study, IDR and heart rate were critical variables to bolus geometry during first-pass arterial enhancement. Next, the tube voltage influenced on bolus geometry significantly, whereas iodine concentration of contrast media was revealed as an insignificant factor. Proper kVp and IDR would generate proper bolus geometry independently on the formulation of iodine contrast media.

CLINICAL RELEVANCE/APPLICATION

The iodine delivery rate and kVp, rather than iodine concentration, are critical parameters for superior bolus geometry during dynamically enhanced CT.

VIE027-b

Pre-procedural Care in Vascular and Interventional Radiology: What Every Resident Should Know (hardcopy backboard)

Bedros Taslakian MD (Presenter): Nothing to Disclose, Aghiad Al-Kutoubi MD : Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: To provide a comprehensive systematic approach to the essential steps in pre-procedural care. To review key history and physical examination findings and discuss the essential laboratory tests required in the pre-procedural period. To emphasize the importance of advance planning in achieving good outcome. To stress the fact that reviewing previous imaging studies and clinical data can aid in planning the procedure, suggesting alternative approach and avoiding complications. To provide a simple preparation plan for challenging cases.

TABLE OF CONTENTS/OUTLINE

- Introduction:
  - Practice of modern interventional radiology
  - Key questions in advance planning
- Patient referral and contact
  - Patient referral: how to approach?
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  - Review of history and physical examination
  - Review of previous laboratory data and imaging findings
  - Indications and informed consent
- Laboratory tests and correction of relevant abnormalities
  - Renal function
  - Coagulation parameters
- Patient preparation
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  - Contrast allergy pretreatment
  - Contrast-induced nephropathy prophylaxis
  - Prophylactic antibiotics
**SSM24-01**

**Should the Informed Consent Process for Interventional Radiology Procedures include the Risk of Radiation Exposure: The Interventional Radiology Patient Perspective**

**Rebecca Zener MD (Presenter):** Nothing to Disclose, Daniele Patrice Wiseman MD, FRCP: Nothing to Disclose, Amol Mujoomdar MD: Speaker, Cook Group Incorporated, Speaker, Covidien AG

**PURPOSE**

Radiation exposure is inherent in intervention radiology procedures. A potential exposure of 1 mSv has been suggested as a cutoff for provision of risk information, as it corresponds to a 1 in 10000 cancer risk. Informed consent requires disclosure of rare yet potentially significant risks, yet patient knowledge of these risks is lacking. The purpose of this study is to explore patient perception of cancer-related risk exposure and whether inclusion of radiation risks in the informed consent is warranted.

**METHOD AND MATERIALS**

A multiple-choice survey was prospectively administered to 26 adult interventional radiology patients at a tertiary care centre (patient mean age = 61.4 years; 64% female, 36% male). 58% of patients had previously undergone an IR procedure. Statistical analysis with Fisher Exact test (p<0.05) was performed.

**RESULTS**

Most patients want to be informed if there is a radiation-related 3% increased cancer risk over 5 years (89%), or if the associated risk is 1 in 1000 (79%) or 1 in 10000 (63%). While half of the cohort considers 3% small, 35% want to further discuss the risks and alternate options, and 15% would only proceed if it were a life-saving procedure. Only 62% of patients were aware they were going to be exposed to radiation, irrespective of previous IR history. Most patients believe radiation consent should be routine for IR procedures (85%) and include radiation-related cancer risks (88%). A majority (62%) believes that the referring physician and the interventional radiologist are responsible for informing patients, and verbal radiation consent is sufficient. No significant difference was present between groups based on previous IR history (p>0.05).

**CONCLUSION**

Patient awareness of radiation exposure is suboptimal. Based on this survey, a majority of patients want to discuss cancer-related radiation risks in order to make informed decisions. Interventional radiologists should consider including radiation consent in the informed consent for procedures with anticipated doses above 1 mSv.

**CLINICAL RELEVANCE/APPLICATION**

Interventional radiology patients want to discuss cancer-related radiation risks in order to make informed decisions, and interventional radiologists should consider including radiation consent in the informed consent for procedures with anticipated doses above 1 mSv.

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**SSM24-02**

**Substantial X-ray Dose Reduction in Intra-arterial Therapy for Liver Cancer: A New Angiographic Imaging Technology**

**Ruediger Egbert Schernthaner MD (Presenter):** Nothing to Disclose, MingDe Lin PhD: Employee, Koninklijke Philips NV, Julius Chapiro MD: Nothing to Disclose, Rafael Duran MD: Nothing to Disclose, Boris Gorodetski: Nothing to Disclose, Jean-Francois H. Geschwind MD: Consultant, BTG International Ltd Consultant, Bayer AG Consultant, Guerbet SA Consultant, Nordion, Inc Grant, BTG International Ltd Grant, F. Hoffmann-La Roche Ltd Grant, Bayer AG Grant, Koninklijke Philips NV Grant, Nordion, Inc Grant, ContextVision AB Grant, CeloNova BioSciences, Inc Founder, PreScience Labs, LLC CEO, PreScience Labs, LLC

**PURPOSE**

To investigate potential x-ray dose reduction, without compromising image quality, of fluoroscopy and digital subtraction angiography (DSA) of a new angiographic imaging system in patients undergoing intra-arterial therapy (IAT) for liver cancer.

**METHOD AND MATERIALS**

In this ongoing prospective trial, 25 consecutive patients underwent hepatic IAT on a new imaging platform (AlluraClarity, Philips Healthcare, Best, The Netherlands). For detailed dose-logging, a radiation dose structured reporting (RDSR) system was setup that included air kerma (AK) and dose area product (DAP) for each run (fluoroscopy, digital subtraction angiography (DSA), single shot exposure and Cone Beam CT). The dose from this imaging platform was compared to 25 other consecutive patients who underwent similar procedures on the predecessor imaging platform (Allura, Philips Healthcare). DSA image quality for both imaging platforms was assessed on a five-rank-scale in a randomized and blinded fashion. Paired t-test was performed for BMI and fluoroscopy time, Mann-Whitney U test was used to compare image quality and dose of each type of run between the two imaging platforms.
RESULTS

Both patient cohorts showed no difference with regard to BMI ($p=0.87$) and fluoroscopy time ($p=0.98$). The new system resulted in a significant dose reduction in total AK and DAP of 58% and 60% compared to the old platform (median of 0.47 Gy and 143.41 Gy*cm$^2$ vs. 1.12 Gy and 359.59 Gy*cm$^2$, respectively ($p<0.01$)). Specifically, DAP for fluoroscopy and DSA decreased significantly by 60% and 77%, respectively ($p<0.01$). During the procedures, no relevant problems due to image quality were reported. Likewise, the blinded evaluation of image quality revealed no differences between the new and the old imaging platforms (mean score 1.16 vs 1.24; $p=0.48$).

CONCLUSION

The new imaging platform allowed for significant x-ray radiation dose reduction in patients undergoing IAT for liver cancer without compromising image quality.

CLINICAL RELEVANCE/APPLICATION

During the last decade, the use of hepatic IAT has steadily increased. Thus, the reduction of x-ray dose for both patients and clinicians is essential for radiation protection.

SSM24-03  
Occupational Radiation Exposure during Endovascular Aortic Repair

Anna Margaretha Sailer MD, MBA (Presenter): Nothing to Disclose , Geert Willem H. Schurink MD, PhD: Nothing to Disclose, Martine Bol: Nothing to Disclose, Michiel W. De Haan MD, PhD: Nothing to Disclose, Wim Van Zwam MD: Nothing to Disclose, Joachim Ernst Wildberger MD, PhD: Nothing to Disclose, Cecile R. L. Jeukens PhD: Nothing to Disclose

PURPOSE

Aim of this study was to evaluate the radiation exposure to operating room personnel and its determinants during endovascular aortic repair procedures.

METHOD AND MATERIALS

Occupational radiation exposure was prospectively evaluated during forty-four endovascular aortic repair procedures. Procedures were performed between 07/2013 and 01/2014 on our hybrid operating room (Allura Xper with ClarityIQ, Philips Medical Systems, Best, The Netherlands). Twenty-two infrarenal aortic procedures (EVAR), eleven thoracic aortic procedures (TEVAR) and eleven fenestrated or branched aortic procedures (FEVAR) were included. Real-time over-lead dosimeters attached to the left breast pocket (DoseAware, Philips) were used to measure personal doses for operators (first (FS) and second (SS) surgeon), radiology technicians (RT), scrub nurses (SN), and anesthesiologists (AN). Besides protective apron and thyroid collar, no radiation shielding was used. Procedural dose area product (DAP), iodinated contrast volume, fluoroscopy time, patients’ weight and angulation of the C-arm were documented. Results were analyzed using regression coefficient and Kruskal-Wallis test.

RESULTS

Average procedural over-lead dose and standard deviation was 0.17 ±0.21 mSv for the FS, 0.042 ±0.045 mSv for the SS, 0.019 ±0.042 mSv for the RT, 0.017 ±0.031 mSv for the SN and 0.006 ±0.007 mSv for the AN. FS doses were significantly higher during FEVAR compared to EVAR and TEVAR (mean FS dose during FEVAR: 0.34 ±0.28 mSv, EVAR: 0.11 ±0.21 mSv, TEVAR: 0.06 ±0.05 mSv; $p=0.003$). There was a significant correlation between the dose of the FS and procedural DAP ($R=0.686$, $p<0.001$) and iodinated contrast volume ($R=0.672$, $p<0.001$) and a weak correlation with fluoroscopy time ($R=0.396$, $p=0.049$). Usage of left anterior C-arm projections >60 degrees was associated with significantly higher FS doses ($p=0.02$). For EVAR procedures, a significant correlation between FS dose and patient’s weight was found ($R=0.561$, $p=0.024$), SS dose and AN dose were significantly correlated with the FS dose ($R=0.668$, $p=0.003$ and $R=0.838$, $p<0.001$).

CONCLUSION

Strong predictors for high personal doses are procedural DAP, iodinated contrast volume, patient weight and left lateral C-arm angulation >60 degrees.

CLINICAL RELEVANCE/APPLICATION

The first surgeon received an average procedural dose of 0.17 mSv, which was on average a factor four higher than the second surgeon who received the second highest average dose.

SSM24-04  
Patient Radiation Dose Reduction during Transarterial Chemoembolization Using a Novel X-ray Fluoroscopy Imaging Acquisition and Processing Platform

Ryan Michael Kohlbrenner MD (Presenter): Nothing to Disclose, Kanti Pallav Kolli MD: Research Grant, Koninklijke Philips NV, Andrew Grenville Taylor MD, PhD: Nothing to Disclose, Maureen Pearl Kohi MD: Nothing to Disclose, Nicholas Fidelman MD: Nothing to Disclose, Robert K. Kerlan MD: Nothing to Disclose, Robert G. Gould DSc: Research Grant, Koninklijke Philips NV

PURPOSE

To compare the patient radiation doses during transarterial chemoembolization (TACE) for hepatocellular
carcinoma (HCC) performed with Philips Allura Xper versus Philips Allura Clarity imaging platforms.

METHOD AND MATERIALS

Total fluoroscopy time, cumulative air kerma, and cumulative dose area product data were retrospectively collected for 129 TACE procedures performed to treat HCC. The first 85 procedures were performed in an interventional radiology suite equipped with the Philips Allura Xper imaging platform. The subsequent 44 procedures were performed in the same suite following installation of the Philips Allura Clarity imaging platform. To confirm similarities in patient size, the anteroposterior diameter of the upper abdomen at the level of the portal vein bifurcation was assessed on CT or MRI for all patients in both groups. Mean values were compared using two-tailed t-tests.

RESULTS

Following installation of the Philips Allura Clarity platform, a 43.7% reduction in mean cumulative dose area product (3033.2 versus 1707.2 mGy-cm², p < 0.0001) and a 29.5% reduction in mean cumulative air kerma (1445.4 versus 1019.3 mGy, p < 0.001) were found in comparison to procedures performed with the Philips Allura Xper platform. Total fluoroscopy time was 20% greater (1679.3 versus 2015.7 seconds, p < .05) for procedures performed with Allura Clarity compared with Allura Xper; Patient size was similar between the two groups (Anteroposterior thickness of 268.4 versus 265.9 mm, p = .70).

CONCLUSION

The Philips Allura Clarity imaging acquisition and processing platform significantly reduces patient radiation dose when compared to Philips Allura Xper in patients of comparable size undergoing TACE for HCC treatment. Dose reduction was achieved despite an increase in average fluoroscopy time. Further studies are necessary to determine whether the increase in fluoroscopy time is related to image quality or bias in patient selection to treat more difficult cases in the new low-dose-room.

CLINICAL RELEVANCE/APPLICATION

TACE procedures can be successfully performed at patient radiation doses significantly below current norms.
SSM24-06  Significant Acquisition Dose Reduction Maintains Diagnostic Quality of Biplane Cerebral Digital Subtraction Angiography

Amir Reza Honarmand MD (Presenter): Nothing to Disclose, Ali Shaibani MD: Nothing to Disclose, Michael Charles Hurley MBBCh: Nothing to Disclose, Christina Louise Sammet PhD: Nothing to Disclose, Sameer A. Ansari MD, PhD: Shareholder, RaPID Medical Technologies, LLC

PURPOSE

We aimed to investigate the feasibility of reducing the radiation exposure dose in diagnostic cerebral DSA examinations while preserving the overall image quality for diagnostic purposes.

METHOD AND MATERIALS

Following IRB approval, a prospective study was performed on patients undergoing diagnostic cerebral DSA using biplane flat detector angiography unit. DSA images were acquired using a predefined manufacturer standard program by selecting detector dose of 3.6 μGy/frame (mean typical tube voltage (TTV): 80.6 kVP, mean tube current (TC): 230.6 mA, using focal spot size (FS) of 0.6 and inherent filtration) and reduced detector dose of 1.2 μGy/frame (mean TTV: 73.6 kVP, mean TC: 153.5 mA, using FS of 0.3 with additional 0.1/0.2 copper filter) dose protocols for each patient. Using identical contrast agent, contrast injection rate, and fluoroscopy time, randomly selected internal carotid or vertebral arteries and their contralateral equivalent arteries were injected to obtain standard radiation dose and low radiation dose AP and lateral DSA images, respectively. Image quality assessment was performed independently by two neurointerventionalists. A 5 point scale was used for qualitative evaluation of arterial, capillary, and venous phases of DSA images respectively. The total score was defined as the overall diagnostic value. Paired sample t-test and Wilcoxon’s signed rank test compared the kerma-area product (KAP) and scores assigned to image quality parameters, respectively. P value <0.05 was considered statistically significant.

RESULTS

Twenty-three DSA image series were obtained from nine patients (8M/1F, mean age: 65.9) undergoing diagnostic DSA. Mean KAP was significantly reduced by 60% or 2.5 fold (1408.90 ± 419.18 μGy/m2 versus 557.08 ± 214.56 μGy/m2, P <0.0001). No significant difference was observed between image quality scores assigned by the observers while assessing arterial (observer 1 (O1): P=1.0; observer 2 (O2): P=0.24), capillary (O1: P=0.54; O2: P=0.3), venous (O1: P=0.14; O2: P=0.7) phases, and overall diagnostic value (O1: P=0.34; O2: P=0.8).

CONCLUSION

Radiation exposure dose can be reduced significantly without compromising image quality for diagnostic purposes in cerebral DSA studies.

CLINICAL RELEVANCE/APPLICATION

Significant reduction of radiation exposure dose is feasible while maintaining image quality for diagnostic and therapeutic purposes in intracranial endovascular procedures.

SSM25

Vascular/Interventional (IR: CTA)

Scientific Papers

SSM25-01 4D CTA for the Evaluation of Arteriovenous Malformations – A Pilot Study

Peter Veendrick MD (Presenter): Nothing to Disclose, Ritse Maarten Mann MD, PhD: Speakers Bureau, Bayer AG, Carine Van der Vleuten MD, PhD: Nothing to Disclose, Frederick Jan Anton Meijer MD: Nothing to Disclose, Dietmar Ulrich MD, PhD: Nothing to Disclose, Bas Verhoeven MD, PhD: Nothing to Disclose, Marc Wijnen MD, PhD: Nothing to Disclose, Wendy Busser MMedSc: Nothing to Disclose, Frank DeLange PhD: Nothing to Disclose, Leo Schultze Kool MD: Nothing to Disclose

PURPOSE
Digital subtraction angiography (DSA) is considered the gold standard in evaluating arteriovenous malformations (AVMs). In recent years four-dimensional CT-angiography (4D-CTA) has emerged as a new modality to image vascular anatomy and flow characteristics. The objective of the study was to evaluate the applicability of 4D-CTA in patients with AVMs for treatment planning considering dose and image quality compared to DSA.

METHOD AND MATERIALS

In this cohort study 23 4D-CTA scans were obtained in 18 patients from June 2011 to March 2014. All 4D-CTAs were acquired using a 320 detector row CT-scanner (Toshiba Aquilon ONE). Effective dose was calculated using dose-length product and standard dose conversion factors. The angiographies were performed on a high-end angiography system (Philips Alura). Effective dose was calculated using the dose-area product. Alternate reading of the DSA and 4D-CTA images was performed by two experienced observers to assess which modality offered the best diagnostic information. A subjective scale was used to compare the DSA and 4D-CTA images. Additionally, 8 of the 23 4D-CTA scans were recalculated to 10 frames per second (fps) and compared to standard 2 fps 4D-CTAs.

RESULTS

Diagnostic information and treatment planning using 4D-CTA was superior to DSA in 11 of the 18 patients (61%), equal to DSA in 4 patients (22%) and inferior to DSA in 3 patients (17%). The 8 4D-CTAs with 10 fps provided better evaluation of the AVM in all patients compared to standard 2 fps 4D-CTA. Average effective dose of the 4D-CTAs was 10.17 mSv (1.00-57.2, median 5.53). Average effective dose of the DSAs was 18.3 mSv (0.089-40, median 10.5). The large variance in dose values is caused by the differences in imaged anatomic regions and their differences in conversion factors.

CONCLUSION

4D-CTA seems to be a promising new imaging modality to evaluate an AVM. In our opinion 4D-CTA images allow for better treatment planning of the AVM in a majority of patients compared to diagnostic DSA. 4D-CTA recalculated to 10 fps gave more insight into the angio-architecture than a standard 2 fps 4D-CTA. Dose comparison revealed a lower average and median effective dose for 4D-CTA than for DSA.

CLINICAL RELEVANCE/APPLICATION

4D-CTA scans allow for better treatment planning of the AVM in a majority of patients compared to DSA with lower average effective dose.

Dynamic CT Angiography of Arterio-venous Fistulas: Feasibility and Impact on Therapy Management in Comparison to Ultrasound

Mathias Meyer (Presenter): Nothing to Disclose, Holger Haubenreisser: Nothing to Disclose, Sonja Sudarski MD: Nothing to Disclose, Stefan Oswald Schoenberg MD, PhD: Institutional research agreement, Siemens AG, Thomas Henzler MD: Nothing to Disclose

PURPOSE

To prospectively evaluate the feasibility and potential impact on therapy management of dynamic computed tomography angiography (dCTA) in patients with forearm arterio-venous fistula (AVF).

METHOD AND MATERIALS

Fifteen patients with malfunctioning forearm AVFs were examined with ultrasound and a dCTA protocol on a 3rd generation dual-source CT using the following scan parameters: 21 phases; 2.5s/phase, 80kV, 100mAs, volume of contrast medium 45mL, flow rate 5.0mL/s. Forearm AVFs were classified into high-flow shunts, stenotic shunts (>50%) or non-stenotic shunts (<50%) by two radiologist. Further, therapy management was evaluated using only ultrasound examination and again by using dCTA in a consensus read by a radiologist and a vascular surgeon. Contrast arrival times and HU values were evaluated by placing regions-of-interest in arterial, venous and muscle structures of the arm.

RESULTS

All imaging studies were completed without any complications and contrast enhancement was rated as sufficient in all patients. Eight patients were scanned with their arms above their head and the other 7 patients with their arms aligned next to their body. Six patients were classified as having high-shunt flow and 6 were classified as having stenotic AVF grafts. The highest mean AVF enhancement was achieved 17 seconds after contrast media application (mean 412±84 HU). Utilizing the information from the dCTA protocol lead to a change in therapy management in 5 patients when compared to ultrasound alone.

CONCLUSION

Dynamic CTA provides adequate AVF contrast enhancement as well as valuable additional clinical information, improving diagnostic confidence and leading to changes in therapy management when compared to ultrasound alone.

CLINICAL RELEVANCE/APPLICATION

3rd generation dual-source CT enables dCTA which is especially important as dCTA allows -next to stenotic lesion evaluation- also the evaluation of abnormalities like high-flow shunts.
Impact of a Novel CT-based Iliac Artery Calcium Scoring System on Renal Transplant Outcomes

Bradley Carl Davis MD (Presenter): Nothing to Disclose, Daniele Marin MD: Nothing to Disclose, Matthew Ellis MD: Nothing to Disclose, Bradley Collins MD: Nothing to Disclose, Lynne Michelle Hurwitz MD: Research Grant, Siemens AG Research Grant, General Electric Company, Charles Yoon Kim MD: Consultant, CareFusion Corporation Research Grant, Galil Medical Ltd Consultant, Kimberly-Clark Corporation Consultant, Cryolife, Inc

PURPOSE

To assess whether a novel composite calcium score of the iliac arteries correlates with outcomes after renal transplantation.

METHOD AND MATERIALS

Retrospective review of renal transplant recipients who underwent CT scanning of the pelvis within 2 years prior to surgery revealed 131 patients (mean age 52, 75 male, 56 female). A semiquantitive calcium score (0-12) incorporating calcium morphology, length and circumferential involvement was generated for each common and external iliac arteries. Operative and clinical notes were reviewed to determine the complexity of the operation. High complexity operations were defined as those requiring nonstandard technique such as intra-operative vascular surgical consultation, inspection of more than one arterial segment due to concern for suboptimal arterial anastomotic target, or any other adjunct arterial surgery. Additionally, all arterial complications such as arterial dissection, anastomotic stenosis, pseudoaneurysm, or hemorrhage were identified. Laboratory values were reviewed to identify delayed graft function (DGF) (need for dialysis within the first week post transplant) and renal function at 1 year based on the eGFR. Renal allograft survival (based on return to dialysis or retransplant) and patient survival were calculated using the Kaplan-Meier technique.

RESULTS

Out of 131 patients who underwent renal transplantation with available CT imaging, 38 patients had their allograft anastomosed to an external iliac artery with some degree of calcification. Seven patients had an arterial complication, 23 were classified as high-complexity, and 17 had DGF. A calcium score of 5+ of the anastomosed external iliac artery correlated with significantly higher rates of DGF (25% vs 8%, p=0.015) and high-complexity operations (46 vs 4%, p<0.001). However, the calcium score did not correlate significantly with arterial complications, the 1-year eGFR or graft survival. Patients with any degree of iliac arterial calcification had significantly lower 1-year patient survival after transplant (92% vs 98%, p=0.05, logrank test).

CONCLUSION

The proposed novel calcium scoring system correlated significantly with renal transplant case complexity and episodes of delayed graft function.

CLINICAL RELEVANCE/APPLICATION

Routine pre-transplant CT for arterial calcium scoring may enable optimal artery selection for anastomosis and ensure appropriate operative planning to reduce surgical complexity.
Clinical Relevance/Application

Analysis of carotid plaque morphology can have significant implications for the selection of patients who would benefit from carotid revascularization. To study the vulnerable plaque, we determined whether there are differences between urgently performed CEAs for acute neurological symptoms and in patients undergoing CEA for asymptomatic high-grade carotid stenosis. We demonstrate the novel finding that affected carotids have a greater amount of soft atheroma, compared to patients with asymptomatic carotid stenosis. Since the lipid-rich/soft atheroma component of a carotid plaque is likely an important predictor of stroke risk in patients with carotid stenosis, future studies based on this methodology may help to further risk stratify patients with asymptomatic carotid disease at risk for plaque rupture.

SSM25-05

Accuracy of MDCT Angiography of the Anterior Abdominal Wall in the Planning of the Mammary Reconstruction with DIEP-Flap in Mastectomized Patients

Francesco Carbonetti MD (Presenter): Nothing to Disclose, Antonio Cremona: Nothing to Disclose, Pierluigi Aloiso: Nothing to Disclose, Nicola Maltzeff: Nothing to Disclose, Giuseppe Argento: Nothing to Disclose, Carlo Capotondi: Nothing to Disclose, Vincenzo David MD: Nothing to Disclose

Purpose

Objective of the study was to prove accuracy and feasibility of MDCT Angiography of the anterior abdominal wall in the planning of breast reconstruction with DIEP flaps in mastectomized patients.

Method and Materials

34 nulliparous (average age 54 yrs.) and 20 multiparous (average age 48 yrs.) underwent MDCT Angiography of the abdominal anterior wall to study the deep inferior epigastric arteries (DIEA) and its perforating branches. (GE 16X0.625, pitch 1.3, 120KV, Xenetix 350) With MPR, MIP and VR reconstructions were evaluated the caliber and integrity of DIEA, the caliber of the perforating arteries at the emergence of the anterior fascia of the rectus abdominis muscle, respectively, and their distance from the transverse umbilical line and the linea alba. The collected data were verified by surgeons in the operating room. A standardized BMI was used for each patient.

Results

For the deep inferior epigastric artery (DIEA) Moon and Taylor classification was used. A correspondence of 100% of the number and location of the perforating arteries was found between the results obtained at the MDCT-Angiography and the surgical results. It was recorded an average caliber size of 1.2 mm for the medial perforating vessels and 0.9 mm for the lateral. In 10/54 patients the caliber of the vessels was overestimated at the MDCT-Angiography, the most frequent complications during surgery were related to venous necrosis of the vessels. Nulliparous showed greater calibers of the arteries compared to multiparous, overweight and obese patients showed greater calibers compared to normal weight patients. P-value was calculated and data were statistically significant.

Conclusion

MDCT-Angiography is a valid technique in the planning of the mammary reconstruction with DIEP flap which permit an accurate evaluation of the perforating vessels and the possibility to decrease the time of the surgery.

SSM25-06

The Role for Radiological Evaluation of Geniculate Flow in Trauma Patients

Sean Keith Johnston MD (Presenter): Nothing to Disclose, Nagaramesh Chinapuvvula MBBS: Nothing to Disclose, Anahtia Dua MD, MS: Nothing to Disclose, Sapan S. Desai, PhD: Nothing to Disclose, Jennifer H. Johnston MD: Nothing to Disclose, Shelia Coogan MD: Nothing to Disclose

Purpose

Assessment of limb viability after injury is classically based on clinical examination and distal vessel perfusion on CT-angiography (CTA). The purpose of this study was to correlate geniculate artery (GA) perfusion with limb salvage outcomes to determine if GA perfusion status should be part of the standard CTA report in the setting of trauma to assist in evaluating limb viability.

Method and Materials

Patients with lower extremity injury were identified retrospectively using the institutional trauma database at a level I trauma center. Patients without CTA, missing records, or under the age of 16 were excluded. Datapoints included demographics, injury severity score (ISS), mechanism of injury, popliteal and GA flow (superior medial, superior lateral, medial, inferior medial, and inferior lateral) on CTA, and limb salvage outcome (amputation vs no amputation). Statistical analysis was completed using analysis of variance (ANOVA) for continuous variables and chi-squared for categorical variables. P <0.05 was considered statistically significant. Values are presented as mean +/- standard deviation where possible.

Results

From 2009-2012, 84 patients with CTA-confirmed distal extremity injury were identified. There were no significant differences between groups with regard to demographic factors, mechanism of injury, or severity of injury. Amputation rates tended to increase as the number of perfused geniculate arteries decreased. Patients...
with 3 patent GA’s as opposed to 2 or 1 regardless of the specific arteries involved were less likely to have an amputation (P<0.05). Patients who underwent amputation and had popliteal artery occlusion had fewer intact GA’s than those with successful limb salvage (2.4 vs. 2.7, P=0.36). This trend remained consistent in patients with any popliteal artery injury (2.4 vs. 2.8, P=0.23). No patients with 3 or 5 patent GA’s underwent an amputation (r = -0.76).

CONCLUSION

There appears to be an inverse relationship between number of patent geniculate arteries and lower extremity amputation after traumatic injury. Geniculate collateralization may be a key marker of limb viability. Reporting the number of perfused geniculate arteries on CTA for mangled extremities may aid in clinical decision-making.

CLINICAL RELEVANCE/APPLICATION

CTA assessment of geniculate artery perfusion in trauma may play a key role in assessment for surgical intervention, and should be included in the CTA report when appropriate.

SPSC50

Controversy Session: Predicting Outcome with Cardiac CT - Which Is Best?

Special Courses

CT VA CA

AMA PRA Category 1 Credits ™: 1.00
ARRT Category A+ Credit: 1.00
Thu, Dec 4 7:15 AM - 8:15 AM  Location: E451A

Participants

Moderator
Suhny Abbara  MD : Research Consultant, Radiology Consulting Group

Sub-Events

SPSC50A Calcium Scoring
John Jeffrey Carr  MD, MS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To describe the pathologic basis for calcified coronary plaque as part of advanced atheromatous plaque in the coronary arteries. 2) Review the evidence on how the CT coronary artery calcium score is an independent and powerful predictor of cardiovascular deaths and myocardial infarction in men, women and minority groups. 3) Discuss how the CT coronary artery calcium score can be integrated into the 2014 prevention guidelines as a tool to reduce deaths from heart disease.

SPSC50B Coronary CT Angiography (CCTA)
Stephan Achenbach  MD (Presenter): Research Grant, Siemens AG Research Grant, Bayer AG Research Grant, Abbott Laboratories Speaker, Guerbet SA Speaker, Siemens AG Speaker, Bayer AG Speaker, AstraZeneca PLC Speaker, Berlin-Chemie AG Speaker, Abbott Laboratories Speaker, Edwards Lifesciences Corporation

LEARNING OBJECTIVES

1) To be familiar with the typical data acquisition modes for CCTA. 2) To identify clinical situations in which CCTA is useful. 3) To understand the prognostic value of CCTA.

SPSC50C Myocardial Perfusion

LEARNING OBJECTIVES

1) To review the available evidence supporting the use of Stress CT perfusion. 2) To understand the importance of combining anatomy and physiology in the non-invasive evaluation of chest pain patients. 3) To describe the limitations and understand the future directions of Stress CTP.

ABSTRACT

A major limitation of coronary CTA is that the physiological significance of stenotic lesions identified is often unknown. Stress myocardial computed tomography perfusion (CTP) is a novel examination that provides both anatomic and physiological information. Multiple single-center studies have established the feasibility of stress myocardial CTP. Furthermore, it has been illustrated that a combined CTA/CTP protocol improves the diagnostic accuracy to detect hemodynamic significant stenosis as compared with CTA alone; this combined protocol can also be accomplished at a radiation dose comparable to nuclear myocardial perfusion imaging exams. Stress
CTP is a modality with significant potential, particularly in the evaluation of chest pain patients, given the advantages of short exam time and comprehensive data acquisition. This lecture will summarize the current literature, indications, limitations and discuss future directions of Stress CTP.

**LEARNING OBJECTIVES**

1) To define the role of lesion specific ischemia as defined by invasively measured FFR to guide coronary revascularization. 2) To review the background and science behind derivation of a computational FFR (FFRCT) from a resting coronary CT angiogram. 3) To review the current diagnostic performance and cost effectiveness data for FFRCT.

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**SPSC50D**

**Fractional Flow Reserve (FFR) CT**

Jonathon Avrom Leipsic MD (Presenter): Speakers Bureau, General Electric Company Speakers Bureau, Edwards Lifesciences Corporation Consultant, Heartflow, Inc Consultant, Circle Cardiovascular Imaging Inc

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**VSER51**

**Emergency Radiology Series: Contemporary and (Sometimes) Controversial Topics in Imaging of Trauma**

**Series Courses**

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**Thu, Dec 4 8:30 AM - 12:00 PM  Location: S405AB**

**Participants**

- **Moderator**: Clint W. Sliker MD: Nothing to Disclose
- **Moderator**: Mariano Scaglione MD: Nothing to Disclose
- **Moderator**: Ferco H. Berger MD: Nothing to Disclose

**Sub-Events**

**VSER51-01**

**Imaging of the Polytrauma Patient: Role of Whole-Body CT**

Savvas Nicolaou MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Appreciate the rationale for Whole Body Imaging in assessing the polytrauma patient. 2) Compare advantages of whole body versus segmental MDCT protocol. 3) Demonstrate significance of arterial and portal venous phase imaging in the setting blunt abdominal trauma (BAT), and the role of whole body imaging in the setting of BAT. 4) Understand and review strategies for reducing radiation exposure. 5) Discuss strategies and techniques for optimization of whole body imaging protocols in the trauma setting. 6) Discuss Future Directions to allow bridging of anatomy and function.

**VSER51-02**

**Are We Missing Traumatic Bowel and Mesenteric Injuries?**

Bret Allan Landry MD (Presenter): Nothing to Disclose, Samir Faidi MD, FRCP_C: Nothing to Disclose, Angela Coates MEd: Nothing to Disclose, Michael Nathan Patlas MD, FRCP_C: Nothing to Disclose

**PURPOSE**

Traumatic bowel and mesenteric injury (TBMI) is an uncommon entity that can be lethal if not detected and treated in a timely manner. The purpose of our study was to evaluate the diagnostic accuracy of 64MDCT for the detection of TBMI in patients at our level 1 trauma centre.

**METHOD AND MATERIALS**

We used our hospital’s trauma registry to identify patients with a diagnosis of TBMI from January 1, 2006 to June 30, 2013. Only patients who had a 64MDCT scan at presentation and subsequently underwent laparotomy/laparoscopy were included in the study cohort. Using the surgical findings as the gold standard, the accuracy of prospective radiology reports was analyzed.

**RESULTS**

Of the 4781 trauma patients who presented to our institution, 44(0.9%) had surgically proven TBMI. 22/44 were excluded as they did not have MDCT before surgery. The study cohort consisted of 14 males and 8 females.
with a median age of 41.5 years and a median Injury Severity Score of 27. 17/22 had blunt trauma and 5/22 had penetrating injury. A correct preoperative imaging diagnosis of TBMI was made in 14/22 of patients. The overall sensitivity of the radiology reports was 63.6% (95% CI: 41-82%), specificity was 79.6 % (95% CI: 67-89%), PPV was 53.9% (95% CI: 33 -73 %) and NPV was 85.5% ( 95% CI: 73-94 %). The accuracy was 90.5%. However, only 59 % (10/17) of patients with blunt injury had a correct preoperative diagnosis. Review of the findings demonstrated that majority of patients with missed blunt TBMI (5/7) demonstrated only indirect signs of injury.

CONCLUSION

The detection of TBMI in trauma patients on 64MDCT can be improved, especially in patients presenting with blunt injury. Missed cases in this population occurred because the possibility of TBMI was not considered despite the presence of indirect imaging signs.

CLINICAL RELEVANCE/APPLICATION

The prospective diagnosis of TBMI remains challenging despite advances in CT technology and widespread use of 64MDCT.

PURPOSE

To evaluate how the implementation of an institutional triaging algorithm impacted the utilization of MDCT imaging of the abdomen and pelvis at a level one trauma center.

METHOD AND MATERIALS

This retrospective HIPAA compliant study was IRB approved. Informed consent was waived. All adult patients admitted for abdominal trauma from 1/1/06-12/31/13 were included in this study. The total number of abdomino-pelvic CT scans acquired, mean injury severity score (ISS) and percentage of trauma scans with positive findings per year were recorded. We then determined the impact that a triaging clinical algorithm, introduced in January 2009, had on these parameters. Patients were divided into two groups: before the implementation of this triaging algorithm (2006-2009) and after (2010-2013). The unpaired t-test and Fisher's exact test were used to compare the two groups for significant differences in the ISS and percentage of positive CT scans, respectively.

RESULTS

The number of annual trauma admissions and the percentage of these patients who received abdomino-pelvic CT scans were: 2006 (2122/71%), 2007 (2234/74%), 2008 (2231/71%), 2009 (2033/60%), 2010 (2167/44%), 2011 (1929/43%), 2012 (1923/36%), and 2013 (1729/39%). The mean ISS and percentage of positive scans for the same time period were: 2006 (9/18%), 2007 (9/19%), 2008 (8/19%), 2009 (9/17%), 2010 (10/20%), 2011 (10/24%), 2012 (11/22%) and 2013(9/20%). Patients admitted after the implementation of the clinical trauma algorithms had a significantly higher mean ISS and a significantly higher percentage of positive CT scans (p<0.0001; p<0.0002, respectively).

CONCLUSION

The implementation of a clinical algorithm at our level one trauma center resulted in decreased utilization of trauma CT scanning. Our analysis suggests that this clinical algorithm can be used successfully to select patients who require CT imaging in the trauma setting.

CLINICAL RELEVANCE/APPLICATION

In the trauma setting, institutional algorithms can be implemented to prevent unnecessary imaging of patients in a nationwide effort to reduce radiation exposure and hospital costs.

A Risk-Benefit Analysis of Adding an Arterial-Phase CT Abdomen When Evaluating for Splenic Trauma

PURPOSE

To quantify the risks and benefits of changing CT protocol in the ED/trauma setting to include an arterial phase CT of the abdomen.

METHOD AND MATERIALS
Several recent studies have demonstrated increased sensitivity for identifying contained splenic vascular injury (ie pseudoaneurysm and arteriovenous fistula formation) in trauma patients by the addition of arterial-phase CT abdominal imaging. However, the overall risk-benefit ratio is not known. Using published data, we quantified the number of previously undiagnosed cases of contained splenic vascular injury in trauma patients age 15 and older, as well as the number of patients for whom management would change and the number of new cancer cases induced by the increased radiation dose. During sensitivity analysis, supplemental data from a level 1 trauma center was used to help identify patient subgroups with a more favorable risk-benefit ratio.

RESULTS
The number needed to scan to identify one new case of contained vascular injury was 182, to change management in one patient was 255, and to induce one new cancer was 3,584. Increased dose length product (DLP) resulted in higher cancer induction risk, but this risk was relatively small and did not result in more cancer cases caused than new vascular injury cases detected over a range of normal DLP values. Analysis using the age distribution of trauma patients at our institution and an age-dependent cancer induction rate did not significantly change results. Pending results include additional analysis utilizing data from a level 1 trauma center, including stratification by gender, mechanism of injury (blunt versus penetrating) and severity of injury (level 1 trauma, level 2 trauma, or overall population).

CONCLUSION
The addition of an arterial phase CT abdomen to a trauma protocol for the assessment of contained splenic vascular injury has a favorable risk-benefit ratio across a range of typical DLP values.

CLINICAL RELEVANCE/APPLICATION
The addition of an arterial phase CT abdomen to a trauma protocol for the assessment of contained splenic vascular injury has a favorable risk-benefit ratio across a range of typical DLP values.

VSER51-05
Blunt Aortic Injury: Still an Enigma
Kathirkamanathan Shanmuganathan MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Demonstrate the spectrum of traumatic aortic injury: typical, atypical and minimal injury. 2) Discuss the role of imaging and treatment of traumatic aortic injury.

VSER51-06
Utility of the CT Severity Index for Determining the Outcome of Embolization as Primary Therapy for Severe Blunt Splenic Trauma with Splenic Injury
Armonde Baghdanian MD (Presenter): Nothing to Disclose, Brian Michael Currie BS: Nothing to Disclose, Arthur Baghdanian MD: Nothing to Disclose, Christina Alexandra Lebedis MD: Nothing to Disclose, Stephan W. Anderson MD: Nothing to Disclose, Jorge A. Soto MD: Nothing to Disclose, Anthony Samuel Armetta MD: Nothing to Disclose

PURPOSE
To determine if the CT Severity Index predicts the need for subsequent splenectomy in patients who undergo splenic artery embolization as the primary therapy of severe blunt splenic injuries.

METHOD AND MATERIALS
This retrospective study was HIPAA compliant and IRB approved with waiver of informed consent. Twenty-five adult patients with blunt splenic trauma evaluated with abdominal CT between 1/1/2006 and 1/31/2013 who subsequently underwent and survived splenic artery embolization were included. The study population included 19 male and 6 female patients. Two radiologists retrospectively and independently reviewed the CT images and classified splenic injuries using the CT Severity Index: intraperitoneal active extravasation (grade 4b), intrasplenic vascular injury (grade 4a) and no vascular injury (grades 2 or 3). Another investigator reviewed the electronic medical records and documented whether or not each patient required splenectomy for definitive therapy. Two-tailed Fisher’s exact test was used to evaluate the association between the admission CT severity index and the success rate of splenic embolization as primary therapy (defined by stable patient discharge without the need for surgical splenectomy).

RESULTS
CT severity Indices: grade 4b (n=13), grade 4a (n=9), grade 3 (n=2) and grade 2 (n=1). Of the 25 patients, 21 recovered with no additional intervention and were determined to have a successful outcome: Ten with grade 4b, eight with grade 4a and three with grades 2 or 3. Four patients required splenectomy and the embolization procedure was deemed a failure: three with grade 4b and one with grade 4a. Thus, 10/13 (77%) patients with grade 4b and 11/12 (92%) patients with grade 2 to 4a injuries had successful embolization procedures as primary therapy. This difference was not statistically significant (p > .05).

CONCLUSION
The majority of patients with blunt splenic injury can be treated with arterial embolization and will not require a splenectomy. This includes patients with intraperitoneal active extravasation (CT severity index grade 4b).

CLINICAL RELEVANCE/APPLICATION
Embolization can be used to successfully treat all types of vascular injuries in the spleen caused by blunt trauma, including free extravasation of contrast-enhanced blood into the peritoneal cavity.
LEARNING OBJECTIVES

1) To discuss the role of MDCT in patients with blunt and penetrating diaphragmatic injuries. 2) Review the MDCT findings of diaphragmatic injuries. 3) Describe potential pitfalls.

ABSTRACT

Diaphragmatic Injuries remain a challenging diagnosis with potential catastrophic delayed complications. A high degree of suspicion in every case of severe blunt thoracoabdominal trauma or penetrating thoracoabdominal injury is essential. This presentation will provide a practical tutorial for radiologists hoping to improve their interpretive accuracy for both blunt and penetrating DIs. The CT signs of diaphragmatic injuries will be explained. A number of instructive cases will be presented, including frequent diagnostic pitfalls.

PURPOSE

Diaphragmatic injuries have a marked impact on the management and prognosis of trauma patients. Motion artifacts may obscure diaphragm injuries during CT of trauma patients with low Glasgow Coma Scale (GCS) scores or those who are intubated and ventilated. CT acquisition times are dramatically reduced by using dual source ultra-high pitch (DS-UHP) as compared with conventional single source (SS) protocols. The purpose of this study was to evaluate diaphragmatic motion on simultaneously acquired DS-UHP and SS CT scans in trauma patients.

METHOD AND MATERIALS

Seventy-five consecutive trauma patients who presented to a level one trauma centre over a 6 month period scanned with a standardized trauma protocol including both DS-UHP chest (pitch = 1.7-3.2) and SS abdominal CT scans (pitch =0.6) were reviewed retrospectively. Subjective analysis of diaphragmatic motion was performed in consensus by two readers using a 4 point likert scale in 7 regions of the diaphragm on coronal 3mm and axial 1mm-3mm slices. An overall confidence score to exclude a diaphragmatic tear based on all coronal and axial images available was also determined (1 to 10, 10 being completely confident and 1 being impossible to exclude). Wilcoxon Rank Sum tests were used for statistical analysis and p < 0.05 was considered significant.

RESULTS

The mean overall confidence score for the DS-UHP was 9.85, which was significantly better than the mean score of 7.66 for SS images (p < 0.0001). The scores for diaphragmatic motion on coronal and axial images were significantly better for DS-UHP images in all areas when compared individually (p < 0.0001). Additionally, utilizing the overall coronal image scores, the subjective diaphragmatic motion was significantly less in the DS-UHP images than the SS images (p < 0.0001).

CONCLUSION

Ultra high-pitch is advantageous as it allows for better evaluation of diaphragmatic structures by minimizing motion artifacts on images of freely breathing trauma patients.

CLINICAL RELEVANCE/APPLICATION

An ultra high-pitch dual source mode is valuable in trauma patients who are unable to breath-hold as it allows minimization of motion artifacts of the diaphragm as compared with conventional single source reconstructions.

PURPOSE

Traumatic diaphragmatic rupture (DR) is an uncommon injury that can be lethal if not detected and treated in a timely manner. The purpose of our study was to evaluate the diagnostic accuracy of 64MDCT for the detection of DR in patients at our level 1 trauma centre.

METHOD AND MATERIALS
We used our hospital’s trauma registry to identify patients with a diagnosis of DR from January 1, 2008 to December 31, 2012. Only patients who had a 64MDCT scan at presentation and subsequently underwent laparotomy/laparoscopy were included in the study cohort. Using the surgical findings as the gold standard, the accuracy of prospective radiology reports was analyzed.

RESULTS

Of the 3225 trauma patients presented to our institution, 38 (1.2%) had a DR. Fourteen of the 38 were excluded as they did not have MDCT pre-surgery. The cohort consisted of 20 males and 4 females with a median age of 34.5 years and a median Injury Severity Score of 26. Fifteen had a blunt trauma while 9 had a penetrating injury (PI). The overall sensitivity of the radiology reports was 66.7% (95% CI: 44.7-84.3%), specificity was 100% (95% CI: 94-100%), PPV was 100% (95% CI: 79.2-100%) and NPV was 88.4% (95% CI: 78.4-94.8%). The accuracy was 91%. However, only 3/9 with PI (33%) had a correct preoperative diagnosis. Most of the missed cases (4/6) had only indirect signs of injury.

CONCLUSION

The detection of DR in trauma patients on 64MDCT can be improved, especially in patients presenting with PI. Most missed cases occurred because the possibility of DR was not raised despite the presence of indirect evidence.

CLINICAL RELEVANCE/APPLICATION

The prospective diagnosis of DR remains challenging despite advances in CT technology and widespread use of 64MDCT.

CTA of Blunt and Penetrating Peripheral Vascular Injuries

Scott David Steenburg MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the optimal CTA imaging protocol for the evaluation of suspected peripheral vascular injuries. 2) Identify the various imaging manifestations of peripheral vascular injuries. 3) Recognize CTA limitations and pitfalls in the diagnosis of peripheral vascular injuries. 4) Recognize when further evaluation with catheter angiography or surgical exploration are required.

Predicting Mortality from Hypovolemic Shock Complex in the Polytrauma Setting

David Tso MD (Presenter): Nothing to Disclose, Jennifer Wang BS: Nothing to Disclose, Patrick McLaughlin FFR(RCSI): Nothing to Disclose, Savvas Nicolaou MD: Nothing to Disclose

PURPOSE

This study examined how the constellation of radiological findings seen in hypovolemic shock complex on a Multi-Detector Computed Tomography (MDCT) scan correlate with survival of polytrauma patients.

METHOD AND MATERIALS

A retrospective study design was undertaken examining patients involved in severe blunt trauma with an Injury Severity Score (ISS) >= 16 who were admitted to the emergency department (ED) at a Level I Trauma Center between July 2011 and June 2013. Patients underwent a standardized multi-phasic whole body MDCT protocol obtained from a single CT scanner located within the ED. Radiological findings of hypovolemic shock were identified from the scan including vascular and non-vascular findings. Radiological variables were correlated with clinical and 30-day mortality data.

RESULTS

50 patients were identified, of which 17 died and 33 survived their injuries. The mortality cohort had lower Glasgow Coma Score (GCS) (6.0 vs. 11.9, p

CONCLUSION

Small caliber of the great vessels and decrease perfusion of the spleen and renal medulla were seen in the mortality group. Contrast enhancement of the left ventricular chamber was greater in the mortality cohort which may be a novel indicator of low cardiac output or increase in systemic vascular resistance in the context of hypovolemic shock.

CLINICAL RELEVANCE/APPLICATION

Quantitative analysis of left ventricular chamber enhancement, diameter of the great vessels, and spleen and renal medulla enhancement on multi-phasic whole body MDCT scans may identify polytrauma patients at risk of death.

The Effect of Soft Tissue Damage Volume on Systemic Inflammation and Organ Failure in Multiple Injury Patients

Scott David Steenburg MD (Presenter): Nothing to Disclose, Travis Frantz: Nothing to Disclose, Todd
MCKinley MD : Nothing to Disclose, Greg Gaski MD : Nothing to Disclose

PURPOSE

The Systemic Inflammatory Response Syndrome (SIRS) can lead to organ failure and death in multiply injured patients (MIPs). SIRS results primarily from an immune response to endogenous molecules thought to be liberated from damaged tissue. However, it is not known how the magnitude of tissue injury affects systemic inflammation and organ dysfunction. It is plausible that certain tissues are more prone to release of inflammatory mediators leading to SIRS, and that the magnitude of soft tissue injury may correspond with the degree of systemic inflammation and subsequent organ dysfunction. The purpose of this study was to determine how the total volume of soft tissue damage, as quantified on admission whole body CT scan, correlated with the magnitude of inflammation and organ dysfunction in MIPs.

METHOD AND MATERIALS

Clinical data from 51 MIPs (ISS ≥ 18, age 18-65), admitted to the ICU for a minimum of 6 days, were used to calculate daily SIRS scores (0 to 4) and daily Sequential Organ Functional Assessment scores (SOFA; 0 - 24). The Soft Tissue Damage Volume Score (STDVS) was calculated by combining the volumetric measurements of all soft tissue injuries (extravascular blood products) in each patient as measured on admission whole body CT scans. Regression analyses evaluated correlations between STDVS and both SIRS and SOFA scores.

RESULTS

The results demonstrate two distinct patient populations; those at High Risk and those at Low Risk for subsequent inflammation and organ dysfunction. The average SIRS score vs STDVS slope was 10.5x higher in high risk patients (Fig 1, p<0.01) and average SOFA scores vs STDVS slope was 6.14X higher in high risk patients (, p<0.01). There is a linear relationship between the STDVS and the SIRS and SOFA scores for these two patient populations.

CONCLUSION

The magnitude of systemic inflammation and organ dysfunction is a function of STDVS. These results demonstrate a dichotomous response of how MIPs tolerate soft tissue damage, suggesting that some patients are at higher risk of systemic inflammation than others.

CLINICAL RELEVANCE/APPLICATION

STDVS as calculated on admission CT may serve as a potential clinical tool for predicting systemic inflammation and organ dysfunction during the recovery process. Further investigations are required to elucidate the underlying pathophysiologic pathways for how soft tissue damage causes inflammation and organ dysfunction in MIPs.

VSER51-14 Streamlining Emergent Hand and Wrist Radiography

Henry Chou MD (Presenter): Nothing to Disclose, Scott David Steenburg MD : Nothing to Disclose, Jeffrey William Dunkle MD : Nothing to Disclose, Sean D. Gussick MD : Nothing to Disclose, Matthew James Petersen MD : Nothing to Disclose, Marc D. Kohli MD : Research Grant, Koninklijke Philips NV Research Grant, Siemens AG, Changyu Shen PhD : Nothing to Disclose, Hongbo Lin MS : Nothing to Disclose

PURPOSE

Physicians often order both a three-view study of the hand and four-view study of the ipsilateral wrist following hand and/or wrist injury. Because hand radiographs include visualization of the carpus, we set out to determine whether a modified study using fewer wrist radiographs performs comparably to the traditional hand and wrist series in the evaluation of acute hand and wrist abnormalities.

METHOD AND MATERIALS

This retrospective study was approved by the institutional review board, and the need to obtain informed consent was waived. Two hundred forty patients (50% male; age range 18-92y) with unilateral three-view hand (posteroanterior, oblique, and lateral) and four-view wrist (posteroanterior, oblique, lateral, and ulnar deviation) radiographs obtained concurrently in the emergency setting were included in this study. Four experienced emergency radiologists, blinded to the original report and clinical records, interpreted the original seven images. The patients’ radiographs were then recombinated to include only the three hand images and a single ulnar deviated wrist view. These were interpreted by the same radiologists following an eight week delay and in random sequence to reduce memory bias. Two radiologists independently evaluated each patient’s studies. Data analysis was performed using kappa statistics to measure agreement between the seven- and four-view image interpretations.

RESULTS

A total of 479 reports were generated in each of the seven- and four-view image sets, with 142 (29.6%) of the seven-view and 125 (26.1%) of the four-view reports conveying certain or suspected acute osseous findings. Statistical analysis yielded an average inter-method kappa coefficient of 0.818 for the four radiologists, which represents strong agreement between the seven- and four-view interpretations.

CONCLUSION

The modified four-view hand and wrist radiographic series produces diagnostic results comparable to the traditional hand and wrist series in the acute clinical setting.
A modified four-view hand and wrist radiographic study is effective for assessing acute hand and wrist injury while reducing cost, time, and radiation dose.

**Interventional Series: Peripheral and Visceral Occlusive Disease**

**Series Courses**

<table>
<thead>
<tr>
<th>AMA PRA Category 1 Credits ™</th>
<th>3.25</th>
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<tr>
<td>ARRT Category A+ Credits</td>
<td>3.75</td>
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**Thu, Dec 4 8:30 AM - 12:00 PM  Location: N226**

**Participants**

**Moderator**
Parag J. Patel MD : Consultant, Medtronic, Inc Consultant, C. R. Bard, Inc Consultant, Cook Group Incorporated

**Speakers**
Bureau, Medtronic, Inc Consultant, Penumbra, Inc

**LEARNING OBJECTIVES**

1) Describe recent evidence concerning the use of renal denervation for malignant hypertension. 2) Explain the use of radial artery access. 3) Outline 3 recommendations for endovascular treatment of peripheral vascular disease. 4) List two important studies published on vascular disease in the past year. 5) Describe 2 uses of stent grafts.

**Sub-Events**

**VSIR51-01**


Marcelo Guimaraes (Presenter): Consultant, Cook Group Incorporated Consultant, Baylis Medical Company Consultant, Terumo Corporation Patent holder, Cook Group Incorporated

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**VSIR51-02**

Limitations and Complications of Trans-brachial Arterial Access for Endovascular Treatment of the Peripheral Vasculature: A Contemporary and Prospective Comparison to Trans-femoral Access

Karla Maria Treitl MD (Presenter): Nothing to Disclose, Maximilian F. Reiser MD : Nothing to Disclose, Marcus Treitl MD : Nothing to Disclose

**PURPOSE**

Trans-brachial (TB) access for intervention is still believed to be dangerous, despite its advantages for the interventionalist and patient. The Aim of the study was to prospectively assess current limitations and complication rates of the TB access technique for endovascular treatment of peripheral vascular pathologies in comparison to the trans-femoral (TF) access technique for the first time.

**METHOD AND MATERIALS**

In total, 300 patients (202 m; age 68.7 ± 11.0yrs) with arterial occlusive disease underwent endovascular therapy via a TB or TF access. Peri-procedural data (sheath size, dose area product, fluoroscopy, examination time) were analyzed. Post-procedural complications of the puncture sites were categorized as minor (local hematoma, pseudoaneurysm, embolization, dissection, minor bleeding) and major (thrombotic occlusion, hematoma requiring surgery, major bleeding, nerve injury) and analyzed by the Fisher’s exact and the Chi2-test according to the target lesions.

**RESULTS**

The minor and major complication rates of both groups did not significantly differ (21/14.0% vs. 26/17.3%, P=0.26; 4/2.7% vs. 3/2.0%, P=0.50). The dose area product and the fluoroscopy time were significantly higher in the TB-group (12752.1 ± 9524.5 cGycm2 vs. 6073.2 ± 6568.5 cGycm2; P=0.00; 24.3 ± 18.4 min vs. 18.9 ± 12.6 min; P=0.01), though examination times were comparable (121.8 ± 48.9 min vs. 125.0 ±44.2; P=0.57).

**CONCLUSION**

Results and complication rates of the TB-access are comparable to the TF-access for endovascular treatment of target lesions in peripheral or visceral artery occlusive disease, making it a safe and important alternative to TF access in selected cases. It is associated with a higher radiation exposure.

**CLINICAL RELEVANCE/APPLICATION**
### VSIR51-03

**Long-term Results after Balloon Angioplasty of the Crural Arteries: Which Variables Influence Limb Salvage and Patient Survival?**

**Inge Kaare Tesdal MD (Presenter): Nothing to Disclose, Christian Krzemien MD: Nothing to Disclose, Christel Weiss: Nothing to Disclose**

#### PURPOSE

To evaluate the technical and clinical success rates, procedure-related complications, and long-term results for patients who underwent angioplasty of the crural arteries.

#### METHOD AND MATERIALS

Retrospectively we evaluated all patients who underwent angioplasty of the crural arteries due to critical chronic limb ischemia or severe claudication in the time period from 1/2002 to 12/2005. These patients were contacted in the time period from 1/2009 to 12/2010, and a follow-up examination including angiography was performed or telephone interviews were conducted with patients, relatives and referring doctors for follow-up. The primary end points were the limb salvage rate and patient survival rate. The secondary end points included the complication rate, technical success rate, and patency rate. The prognostic relevance of treatment and selected variables with respect to limb salvage and patient survival were analyzed with multiple logistic regression.

#### RESULTS

212 patients with a mean age of 77.8 years (99 women and 113 men) underwent crural angioplasty on 239 limbs. 78 patients (36.6%) suffered from severe claudication (Rutherford category 3) and all others had critical chronic limb ischemia (category 4 to 6, resp. Fontaine-stage 3 and 4). The technical success rate was 98.4 % and the complication rate (SIR classification) was 9.1 % (5.2 % major). After a mean follow-up of 3.7 years, 48 patients (22.6 %) experienced minor- or major-amputation on 53 legs (22.2 %). The limb salvage rate (Kaplan-Meier estimation) was 85.4 % after 5 years. The mean survival rate according to Kaplan-Meier was 79.7 %, 72.2 %, 67.3 % and 51.4 % after 1, 2, 3 and 5 years, respectively. Results of multiple logistic regression analysis showed that negative prognostic variables with respect to patient survival were amputation (p=0.0017) and dialysis (p=0.0011) and with respect to limb salvage dialysis (p<0.0001) and non-patent peroneal artery (p<0.0001).

#### CONCLUSION

Balloon angioplasty of the crural arteries shows a high technical success rate with an acceptable complication rate. Dialysis and non-patent peroneal artery are negative prognostic variables for the clinical long-term success. However, the survival rate was limited by the co-morbidity and the high age in this patient group.

#### CLINICAL RELEVANCE/APPLICATION

Peroneal artery should be the preferred crural artery to be recanalized.

### VSIR51-04

**Evaluation of a Novel Bioabsorbable and Non-synthetic Vascular Closure Device: FISH in Daily Routine**

**Marcus Treitl MD (Presenter): Nothing to Disclose, Maximilian F. Reiser MD : Nothing to Disclose, Karla Maria Treitl MD : Nothing to Disclose**

#### PURPOSE

Vascular closure devices are typically made of synthetic materials, inducing an inflammation of the vessel wall that can cause scaring over of the access vessel. A novel femoral introducer sheath and hemostatic device (FISH) introduces small intestinal submucosa (SIS), that is known from treatment of burn wounds, as a closing agent into the vessel wall. In contrast to other devices this is meant to induce wound healing instead of scaring over. We present first results of the usage of this novel closure device in daily routine.

#### METHOD AND MATERIALS

132 consecutive patients (88 m; mean age 71,5yrs) with indication for endovascular treatment of peripheral artery disease received the FISH device for closure of the access vessel. Technical success of device deployment, the time to hemostasis, as well as the time to ambulation were recorded. Control of the access site was done by clinical examination and duplex ultrasound the following day. Small hematomas and bleedings were assessed as minor complications, whereas pseudoaneurysms or bleedings requiring surgical intervention were assessed as major complications.

#### RESULTS

Technical success was achieved in 97%. Device failure occurred in 2 cases. 2 patients developed a pseudoaneurysm that could be treated conservatively. No complication requiring surgical intervention has been observed. Mean time to hemostasis was 45 +/- 91 sec. Mean time to ambulation was 60 min. Most patients were on ASA. Mean INR was 1.11. Re-puncture of the vessel was done the next day in 6 cases without any complications. An intravascular device deployment or embolization was never observed. Re-puncture after several months was done in 12 cases without observation of scaring of the access vessel.
CONCLUSION

The novel FISH device is a safe and potent vascular closure device with excellent performance and a comparable low complication rate of 0.8%. In contrast to synthetic devices it seems to induce less scaring of the access vessel and allows immediate re-puncture without the risk of embolization.

CLINICAL RELEVANCE/APPLICATION

FISH - has a broader range of suitable vessel diameters - is not contraindicated in case of calcification - is made of biologic material known from wound therapy - is believed to induce less scaring over of the access vessel. It is therefore an important alternative and new device for vascular closure after peripheral intervention.

VSIR51-05

Update on Recommendations for Endovascular Treatment of PVD in 2014—"This is what to do and why to do it."


LEARNING OBJECTIVES

1) Know the results of Balloon Angioplasty, Stenting, drug-eluting stents, and drug-eluting balloon in the iliac arteries, the femoral artery and below the knee as put forward in recent major studies. 2) Put interventional therapy and results into perspective with surgical options. 3) Be able to select the optimal treatment strategy depending on lesion and patient characteristics. 4) Be aware of procedural costs and know the main factors influencing resource allocation.

VSIR51-06

Renal Denervation—Now What?

Dheeraj Kumar Rajan MD (Presenter): Consultant, TVA Medical, Inc Consultant, Johnson & Johnson

LEARNING OBJECTIVES

1) Describe what renal denervation is. 2) Summarize prior relevant pivotal studies for renal denervation and results of the HTN-3 study. 3) What clinical potential still exists for renal denervation.

VSIR51-07

Renal Sympathicolysis by Percutaneous Periarterial Injection of Vincristin—A Feasibility Study in Pigs

Patrick Freyhardt MD (Presenter): Nothing to Disclose, Ricardo Donners: Nothing to Disclose, Alex Riemert: Nothing to Disclose, Joerg Schnorr: Nothing to Disclose, Nicola Stolzenburg: Nothing to Disclose, Jan-Leo Rinnenthal: Nothing to Disclose, Rolf Wilhelm Guenther MD: Nothing to Disclose, Bernd K. Hamm MD: Research Consultant, Bayer AG Research Consultant, Toshiba Corporation Stockholder, Siemens AG Stockholder, General Electric Company Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips NV Research Grant, Siemens AG Research Grant, General Electric Company Research Grant, Elbit Medical Imaging Ltd Research Grant, Bayer AG Research Grant, Guerbet AG Research Grant, Bracco Group Research Grant, B. Braun Melsungen AG Research Grant, KRAUTH medical KG Research Grant, Boston Scientific Corporation Equipment support, Elbit Medical Imaging Ltd Investigator, CMC Contrast AB, Florian Streitparth: Nothing to Disclose

PURPOSE

To evaluate feasibility, safety and efficacy of renal sympathetic denervation with CT-guided needle-based percutaneous periarterial injection of vincristin in pigs.

METHOD AND MATERIALS

Percutaneous unilateral periarterial injection of 10 ml of a mixture of Vincristin 0.1 mg dissolved in 0.9% Saline, Bupivacaine and Accupaque 250 (ratio 7:2:1) was performed in 6 normotensive pigs. Needle placement and injections were performed under CT-guidance in all animals. Blood pressure measurements and CT scans of the kidneys perirenal structures were performed immediately pre- and post intervention and 4 weeks after treatment. After euthanasia Norepinephrine (NE) concentration of both kidneys was determined. The renal arteries and the surrounding tissue were examined histologically to look for induced nerve fibre degeneration.

RESULTS

All procedures were technically successful with good periarterial distribution of the injectant. No major events occurred. No postinterventional complications were observed. NE concentration of the renal parenchyma was significantly lower on the treated side in all pigs with a mean decrease of 53.5% (min: 43%, max: 66%) compared to the contralateral untreated kidney. Histological examination revealed neural degeneration in all animals.

CONCLUSION

CT-guided needle-based percutaneous periarterial Vincristin injection for renal sympathetic degeneration was feasible, effective and safe. This approach may be an alternative to the catheter-based techniques in the treatment of therapy resistant hypertension.

CLINICAL RELEVANCE/APPLICATION

Renal sympathicolysis by percutaneous periarterial Vincristin may be an alternative to catheter-based techniques. Apart from efficacy the procedure is less invasive and faster than RFA-based methods.
Accuracy of Simple Visual Estimation in Grading Peripheral Arterial Stenosis—Is Eyeballing Enough?


PURPOSE
To evaluate accuracy, inter-observer and intra-observer reliability of simple visual estimation (SVE) in grading peripheral arterial stenosis compared to calibrated measurements.

METHOD AND MATERIALS
23 interventionalists with a wide range of experience (1-30 years) and subspecialty training (IR (13), Neuro-IR (2), interventional-cardiology (4) and vascular surgery (4)) reviewed 42 angiographic images of peripheral and carotid arteries in two sessions. Images were shuffled between readings. An independent team measured all lesions using manual calipers. A +/- 5% error was considered as threshold for accurate visual estimation. Lesions were categorized by clinical significance (80% severe). SVE was compared for agreement by weighted kappa statistics. Reliability was assessed by intraclass correlation.

RESULTS
Overall accuracy of SVE in grading stenosis was 28.3% and 27.4% for the two assessments. Errors in excess of +/- 5% occurred in 71.7% and 72.6% respectively. Agreement with respect to clinical category was fair with a weighted kappa of 0.579 in the first testing session and 0.588 in the second. 92.6% and 93.8% of severe lesions, 40.9% and 41.5% of significant lesions and 71.5% and 73.3% of insignificant lesions were correctly identified in the first and second sessions respectively. In the first session 53.0% of significant and 4.4% of insignificant lesions were categorized as severe stenosis. 49.9% of significant lesions and 4.6% of insignificant lesions were overestimated as severe in the second session. Intra-rater reliability was good (0.990) and inter-rater reliability was fair for assessment of peripheral arteries (0.823, 0.809), and carotids (0.748, 0.708). Accuracy did not differ in relation to years of experience or specialty.

CONCLUSION
Despite good intra-observer reliability, inter-observer reliability was fair. Estimation of peripheral arterial stenosis often results in overestimation of stenosis, most pronounced in the 60-80% range. There were no significant differences based on years of experience in practice or specialty. Visual estimates of stenosis potentially lead to therapeutic decisions based on inaccurate information.

CLINICAL RELEVANCE/APPLICATION
Clinical decision making should be based on caliper measurements especially in non-significant stenoses.

Evaluation of Infrapoplitial Blood Flow Changes During Endovascular Revascularization Using 2D X-ray Perfusion Software: A Pilot Study

Michelle D.M.E. Meeks MSc: Research Consultant, Koninklijke Philips NV, Julie Mayer: Nothing to Disclose, Pascal Desgranges: Nothing to Disclose, K You: Nothing to Disclose, Jean-Francois Deux (Presenter): Nothing to Disclose, Hicham Herve Kobeiter MD: Nothing to Disclose

PURPOSE
To evaluate a 2D X-ray Perfusion software to quantify infrapoplitial blood flow changes during endovascular revascularization of femoropopliteal lesions.

METHOD AND MATERIALS
Fifteen patients undergoing endovascular revascularization were included in this study. Forty-one vessels were analyzed using 2D Perfusion software (Philips Healthcare, Best, The Netherlands). 2D Perfusion images could be collected after regular DSA, without additional radiation or contrast usage. A region of interest was drawn in the distal part of the 3 tibial arteries. Parameters: -time to peak (TTP), -wash in rate (WIR) and -arrival time (AT) were calculated. Parametric differences, before and after revascularization and between Rutherford classes, were statistically compared using paired and one-sample Student’s t-test, respectively.

RESULTS
Eight patients suffered from Rutherford class <3 and 7 from Rutherford class ≥ 3. Ten patients underwent SFA stent placement, the remaining five were treated with balloon angioplasty of the SFA and/or popliteal tibial arteries. Results demonstrated significant differences after revascularization in TTP (7% decrease), WIR (41% decrease) and AT (35% increase). Sub analysis showed a significant difference (p=0.004) in arrival time in CLI patients when compared to PAD patients, respectively a 40% decrease and 2.7% increase after revascularization.

CONCLUSION
2D Perfusion software allows for hemodynamic measurement of flow differences after endovascular revascularization. CLI patients, at rest, demonstrate a faster arrival time after revascularization when compared to PAD patients. This could be explained by the symptomatic appearance of vascular disease in PAD patients during physical exercise. Further research is needed to prove whether these hemodynamic differences are related to clinical outcome and tissue reperfusion.
CLINICAL RELEVANCE/APPLICATION

2D X-ray Perfusion Software is a promising post-processing imaging technique to increase our knowledge on blood flow characteristics in patients with Peripheral Artery Disease.

VSIR51-10  Updates in Vascular Disease
Parag J. Patel  MD (Presenter):  Consultant, Medtronic, Inc Consultant, C. R. Bard, Inc Consultant, Cook Group Incorporated Speakers Bureau, Medtronic, Inc Consultant, Penumbra, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIR51-11  Stent Grafts Explained
Lindsay S. Machan  MD (Presenter):  Medical Advisory Board, Boston Scientific Corporation Medical Advisory Board, Arsenal Medical Inc Steering Committee, Cook Group Incorporated Stockholder, Analytics 4 Life Stockholder, Calgary Scientific, Inc Stockholder, Harmonic Medical Stockholder, IKOMED Technologies Inc Stockholder, Nitinol Devices & Components, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

VSVS51

Vascular Imaging Series: CT Angiography—New Techniques and Their Application

Series Courses

CT VA
AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 4.00
Thu, Dec 4 8:30 AM - 12:00 PM  Location: E352

Participants

Moderator
Dominik Fleischmann  MD : Research support, Siemens AG

LEARNING OBJECTIVES

1) To describe and illustrate new techniques for CT angiography. 2) To show present and future clinical applications of these methods.

Sub-Events

VSVA51-01  Iterative Reconstruction for CTA
Sandra Simon Halliburton  PhD (Presenter):  Research Grant, Koninklijke Philips NV Research Grant, Bayer AG

LEARNING OBJECTIVES

1) Understand the basic principles of iterative reconstruction for CT. 2) Describe commercially available iterative reconstruction techniques. 3) Review the advantages and disadvantages of iterative reconstruction. 4) Discuss the incorporation of iterative reconstruction algorithms into clinical protocols for CT angiography.

VSVA51-02  Comparison of Objective and Subjective Image Quality between Filtered Back-Projection and Adaptive Statistical and Model-based Iterative Reconstruction Techniques in CT Venography using 80 kVp
Ki Seok  Choo  MD : Nothing to Disclose, Jae-Yeon  Hwang  MD : Nothing to Disclose, Jin Hyeok  Kim  MD (Presenter):  Nothing to Disclose, Myeong-Ja  Yun : Nothing to Disclose, Soo Jin  Lim : Nothing to Disclose

PURPOSE

To evaluate objective and subjective image quality of CT venography (CTV) using 80 kVp with model-based iterative reconstruction (MBIR) and compare with filtered back projection (FBP) and adaptive statistical iterative reconstruction (ASIR)

METHOD AND MATERIALS

This retrospective study was approved by our institutional review board. Total 44 consecutive patients (mean age: 56.1 ± 18.1) who were underwent CTV using 80 kVp for evaluation of deep vein thrombosis (DVT) were enrolled. The same raw data were reconstructed using FBP, ASIR and MBIR. Objective image quality (vascular
enhancement, noise, contrast to noise ratio (CNR) were measured in the inferior vena cava (IVC), femoral vein (FV) and popliteal vein, respectively by independent two radiologists who blinded to reconstruction method. In addition, subjective image parameters (image quality, image noise, confidence to find DVT) were assessed using a 5 point scale system by same two radiologists independently. Data were analyzed using repeated measures ANOVA and effective dose was estimated using the dose-length product (DLP).

RESULTS

All images reconstructed by MBIR were acceptable for diagnosis and DVT was diagnosed in 8 patients (18.2%). The mean CNR of MBIR was significantly higher than those of FBP and ASIR in the IVC, FV and popliteal vein and images in MBIR had significantly lower objective image noise (p < 0.01). However, mean vascular enhancement of MBIR was not significantly different from those of FBP and ASIR. In addition, the subjective image quality and confidence of find DVT of MBIR was significantly higher than those of the others (p < 0.01) while MBIR had the lowest score for subjective image noise (p < 0.01). The mean DLP was 364.31 ± 61.20 mGy cm

CONCLUSION

CTV using 80 kVp with MBIR provided diagnostic acceptable image quality for evaluation of DVT with low radiation dose and it was superior to FBP and ASIR in objective and subjective image quality.

CLINICAL RELEVANCE/APPLICATION

CTV using 80 kVp with MBIR will be optimal protocol for diagnosis of DVT with lowest radiation dose.
METHOD AND MATERIALS

On an SDCT (Philips Healthcare) 49 patients underwent contrast-enhanced examinations of the chest and abdomen following routine or CTA protocols. A subset of 36 examinations were chosen which had mean aortic attenuation of less than 200 HU calculated as the average of 8 regions of interest within the aorta. Subjective evaluation of vascular enhancement and overall image noise was graded on a 5-point scale (1 = Non-diagnostic, 5 = Excellent). Monoenergetic energy levels were chosen as the highest energy that provided mean aortic attenuation greater than 200 HU and maintained diagnostically acceptable subjective image noise and vascular enhancement. An ideal monoenergetic energy level was chosen as the highest energy that provided mean aortic attenuation greater than 200 HU and maintained diagnostically acceptable subjective image noise and vascular enhancement. At this energy level attenuation, noise, and signal-to-noise ratios as well as subjective image quality and vascular enhancement were compared to the standard 120 kVp polyenergetic study. Paired t-test and Wilcoxon signed-rank test were used for analysis.

RESULTS

34 studies (94%) met criteria for successful optimal monoenergetic reconstruction, with a mean optimal energy of 57 ± 6.4 keV. Optimizing energy levels significantly increased aortic attenuation compared to the 120 kVp studies by an average of 66% (238 ± 25 vs. 144 ± 25 HU; p<.001). Image noise averaged 16% higher in the monoenergetic energy studies than the 120 kVp exams (19.6 ± 3.9 vs. 16.9 ± 4.1; p<.001), while SNR was 41% higher (13.3 ± 2.9 vs. 9.4 ±2.5; p <.001). Subjective vascular enhancement was significantly higher on the monoenergetic images (4.7 vs 2.4, p <.001). While subjective image noise increased (4.2 vs. 5.0, p < .001), the resulting image set was diagnostically acceptable.

CONCLUSION

SDCT enables retrospective creation of an optimal monoenergetic image set which achieves attenuation levels comparable with dedicated aortic angiographic exams and remains acceptable for diagnosis despite increased image noise.

CLINICAL RELEVANCE/APPLICATION

SDCT enables the creation of retrospective aortic angiograms from studies that otherwise may not be diagnostic, suggesting the ability to create angiograms from routine or low contrast studies.

VSSA51-06


Philipp Riffel MD (Presenter): Nothing to Disclose, Stefan Haneder MD : Nothing to Disclose, Holger Haubenreisser : Nothing to Disclose, Bernhard Schmidt PhD : Employee, Siemens AG, Stefan Oswald Schoenberg MD, PhD : Institutional research agreement, Siemens AG, Thomas Henzler MD : Nothing to Disclose

PURPOSE

Previous studies demonstrated that calculated low keV monoenergetic datasets from Dual energy (DE)CT abdominal angiography imaging does not significantly improve contrast-to-noise ratio (CNR) when compared to polyenergetic images (PEI), which is due to the dramatic increase in image noise at lower keV levels. The recently introduced frequency-split technique combines the lower spatial frequency stack at low keV for high contrast with the high spatial frequency stack for image noise at high keV levels to calculate noise-reduced images at ultra-low keV levels below 70 keV. The aim of this study was to compare objective image quality indices in DECT angiography studies of the abdomen using conventional polyenergetic images (PEIs) and virtual monoenergetic images (MEIs) at different keV levels using the frequency-split technique.

METHOD AND MATERIALS

20 patients (14 male; mean age 70±10 years) who underwent DECT angiography of the abdomen were retrospectively included in this study. MEIs from 40 to 120 keV were reconstructed using the frequency-split technique. Signal intensity, noise, signal-to-noise ratio (SNR) and CNR were assessed in infrarenal aorta, superior mesenteric and external iliac arteries. Comparisons between MEIs and PEIs were performed using a Mann-Whitney U test.

RESULTS

60 arteries were evaluated. 40 keV MEIs resulted in significantly higher signal intensity (+254% on average; all p < 0.05) compared to PEIs at slightly higher SNR (+7% on average; p > 0.05). Highest CNR values were found in 40 keV MEIs (9 ± 0.8 HU, 7 ± 1.6 HU, 9 ± 1.4 HU in the infrarenal aorta, superior mesenteric and external iliac arteries, respectively), which were significantly higher compared to PEI (7 ± 1 HU, 5 ± 1.5 HU, 7 ± 1.5 HU in the infrarenal aorta, superior mesenteric and external iliac arteries, respectively, all p < 0.05).

CONCLUSION

Combining the lower spatial frequency stack for contrast at low keV levels with the high spatial frequency stack for noise at high keV levels leads to improved image quality of ultra-low keV monoenergetic abdominal DECT datasets when compared to previous monoenergetic reconstruction techniques without the frequency-split technique.

CLINICAL RELEVANCE/APPLICATION

With a frequency split approach, 40 keV MEIs provide improved objective image quality in DECT abdominal angiography compared to standard PEI. Their additional reconstruction might improve diagnostic accuracy.
PURPOSE

To evaluate image quality and radiation dose saving potential of a CT scan protocol that uses a detector with integrated signal-transformation, a high-pitch acquisition technique, automatic kVp selection and an iterative reconstruction algorithm.

METHOD AND MATERIALS

Between January and April 2014, 55 consecutive patients underwent CT angiography (CTA) of the chest, abdomen and pelvis on a third-generation dual-source CT using an ultra high-pitch (73 cm/s) acquisition protocol, topogram-based automatic kVp selection and mAs modulation in combination with a model based iterative reconstruction algorithm (group 1). As a control group, 55 patients who had undergone CTA with comparable scan ranges on a second-generation dual-source CT in 2012 and 2013 were matched according to gender, age and BMI (group 2). In all patients, 20 vascular segments were analyzed for attenuation and image noise by two readers on 3.0mm slices. Signal-to-Noise ratio (SNR) and Contrast-to-Noise ratio (CNR) were calculated for all segments. Dose-Length-Product (DLP) was documented to calculate effective dose.

RESULTS

There were no significant differences in age, weight or BMI between groups. In group 1, tube potential was 90kVp, 80kVp and 70kVp in 29 (53%), 24 (43%) and 2 (4%) patients. In group 2, tube potential was 140kVp, 120kVp and 100kVp in 7 (13%), 29 (53%) and 19 (34%) patients. Across all vascular segments, SNR and CNR were considerably higher in group 1 (SNR: 29.6 ± 3.3 vs. 21.0 ± 3.0; CNR: 26.7 ± 3.9 vs. 18.3 ± 2.9, both p's < 0.01). DLP, on the other hand, was substantially lower in group 1 (230 ± 63 vs. 391 ± 166 cm*mGy, p<0.001).

CONCLUSION

In third-generation dual-source CT scanners, the combination of an integrated detector design, a high-pitch acquisition technique, automatic kVp selection and iterative-reconstruction algorithms results in dose reductions of at least 40% in comparison with earlier scanner generations at preserved image quality.

CLINICAL RELEVANCE/APPLICATION

This study highlights the importance of a rapid and successful translation of the considerable engineering progress of the last years into radiation dose reduction and thus patient benefit.
A total of 84 patients (35 women and 49 men; mean age 66.5 years; range, 37-86 years) with abdominal aorta disease, from June 2011 to December 2013, were prospectively enrolled. All patients underwent 256 MDCT scan examination of abdominal aorta (Brilliance-iCT, Philips, NL). Forty-six patients were evaluated using low-dose radiation protocol (100kV; automated tube current modulation) and ultra low-contrast volume (40ml; 4ml/s; 350mgI/ml). A control group of 38 patients underwent standard CTA protocol (120kV; automated tube current modulation) with standard contrast volume (80ml). Intravessel density measurements (HU) were performed manually drawing a region of interest (ROI) in the lumen of abdominal aorta, renal arteries and common iliac arteries. The radiation dose exposure (dose-length product, DLP; CT dose index, CTDIvol) and the signal-to-noise-ratio (SNR) were also calculated. The data were then compared and statistically analyzed.

RESULTS

All exams were presented high diagnostic quality, permitting the correct visualization of the main aortic branches and vascular wall. Higher density measurements were obtained in low-kV protocol as compared to control group, in abdominal aorta (mean attenuation value 343HU vs 320HU), renal arteries (332HU vs 298HU) and common iliac arteries (325HU vs 320HU). No significant noise increase was observed in the study group (mean signal to noise ratio, SNR 15.2) in comparison to control group (SNR 18.6). A significant (p<0.05) overall reduction of 65% in radiation dose exposure was obtained using low-kV protocol (DLP335mGy*cm, CTDIvol5.8mGy) as compared to control group (DLP973mGy*cm; CTDIvol19.4mGy).

CONCLUSION

Low-kV CTA by using 256 MDCT scanner permits to significantly reduce the radiation dose exposure (over 65%) and the amount of contrast media volume injected, maintaining high diagnostic quality as compared to standard protocol, reducing also the risk of renal damage.

CLINICAL RELEVANCE/APPLICATION

Low kV protocol with low contrast media volume reduces the radiation exposure, preserving renal function and providing an effective tool for the evaluation of patients with abdominal vascular disease.

CT Angiography of the Abdomen and Pelvis in Azotemic Patients utilizing 80 kVp Technique and Low Dose Iodinated Contrast—Comparison with Routine 120 kVp Technique

David Knipp MD : Nothing to Disclose, Jason Wayne Mitchell MD : Nothing to Disclose, Barton Frederick Lane MD : Nothing to Disclose, Barry David Daly MD (Presenter): Research Grant, Koninklijke Philips NV

PURPOSE

Reduction of iodinated contrast load for CTA is of importance in azotemic patients, especially those who are not dialysis dependent, and may be achieved with the improved iodine absorption of lower kVp techniques. We compared quantitative and qualitative scan data in two abdominopelvic CT Angiography (AP-CTA) protocols, one with a 50% reduced dose of iodinated contrast @ 80 kVp, the other with a standard dose @ 120 kVp. Radiation dose was also compared between the two techniques.

METHOD AND MATERIALS

A chart review was performed yielding 103 patients who underwent AP-CTA on 64 or 256 channel CT scanners with 320-350 mg I/mL contrast: 49 with 30-60 mL (mean 48) at 80 kVp, and 54 controls with 90-100 mL (mean 98) at 120 kVp. Objective image quality parameters included arterial attenuation, noise, and contrast to noise ratio (CNR) measured at 6 levels in the aorta and iliac arteries. Subjective assessment of image quality (IQ), enhancement intensity (EI) and image noise (IN) was scored blindly at the same levels by three attending radiologists on a 3 point scale. Iterative reconstruction (iDose, Philips Healthcare, Cleveland, OH) was utilized in 18 and 49 of the 120 and 80 kVp groups respectively. Radiation dose (CTDIvol and DLP) was recorded in each case.

RESULTS

The aggregate of 6 level CNR for the 120 kVp group was 12.4 ± 4.6, compared to 11.8 ± 7.0 for the 80 kVp group (p =0.60). The 120 kVp technique scored better for subjective IQ (p=0.042) and IN (p=0.004) but not for EI (p=0.205). No study had to be repeated. Radiation dose was significantly higher in the 120 kVp than 80 kVp group [DLP 863 ± 344 and 482 ± 206 (mGy*cm) respectively (p<0.0001)]. In the 80 kVp group, serum creatinine pre-and post AP-CTA (means 3.7 and 3.4 mg/dl respectively) showed no significant change (p=0.172).

CONCLUSION

Based upon objective CNR and subjective EI scores, the 80 kVp technique with 50% lower iodine contrast dose allowed satisfactory AP-CTA studies without nephrotoxicity in azotemic patients. Use of iterative reconstruction in all 80 kVp group cases contributed to a 43% mean radiation dose reduction. Negative but potentially reversible sequelae of this major drop in radiation dose included increased IN and reduced subjective IQ.

CLINICAL RELEVANCE/APPLICATION

In azotemic patients, 80 kVp technique using 50% lower iodinated contrast dose and iterative reconstruction allows safe and satisfactory AP-CTA studies with major radiation dose reduction.

Dual-Phase Triple Split-Bolus Protocol for Pre-Operative CT Evaluation of Laparoscopic Donor Kidney Anatomy: A Way for Dose Reduction

VSVA51-11
Kidney Anatomy: A Way for Dose Reduction

Roberto Iezzi MD (Presenter): Nothing to Disclose, Michele Fabio La Torre MD: Nothing to Disclose, Alessandra Guerra MD: Nothing to Disclose, Massimiliano Nestola MD: Nothing to Disclose, FRANCO CITTERIO MD: Nothing to Disclose, Lorenzo Bonomo MD: Nothing to Disclose

PURPOSE
To evaluate the diagnostic performance of a triple bolus dual-phase acquisition protocol (unenhanced/combined artero-venous-excretory phases) for the preoperative assessment of kidney anatomy in renal laparoscopic living donors.

METHOD AND MATERIALS
Twenty consecutive patients, referring to our department to undergo CT evaluation prior to living donor nephrectomy, were enrolled in our single-center prospective randomized comparison of 2 CT-acquisition protocols. Ten patients (Group A) underwent standard quadri-phase CT-examination (unenhanced, arterial, venous, and delayed phases) during a single injection bolus of 100 ml of contrast medium whereas the last 10 patients (Group B) underwent a dual-phase CT protocol (unenhanced and combined artero-venous-excretory phases). Combined artero-venous-excretory phase (Renal Triple-Rule-Out) was performed with a triple split-bolus injection protocol (CM: 30+30+40 ml, @4mL/sec) and an optimized time delay triggered to obtain both artery, veins and renal pelvis opacification at the same time. CT-images were quantitatively and qualitatively compared by two blinded independent readers. The 2 protocol were also compared in terms of diagnostic performance using the surgical assessment during nephrectomy, as gold standard.

RESULTS
All CT examinations were considered technically adequate and no complications occurred. Significantly higher vascular attenuation values (renal arteries and veins) were obtained in Group B. No significant differences were noted in terms of image quality with either axial source images or 3D reconstructions. Likewise, no significant differences were found among the two protocols in terms of noise. No beam-hardening artifacts due to renal pelvis opacification affecting image interpretation were found. No significant differences were found among the two groups with regard to diagnostic performance. Overall dose reduction of 60% was achieved in Group B.

CONCLUSION
Renal Triple-Rule-Out CT Protocol by using a triple-bolus injection protocol is feasible and effective in the preoperative planning of laparoscopic living kidney donors, without compromising image quality and diagnostic performance with a substantial reductions of radiation dose.

CLINICAL RELEVANCE/APPLICATION
Renal-Triple-Rule-Out CT protocol may allow a significant reduction in radiation burden in renal laparoscopic living donor without affecting an accurate pre-treatment planning.

Gravitational Gradient (GG) in Abdominal Aortic Aneurysms (AAA) during CT Angiography (CTA) as a Sign of Disturbed Hemodynamics and Adverse Clinical Outcome

Elizabeth George MD: Nothing to Disclose, Michael Lally Steigner MD: Speaker, Toshiba Corporation, Antonios Antoniadis: Nothing to Disclose, Michael Hanley MD: Nothing to Disclose, Frank John Rybicki MD, PhD: Research Grant, Toshiba Corporation, Dimitris Mitsouras PhD (Presenter): Nothing to Disclose, Amir Imanzadeh MD: Nothing to Disclose, Kanako Kunishima Kumamaru MD, PhD: Nothing to Disclose, Yiannis M. Chatzizisis MD: Nothing to Disclose, Ruth M. Dunne MBBC: Nothing to Disclose, Andreas Giannopoulos MD: Nothing to Disclose

PURPOSE
A recently proposed sign at CTA, the “gravitational gradient” (GG), quantifies the antero-posterior inhomogeneity of luminal contrast enhancement under the hypothesis that it may signify slow flow in large vessels. We thoroughly investigated the GG in infrarenal AAA as a source of hemodynamic information and assessed its relevance with respect to rapid AAA growth.

METHOD AND MATERIALS
The GG was measured in 67 consecutive pre-repair CTAs and used to classify patients as high (≥1.4) or normal (<1.4) GG (Figure). We compared the two groups for a) cardiovascular (CV) status, including ejection fraction; b) CTA scan and contrast delivery parameters, including timing; c) aortic and AAA geometry; d) characteristics of the blood flow patterns using computational fluid dynamics in 5 high and 5 matched normal GG patients; and e) AAA growth >0.4cm/yr in a 3-year period. We also assessed GG change in post-repair CTA available in 10 high GG patients.

RESULTS
18% of AAAs (n=12) exhibited a high GG≥1.4. A high GG was independent of patient CV status, CT scan/contrast delivery parameters, and AAA/aortic geometry (all p>0.05). The only significant differences between patients with high vs normal GG were a sudden drop in aortic enhancement between the renal arteries and aortic bifurcation (43±38 vs 10±39 HU drop, p<0.05; Figure), and all CFD-derived parameters, namely extent of retrograde flow or stasis (10±6% vs 24±2% luminal area affected, p<0.05, Figure), helicity (5±2 vs 12±5 m2/s2, p<0.05), and vorticity (72±25 vs 109±27 s-1, p<0.05). In the 10 high GG patients that underwent repair, both the high GG and sudden drop in aortic enhancement across the AAA resolved (pre vs post GG=1.9±0.5 vs 1.0±0.1, p<0.05; HU drop=42±42 vs 20±20, Figure). Finally, a high GG was associated with a relative risk of 2.7 (95% CI: 1.3-5.3, p<0.05) for AAA growth >0.4cm/yr.

CONCLUSION
Inhomogeneous luminal contrast enhancement in infrarenal AAA CTA as detected by the GG is associated with complex hemodynamic patterns and rapid aneurysm enlargement. Its potential use to detect patients at risk of rapid AAA growth and rupture should be further explored.

**CLINICAL RELEVANCE/APPLICATION**

The Gravitational Gradient is a readily identifiable imaging sign in AAA CTA that is associated with disturbed blood flow patterns and clinically significant disease progression. It may have potential use in surveillance and elective repair algorithms toward reducing rupture rates.

**VSSA51-13**

**Quantitative Determination of Respiratory Movement of the Aorta and Side Branches**

Anna Margaretha Sailer MD, MBA (Presenter): Nothing to Disclose, Bart A.J.M. Wagemans MD: Nothing to Disclose, Marco Das MD: Research Consultant, Bayer AG Research Grant, Siemens AG Speakers Bureau, Siemens AG, Michiel W. De Haan MD, PhD: Nothing to Disclose, Joachim Ernst Wildberger MD, PhD: Nothing to Disclose, Geert Willem H. Schurink MD, PhD: Nothing to Disclose

**PURPOSE**

Aim of this study was to quantitatively assess the magnitude and direction of respiratory movement of the aorta and side branches.

**METHOD AND MATERIALS**

This prospective study was approved by the institutional review board; informed consent was obtained from all patients. We performed a quantitative three-dimensional subtraction analysis of computed tomography during inspiration and expiration to establish the respiratory geometric movements of the aorta and side branches. 60 patients (42 men, 18 women, mean age 70 ± 9 years) with aortic disease were included. During breath-hold expiration and inspiration respectively, one millimeter (mm) slice thickness non-contrast enhanced and contrast-enhanced computed tomography of the aorta were performed respectively. By means of dedicated multiplanar reformation image subtraction software using the spine as reference point, position of relevant anatomic sections from both datasets were analyzed. These included the diaphragm domes, anterior thorax wall, ascending thoracic aorta (AAo), the origin of the left subclavian artery (LSO), descending thoracic aorta at level of tenth thoracic vertebra (DAO) as well as the origin of the renal arteries (RAO).

**RESULTS**

With inspiration, the regions of interest of the aorta and side branches moved in anterior, medial and caudal direction compared to the expiration state. Threshold for vessel displacement was at least five mm anterior-posterior thoracic excursion or ten mm diaphragm dome movement. Mean 3-dimensional movement (± standard deviation) was 8.9 ± 3.6 mm (AAo), 11.1 ± 3.9 mm (LSO), 4.9 ± 2.5 mm (DAO) and 1.4 ± 1.1 mm (RAO). There was significantly less movement in the DAo compared to LSO (p < 0.001). Correlation coefficient between extent of LSO displacement and thorax excursion was 0.78.

**CONCLUSION**

The aorta and side branches undergo considerable respiratory movement. This finding may be important for thoracic and complex thoraco-abdominal endograft designs as well as fusion image guidance during endovascular aortic repair.

**CLINICAL RELEVANCE/APPLICATION**

Respiratory movement is an important contribution to understanding the aortic dynamics; it has implications especially for planning and implantation of endovascular thoraco-abdominal aortic repair.

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**VSSA51-14**

**Post Processing, Workflow and Interpretation**

Karin Evelyn Dill MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To illustrate steps in image post-processing for the interpretation of CTA images. 2) To highlight elements that can be used to optimize workflow for multiplanar reformatted images, maximum intensity projections, and three-dimensional volumes.

**ABSTRACT**

During this presentation, the most current post processing techniques available for CT angiography will be reviewed. The audience will understand the application of these tools for optimal image interpretation. Imaging and workflow protocols will be introduced, with the emphasis on improving patient care, as part of a multidisciplinary team.
**SUB-EVENTS**

**SSQ15-01**  
**Nuclear Medicine Keynote Speaker: New PET Cardiovascular Biomarkers—Beyond Perfusion and Viability**

Robert J. Gropler MD (Presenter): Advisory Board, Bracco Group Advisory Board, GlaxoSmithKline plc Advisory Board, Pfizer Inc Advisory Board, Bayer AG Research grant, GlaxoSmithKline plc Research grant, Pfizer Inc Research grant, Clinical Data, Inc Research grant, Lantheus Medical Imaging, Inc

**SSQ15-03**  
**Comparison in Diagnostic Performance between Single Semi-supine Acquisition and 2-position (Upright and Supine) Acquisition in Myocardial Perfusion Imaging with a Solid State Dedicated Cardiac Scanner**

KA Chun Yip (Presenter): Nothing to Disclose, Yu Ching Lau: Nothing to Disclose, Sirong Chen: Nothing to Disclose, William Cheung: Nothing to Disclose, Chi Lai Ho: Nothing to Disclose

**METHOD AND MATERIALS**

36 patients (M=32, mean age=65±12y, mean BMI=25.3±4.1) suspected of coronary artery disease (CAD) underwent same day Tc-99m tetrofosmin rest-stress MPI on a CZT solid state cardiac scanner (D-SPECT, Spectrum Dynamics) in 3 positions: U, S and SS (40° with lumbar support, detector head reclining), all with 1 M left ventricular coned counts. Reconstructed images by standard algorithms were individually interpreted by 2 experienced NM physicians in consensus for discriminating perfusion abnormalities from inferoapical (IA) or inferior wall (IW) artifacts. All patients had invasive coronary angiography (ICA) within 3 months after MPI, with>70% luminal stenosis as positive.

**RESULTS**

ICA confirmed 34 patients with CAD. The patient-based sensitivity and accuracy of SS MPI were 85% (29/34) and 83% (30/36), respectively, similar to those for combined U and S MPI (sensitivity 85%, accuracy 86%). 12/36 (33%, mean BMI=28.4±5.8) patients had IA artifacts on U MPI but all were partially or completely normalized on SS images. 7/36 (19%) large patients with BMI 25.4 - 44.8 showed fixed and mild IW artifacts significantly less severe than those on S MPI.

**CONCLUSION**

Single SS MPI with lumbar support could minimize IA and IW artifacts commonly appeared on U and S MPI. It has sensitivity and accuracy comparable to a 2-position U and S MPI for detection of CAD by D-SPECT.

**CLINICAL RELEVANCE/APPLICATION**

Pre-acquisition optimization to improve raw data signal reception is as important as post-acquisition data processing. This may also improve imaging time and patient through-put.

**SSQ15-04**  
**Characterization of the Difference in Appearance between Supine and Prone Myocardial Perfusion Imaging on a High-efficiency Pinhole SPECT System**

Brandon Augustus Howard MD (Presenter): Nothing to Disclose, Jorge Daniel Oldan MD: Nothing to Disclose, Robert Pagnanelli RT: Nothing to Disclose, Salvador Borges-Neto MD: Speakers Bureau, General Electric Company

**PURPOSE**

Cadmium-zinc telluride (CZT) detectors promise improved resolution, scan times, and radiation dose in myocardial perfusion imaging (MPI). Traditional Anger cameras suffer from attenuation artifact, which in men is seen in the inferior wall. Specificity for CAD reportedly improves when prone imaging is added to supine imaging, and this practice has become commonplace. However, a systematic study of the difference in uptake between prone and supine imaging has not yet been undertaken.
METHOD AND MATERIALS

Twenty patients referred for MPI underwent rest (supine and prone) and stress (supine and prone) Tc-99m tetrofosmin imaging on a CZT camera (GE Discovery NM 530c) between Oct. and Nov. 2013. One patient was excluded due to bowel uptake. Patient were 18 males and 1 female, with ages 35-76 (mean 60). Thirteen had known CAD and 6 had cardiac risk factors. Two board certified nuclear medicine physicians who were blinded to the clinical information, stress test results, and gated study scored perfusion using the 17 segment model and five point scale. Mean perfusion score (MPS) was computed for each segment and summed rest and stress scores (SRS, SSS) for each of the four conditions. Student’s T test with Bonferroni correction was used for statistical analysis.

RESULTS

SSS significantly decreased from supine to prone (SP) ($p=0.00622$). Perfusion in the basal inferior wall significantly increased from supine to prone at rest ($p=0.0013$) and at stress ($p=0.0000000103$). Removal of the basal inferior segment abolished the difference in SSS. Trends from SP not meeting cut-off for significance ($p=0.0147$) were as follows: rest perfusion increased in the mid- inferior segment ($p=0.0052$); stress perfusion increased in the basal inferoseptal, mid- inferoseptal, and mid- inferior segments ($p=0.00447$, $p=0.00231$, and $p=0.00325$, respectively). No other significant differences were noted.

CONCLUSION

Prone imaging results in an overall decrease in summed stress score (SSS) compared to supine, and this difference is solely due to increased tracer uptake in the basal inferior segment on prone. Perfusion in the basal inferior segment is also significantly greater on prone than supine imaging at rest, with no significant difference in SRS.

CLINICAL RELEVANCE/APPLICATION

Prone imaging results in increased tracer uptake in the basal inferior wall at stress and rest versus supine, and decreases overall summed stress score. Further study of prognostic and gender-specific effects is needed.

SSQ15-05

Feasibility Study of a Novel 6 Receiver Channel PET-optimized MR Coil for Hybrid Imaging of the Carotids


PURPOSE

Recently, hybrid PET/MR imaging of atherosclerosis was compared to conventional PET/CT imaging concluding potentially an enhanced applicability of PET/MR carotids imaging in patients with no overt atherosclerosis. Regarding the higher soft tissue contrast of MR imaging simultaneous PET/MR imaging of the carotid artery wall and particularly imaging of carotid artery atherosclerosis is appealing. Thus, we present an evaluation of a PET-optimized MR-carotids coil for advanced imaging of atherosclerosis

METHOD AND MATERIALS

A novel 6 receiver channel coil for simultaneous PET/MR imaging of the carotids was developed. To examine the overall performance, signal-to-noise ratio (SNR) and image quality was evaluated in phantoms and volunteers (N=5, using a T1-TSE-darkblood-, a T2-fat saturated, a DCE-test- and a 3D MPRAGE - sequence as well as 10 min PET acquisitions). The MR-image quality was assessed by a blinded diagnostic evaluation against the clinical standardized procedure using images. Using the same clinical protocols the PET performance was assessed using homogeneous phantoms (FDG, 80-100MBq).

RESULTS

MR image quality for the novel PET/MR carotids coil showed significant advantages over the clinical standard imaging using a dedicated MR-only coil. The quantitative validation for the PET performance showed that the average attenuation in homogeneous phantoms in the volume affected by the two coil elements (VOI: 8cm diameter by 12cm length) variaof the new PET-optimized MR coil (mean ± SD = 0.82 ± 0.005 SUV) is only a little lower than using a conventional MR-only coil (mean ± SD = 0.80 ± 0.02 SUV). However, regarding the mean variation the variability of a conventional coil (min. value - max. value = 0.78-0.86 SUV) being three times higher than the newly developed PET/MR carotids coil (min. value - max. value = 0.81-0.83 SUV).

CONCLUSION

Considering the small VOI for imaging atherosclerosis in the carotids the novel PET-optimized 6 receiver channel coil is capable of simultaneous hybrid PET/MR imaging with excellent MR-image quality and homogeneous PET tracer attenuation for improved tracer uptake quantification.

CLINICAL RELEVANCE/APPLICATION

Simultaneous hybrid PET/MR imaging of carotids using the newly developed coil is able to advance diagnostic evaluation of atherosclerosis.

SSQ15-06

Limitations of the Most Diseased Segment for Use in 18FDG Vascular Imaging of the Aorta

Mark Allan Ahlman MD (Presenter): Nothing to Disclose, Veit Sandfort MD: Nothing to Disclose, Davis M. Vigneault BS: Nothing to Disclose, Nehal Mehta: Nothing to Disclose, David A. Bluemke MD, PhD: Research support, Siemens AG
**Purpose**

Changes in FDG arterial activity within the most diseased segment target to background ratio (MDS TBR) has been used to measure response to treatment. MDS TBR is calculated by averaging the maximum arterial activity of 3 contiguous axial slices centered at the slice that has the highest standardized uptake value (SUV), divided by the mean venous activity. For a normal adult patient population, we evaluate the MDS value and location using differing image reconstruction algorithms and methods for calculation.

**Method and Materials**

FDG PET-CT images were obtained at 2 hrs uptake time with a Siemens Biograph 128 mCT. Transaxial reconstruction of the descending aorta at 1.5mm slice thickness resulted in 200-300 images covering the descending aorta (DaO) from the arch to the bifurcation. PET-CT images were obtained in 17 hyperlipidemic subjects (age 56.8 ± 12.8, 59% female). Image reconstruction (256x256 matrix) was performed using both high definition (HD) and time-of-flight (TOF) algorithms. For either reconstruction, aortic MDS TBR was identified and the corresponding MDS TBR at the same slice location was measured in the second reconstruction. Any difference in MDS slice location was recorded. The MDS TBR was measured on both reconstructions using both 3- and 5-contiguous slices for comparison.

**Results**

MDS was located on the same slice between HD and TOF volumes in only 2/17 (11%) of subjects, and was 7.4 ± 6.6 cm apart on average. There was no difference in MDS TBR between HD and TOF when the same slice measurement method was used (e.g. 3-slice HD vs 3-slice TOF). However, there was higher value of 3-slice MDS TOF compared to 5-slice methods for either reconstruction (p<0.01). Specific to location, where TOF MDS TBR was found for 3- and 5-slice methods, the reference HD MDS TBR was lower (p<0.001 and p<0.001, respectively). Similarly, where found on HD images, the reference MDS TBR on the TOF reconstruction was lower (p<0.001 and p<0.01, respectively).

**Conclusion**

MDS location and value is highly dependent on reconstruction algorithm. Independent of MDS TBR length, values will regress to a lower value on the same slice on alternate PET reconstructions evaluated.

**Clinical Relevance/Application**

Designed to quantify changes in FDG PET arterial inflammation in research as well as for clinical application for cardiovascular risk stratification, we evaluate the MDS TBR with different reconstruction algorithms and measurement methods.

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**Cardiovascular Consequences of Liver Cirrhosis: Diagnosis of Portal Hypertension and Prediction of Pulmonary Consequences on Equilibrium Radionuclide Ventriculography**

Laurent Dercle MD (Presenter): Nothing to Disclose, Thomas Cognet: Nothing to Disclose, Olivier Lairez: Nothing to Disclose, Camille Christol: Nothing to Disclose, Monia Ouali: Nothing to Disclose, Marie-Angele Robic: Nothing to Disclose, Isabelle Berry: Nothing to Disclose, Christophe Bureau: Nothing to Disclose

**Purpose**

Liver cirrhosis leads to portal hypertension and hyperdynamic circulation that are responsible for hepatopulmonary syndrome and portopulmonary hypertension. The aim of this study was to determine if gated blood pool SPECT could become a one-stop-shop procedure in order to predict the cardiovascular complications of liver cirrhosis.

**Method and Materials**

100 patients referred for gated blood pool SPECT were prospectively included: 16 cirrhotic patients and a control group (n=84). The parameters of the function of both ventricles were measured: global, regional, systolic, diastolic, synchrony and Spleno-Hepatic Score [SHS]. The SHS is a new score of the severity of the vascular redistribution from liver to spleen due to the portal hypertension and is calculated according to the formula: SHS=(S25*LSD)/(H25*LHD). LSD: longest splenic diameter, LHD: longest hepatic diameter, H25 (S25): mean activity per pixel at the center of the right liver (spleen) in a 25 pixel ROI. The gold standard for the measurement of the portal pressure and of the mean pulmonary arterial pressure was catheter measurement.

**Results**

Clinical parameters were not statistically different in the two groups. Biological parameters related to liver cirrhosis were statistically different. Concerning the treatment, the proportion of diuretics and inhibitors of angiotensin converting enzyme was significantly higher in the cirrhotic group. By multivariate regression analysis, two parameters were independent predictors of liver cirrhosis: SHS and LVEF. Odds Ratio were: 3.7 for SHS (95CI: 1.4-9.6) and 1.2 for LVEF (95CI: 1.0-1.4). According to ROC curve analysis, the best thresholds were SHS>0.73 (AUC:0.97 (95CI: 0.94-1.00), Sensitivity 88%, Specificity 95%) and LVEF>76% (AUC: 0.90 (95CI: 0.81-0.99), Sensitivity 88%, Specificity 83%). In the liver cirrhosis group, the strongest correlation with the mean pulmonary arterial pressure was for SHS (r=0.56).

**Conclusion**

Gated blood pool SPECT is efficient to predict the cardiovascular complications of liver cirrhosis. SHS and LVEF are two independent parameters that assess the severity of the vascular redistribution and the hyperdynamic circulation. An increased SHS could be considered as a predictor of an increased pulmonary arterial pressure.
SSQ15-08  The Redistribution of Outpatient Radionuclide Myocardial Perfusion Imaging (MPI) from Offices to Hospital Facilities as a Result of Code Bundling – Cost Implications

David C. Levin MD (Presenter): Consultant, HealthHelp, LLC Board of Directors, Outpatient Imaging Affiliates, LLC, Bhavik Patel MD: Nothing to Disclose, Laurence Parker PhD: Nothing to Disclose, Vijay Madan Rao MD: Nothing to Disclose

PURPOSE

In 2010, the CPT codes for MPI, LV wall motion, and LV ejection fraction were bundled together into a single new code that sharply reduced reimbursement. Other policy decisions in recent years have also adversely affected reimbursement. As a result, many cardiology office practices migrated into hospital employment. Our purpose was to see if this led to a noticeable shift in place-of-service of these exams from offices to hospital outpatient departments (HOPDs). This would lead to higher costs, since outpatient imaging reimbursements to hospitals are considerably higher than those to offices.

METHOD AND MATERIALS

The nationwide Medicare Part B databases for 2002 to 2012 were the data sources. The primary CPT codes for MPI were selected and utilization rates per 1000 beneficiaries were calculated for outpatients. Medicare's place-of-service codes were used to identify elective outpatient studies done either in private offices or HOPDs. Specialty codes identified those exams done by radiologists (including nuclear medicine physicians), cardiologists, and other physicians. Trends were analyzed over the study period.

RESULTS

The private office MPI utilization rate per 1000 rose from 37.8 in 2002 to a peak of 57.3 in 2008 (+52%). It dropped slightly in 2009, then began a steady and steeper decline, dropping to 35.0 in 2012 (-39% vs peak). In HOPDs, the rate dropped somewhat from 18.8 in 2002 to 15.6 in 2008 and 2009 (-17%), but then increased to 20.6 in 2012 (+32% vs nadir). Most outpatient MPI scans are done by cardiologists and their utilization trends generally mirrored the trends for total MPIs by all specialists as a group. On the other hand, radiologists' use of MPI has declined steadily in both venues in recent years.

CONCLUSION

In recent years, outpatient MPI use has declined sharply in offices. This is likely due to lower reimbursement - principally resulting from code bundling - which has led many cardiologists to close their offices and become hospital employees. At the same time, MPI use in HOPDs has begun to increase. This shift is an unfavorable result of code bundling. Costs will rise because Medicare pays HOPDs more than it does private offices for the scans. In addition, the role of radiologists and nuclear medicine physicians has been diminished.

CLINICAL RELEVANCE/APPLICATION

not applicable
wave velocity (PWV), flow-mediated dilation (FMD) of brachial artery, lacunar brain infarcts, and periventricular and deep white matter hyperintensities (WMHs) were assessed. Pearson and Spearman correlation analysis were performed to analyze the association of aortic arch PWV, AD and FMD with clinical data and biochemical test results. Univariable logistic regression analyses were used to analyze the association of aortic arch PWV, AD and FMD with cerebral small vessel disease. Multiple logistic regression analyses were used to find out the independent predictive factors of cerebral small vessel disease.

RESULTS

Mean aortic arch PWV was 6.73±2.00 m/s, ascending aorta AD (AA-AD) was 2.64±1.49 ×10⁻³ mm Hg⁻¹, proximal thoracic descending aorta AD (PDA-AD) was 3.08±1.25 ×10⁻³ mm Hg⁻¹, distal descending aorta AD (DDA-AD) was 3.69±1.87 ×10⁻³ mm Hg⁻¹, FMD was 16.67±9.11%. After adjustment for age, sex, smoke situation, diabetes duration and hypertension, PWV was statistically significantly associated with lacunar brain infarcts (OR=2.00, 95%CI: 1.14-3.2, p<0.05) and FMD was statistically significantly associated with periventricular white matter hyperintensities (OR=0.82, 95%CI: 0.71-0.95, p<0.05).

CONCLUSION

Quantitative evaluation of aortic compliance and endothelial function by using 3.0 T high-resolution MRI may contribute to stratify the cardiovascular risk factors of DM2 patients with a potential risk of cerebral small vessel disease.

CLINICAL RELEVANCE/APPLICATION

Our results suggested that high-resolution MRI may help stratify cardiovascular risks in DM2 patient with direct quantification of both aortic stiffness and endothelial dysfunction.

VIS264

Hyperemic Fractional Microvascular Blood Plasma Volume Is Related to Arterial Flow Reserve in Patients with Arterial Disease (Station #2)

Bharath Ambale venkatesh PhD (Presenter): Nothing to Disclose, David A. Bluemke MD, PhD : Research support, Siemens AG, Joao A. C. Lima MD : Research Grant, Toshiba Corporation, Chikara Noda : Nothing to Disclose

PURPOSE

Lower-extremity hyperemic skeletal muscle perfusion and popliteal arterial flow reserve measures could be valuable for diagnosing peripheral artery disease (PAD) and evaluating treatments that promote angiogenesis and tissue regeneration.

METHOD AND MATERIALS

The Patients with Intermittent Claudication Injected with ALDH Bright Cells (PACE) study is a randomized, double-blind, placebo-controlled multi-center clinical trial, to assess the clinical safety and efficacy of autologous bone marrow derived aldehyde dehydrogenase-bright cells. In a preliminary analysis of 16 PAD patients with an ankle-brachial index <0.9 and significant stenosis in the infrainguinal arteries at baseline as part of this study, MRI-derived measures of hyperemic calf muscle perfusion from dynamic contrast-enhanced (DCE) MRI and hyperemic popliteal artery flow from phase-contrast (PC) MRI were evaluated. Scans were performed in 1.5-T and 3-T scanners (GE, Siemens and Philips) across multiple centers using 0.05 mmol/kg Magnevist, and using a 5-minute occlusion of femoral artery flow by inflating a thigh cuff to suprasystolic pressures on the asymptomatic leg to induce hyperemia. DCE-MRI was performed at 8 slices at mid-calf using 3D SPGR sequences (spatial resolution: 1x1x5 mm, temporal resolution <5ms) and was preceded by a variable flip angle method to measure T1. Semi-quantitative measures and quantitative measures were obtained from the modified Tofts’ model post-hyperemia: area under the gadolinium curve at 60s (iAUC) and fractional blood plasma volume (Vb). The arterial flow reserve (AFR) was obtained as difference in peak flow (ml/s) after and before induced hyperemia from PC-MRI.

RESULTS

The patients were on average 66 years, with mean Vb = 4.5±5.2%, iAUC = 1.097±0.43 mmol/L*s and AFR = 1.144±1.15 ml/s. The iAUC was correlated with the absolute AFR - r = 0.55, p=0.027. The difference in average velocity at hyperemic and resting states was correlated to both the iAUC (r=0.51, p=0.045) and Vb (r=0.6, p=0.015).

CONCLUSION

Hyperemic blood flow rates measured with PC-MRI were related with hyperemic fractional blood plasma volume and tissue contrast uptake from DCE-MRI in PAD patients.

CLINICAL RELEVANCE/APPLICATION

This helps in indentification of skeletal muscle perfusion in relation to blood flow.

VIS265

Detection of Endoleaks after Endovascular Aortic Repair Using Unenhanced MR Imaging: Diagnostic Accuracy of Balanced Turbo Field Echo Sequence with Motion-sensitized Driven Equilibrium (Station #3)

Kensaku Mori MD (Presenter): Nothing to Disclose, Tsukasa Saida MD : Nothing to Disclose, Fujio Sato : Nothing to Disclose, Katsuhiro Nasu MD, PhD : Nothing to Disclose, Toshitaka Ishiguro MD : Nothing
To evaluate the diagnostic accuracy of unenhanced balanced turbo field echo sequence (BTFE) with motion-sensitized driven equilibrium (MSDE) for detecting endoleaks after endovascular aortic repair (EVAR).

**RESULTS**

On contrast-enhanced CT, 1 and 5 patients had type-1 and type-2 endoleaks, respectively. The respective area under the ROC curve, accuracy, sensitivity, and specificity for detecting endoleaks on unenhanced MR imaging were 0.983, 92.3%, 100%, and 90% for the observer 1 and 0.992, 96.2%, 100%, and 95% for the observer 2. The kappa value was 0.651, indicating good interobserver agreement. No, minimal, moderate, and severe artifact was assigned in 19, 4, 3, and 0 patients by the observer 1 and in 13, 9, 4, and 0 patients by the observer 2, respectively.

**CONCLUSION**

Endoleaks can be accurately diagnosed on BTFE with MSDE without use of contrast medium.

**CLINICAL RELEVANCE/APPLICATION**

BTFE with MSDE is a truly non-invasive method to detect endoleaks after EVAR, requiring neither contrast-medium injection nor radiation exposure. Thus, this technique will help to reduce invasiveness of follow-up imaging after EVAR, especially in patients with renal dysfunction.

**Clinical Outcomes in Primary Hyperaldosteronism Treatment: Radiofrequency Ablation vs. Adrenalectomy vs. Medical Therapy (Station #4)**

**PURPOSE**

To report and compare outcomes in patients undergoing radiofrequency ablation (RFA), surgical and medical treatment for primary hyperaldosteronism.

**RESULTS**

RFA group: Clinical follow-up was performed 73±40 days post-RFA. Blood pressure decreased from 146±18/92±15 pre-RFA to 135±22/82±12 post-RFA (SBP: p<0.05, DBP: p=NS). Number of anti-HTN drugs decreased from 3.1±1.4 pre-RFA to 1.9±1.7 post-RFA (p=0.01). Adrenalectomy group: Clinical follow-up was available in all patients, 48±255 days after AVS. Pre-AVS blood pressure was 144±19/88±12 vs. 136±20/83±11 post therapy (SBP: p=0.02, DBP: p=0.006). The patients on medical therapy were on an average of 3.1±1.8 anti-HTN medications prior to the AVS and an average of 3.3±1.8 on follow-up (p=NS). Whereas there was a decrease in hypertension and anti-HTN needed for control after treatment, in the surgical group (p<0.001) and the RFA group (p=0.003) compared to the medical therapy group, there was no significant difference in the change in anti-HTN after treatment between the surgical and RFA group (p=0.07). The percentage of responders-to-therapy (Figure 1) in the surgical and RFA group were similar (p=0.06) but lower in the medical therapy group.

**CONCLUSION**

RFA is a successful treatment for AVS-proven aldosterone producing adenomas with clinical outcomes comparable to adrenalectomy.
RFA is a successful treatment for primary hyperaldosteronism lateralizing to one gland on AVS with outcomes comparable to adrenalectomy, with the advantages of no incision, same day discharge and early return to daily activities.

**Efficacy of MR Guided Focused Ultrasound Surgery in Treating Adenomyosis: Study of 19 Indian Patients (Station #5)**

**PURPOSE**

To assess the efficacy of MR guided focused ultrasound surgery (MRGFUS) in treating adenomyosis by evaluation of non-perfused volumes (NPV) and symptom severity score (SSS).

**METHOD AND MATERIALS**

19 Indian women with significant symptomatic adenomyosis (SSS > 21) were selected. Patients underwent evaluation of the adenomyosis with post contrast MRI of pelvis. Those with focal and diffuse adenomyosis with definable treatable areas were treated by MRGFUS. Post treatment post contrast MRI pelvis was performed to assess the NPV. 6 months follow up with SSS questionnaire and MRI pelvis with contrast.

**RESULTS**

MRgFUS treatment of adenomyosis resulted in significant reduction in SSS in 74% patients. The post treatment SSS at 6 months and reduction in score was 16± 4.8 (SD) and 12.6 ± 5.4 (SD) respectively which showed strong correlation with the NPV and percentage of adenomyosis reduction (p < 0.01). NPV had a strong and highly positive correlation with reduction in SSS (r=0.92). The unpaired t-test determined that there was significant difference in NPV values in patients who had clinically significant reduction in SSS (p < 0.01). The ROC of NPV with reduction in SSS showed that an NPV > 22% resulted in significantly reduced SSS. Nearly 80% of our patients were adverse event free with the remaining having self-limited complications like abdominal pain, early menses and back pain. There was 1 patient of 1st degree burn due to previous surgery scar which also resolved within a month of the treatment.

**CONCLUSION**

MRgFUS can provide effective treatment of adenomyosis. The treatment is able to achieve NPV values that will result in clinically significant reduction in symptoms. The reduction in the SSS and percentage of adenomyosis reduction follows the NPV very closely and linearly, which means that achieving greater NPV will essentially result in significant symptom reduction. This procedure is safe with minimal adverse effects.

**CLINICAL RELEVANCE/APPLICATION**

MRgFUS should be used to treat focal or diffuse adenomyosis where a treatable area can be defined. NPV more than 20% should be therapeutic, however highest possible NPV that can be safely achieved should be sought for better symptom reduction.

**Doppler Sonographic Findings of Splenic Steal Syndrome after Liver Transplantation (Station #6)**

**PURPOSE**

The purpose of this retrospective study is to compare the most commonly used Doppler parameters between splenic steal syndrome (SSS) patients after orthotopic liver transplantation and the control group to investigate the findings and the value of Doppler ultrasound in the diagnosis of SSS and follow-up after treatment.

**METHOD AND MATERIALS**

A total of 51 patients with angiographic confirmed SSS (40 men, 11 women, average age of 57.7±9.9 years, age range 27-76 years) were enrolled in this study. The control group consisted of 50 liver transplant patients (40 men, 10 women, average age of 55.8±10.4 years, age range 8-75 years) with normal liver enzyme levels from the same period. The clinical data and ultrasound examination records were reviewed. All the patients were treated with proximal splenic artery embolization after the diagnosis of SSS was established. All the patients with SSS underwent Doppler ultrasound examination before and after the treatment. The following parameters were documented and analyzed in both groups: portal venous velocity (PVV), peak systolic velocity (PSV) of hepatic artery, resistance index (RI) of hepatic artery, and the size of spleen.

**RESULTS**

RI of the SSS group (0.94±0.08) was significantly higher than those of the control group (0.80±0.10) (P< 0.0001). RI>0.91 is the optimal threshold for the diagnosis of SSS with sensitivity of 72.0%, specificity of 80.8%, PPV of 78.9%, and NPV of 74.3% (AUC=0.81, P<0.0001). Moreover, RI tends to remain a high level in SSS patients, while it will normalize in the control group. Therefore, it may be more helpful for the diagnosis to observe the change of RI dynamically over time. There was no significant difference of PVV and PSV of hepatic
artery between the two groups. After the SAE, RI significantly decreased from 0.94±0.08 to 0.77±0.11 (P<0.0001), and PVV decreased from 87.9±25.2 cm/s to 43.1±17.7 cm/s (P<0.0001). PSV of hepatic artery increased from 68.0±37.7 cm/s before SAE to 72.1±41.6 with no statistically significant difference (P=0.14).

CONCLUSION

A persistent high resistance hepatic arterial waveform should lead to the suspicion of SSS. RI and portal vein velocity are better indicators than hepatic arterial PSV for successful treatment of SSS.

CLINICAL RELEVANCE/APPLICATION

Doppler ultrasound imaging is a useful screening method for both the diagnosis of SSS and the follow-up after treatment.

A New Approach in the Treatment of Bone Metastases: Efficacy of CT-guided Cryotherapy Combined with Radiotherapy (Station #7)

Lorenzo Maria Gregori : Nothing to Disclose , Francesco Arrigoni (Presenter): Nothing to Disclose , Fernando Smaldone MD : Nothing to Disclose , Luigi Zugaro : Nothing to Disclose , Antonio Barile MD : Nothing to Disclose , Carlo Masciocchi MD : Nothing to Disclose

PURPOSE

Aim of this study was to evaluate the role of percutaneous CT-guided cryoablation in the synergistic treatment with radiotherapy in the management of painful bone metastases.

METHOD AND MATERIALS

From July 2011, one hundred and two oncologic patient, with histologically and radiologically confirmed painful bone metastases were included in the study. All subjects experienced pain localized to the site of the bone metastases with a score >5 on the validated visual analogue scale (VAS). Cryoablation was performed in 38 subjects. Eighteen of them underwent a radiation course (20 Gy in 5 daily fraction) 10 days after the ablation. These subjects were retrospectively matched with a group of subjects treated by CA or RT. Exclusion criteria were the presence of other visceral or not-visceral metastasized sites. The rate of pain relief in terms of complete (CR) and partial (PR) response and the changes in self-rated Quality of life (QoL) were measured 3 months after treatments.

RESULTS

A significant higher proportion of subjects treated by CA (37%) (p=0.016) or CA followed by RT (72%) (p<0.01) experienced a CR compared to patients treated by RT alone (13%). Interestingly, the addition of RT to CA significantly improved the rate of CR compared to CA alone (p=0.034). The higher rate of CR observed in patients treated by CA or CA-followed RT paralleled with an improved self-rated QoL. Thirty-seven (84%) patients were successfully ablated without complications with the rate of major complications of 16%. Patients had pain relief for a period ranging from 3 to 24 months (mean 7.8 months). Technical success was 100%.

CONCLUSION

Combined treatment of CT-guided cryoablation and radiotherapy improves relief from pain due to bone metastases.

CLINICAL RELEVANCE/APPLICATION

In the treatment on painful bone metastases, combined treatment of CT-guided cryoablation and radiotherapy offer the best therapeutic outcomes.

Comparing Percutaneous Tumor Ablation Modalities: Microwave Ablation, Radiofrequency Ablation, Cryoablation, and Irreversible Electroporation (hardcopy backboard)

Seyed Amin Astani MD, MBA (Presenter): Nothing to Disclose , Kevin McGill MD, MPH : Nothing to Disclose , Scott E. Schwartz MD : Nothing to Disclose

TEACHING POINTS

To compare the current indications, contraindications, technique, advantages, and mechanism of action of the 4 most commonly used percutaneous ablation modalities (microwave ablation, radiofrequency ablation, cryoablation, and irreversible electroporation).

TABLE OF CONTENTS/OUTLINE

Compare the microwave ablation, radiofrequency ablation, cryoablation, and irreversible electroporation in: • Mechanism of action and physics behind them • Indications and contraindications • Techniques • Advantages, challenges, and disadvantage • Complications • Cost
Sub-Events

VIS270

Migration of Retrievable, Expandable Metallic Stents Inserted for Malignant Esophageal Strictures: Incidence, Management, and Prognostic Factors in 332 Patients (Station #1)

Wei-Zhong Zhou (Presenter): Nothing to Disclose, Ho-Young Song MD: Nothing to Disclose, Jung-Hoon Park MS, RT: Nothing to Disclose, Ji Hoon Shin MD: Nothing to Disclose, Jin Hyoung Kim MD: Nothing to Disclose, Young Chul Cho BS: Nothing to Disclose, Jong Kun Jang: Nothing to Disclose, Eun Jung Jun PhD: Nothing to Disclose

PURPOSE

Focused on evaluating the factors that influence stent migration following placement of single design stent was not previously reported. The purpose of this study was to evaluate the incidence, prognostic factors, and secondary management of stent migration in patients with malignant esophageal strictures.

METHOD AND MATERIALS

A retrospective cohort study was performed in a single, tertiary-referral, university hospital to identify the incidence, management, and prognostic factors for stent migration in 332 consecutive patients with placement of a retrievable, expandable, metallic stent for malignant esophageal strictures. Stent migration was classified into four patterns as locations of a migrated stent when migrated stents were detected. A multivariate logistic regression model was used to identify the independent predictive factors associated with stent migration.

RESULTS

Stent migration occurred in 42 (12.6%) of 332 patients. Migration was partial (n=21) or complete (n=21), and nine, 12, 11, and 10 patients had patterns I, II, III, and IV, respectively. Multivariate analysis identified the following prognostic factors: esophagogastic junction strictures caused by cancer of the gastric cardia (OR, 3.330; 95% CI, 0.156-9.698; p = 0.004), patients who underwent anti-cancer treatment after stent placement (OR, 17.514; 95% CI, 7.094-43.235; p < 0.001), and patients with a longer survival time (OR, 2.994; 95% CI, 0.991-7.996; p < 0.001). Secondary management was needed for 33/42 (79%) patients. The strictures in the remaining nine patients improved throughout the follow-up.

CONCLUSION

Stent migration occurs most commonly in patients with cancer of the gastric cardia, longer survival time and who underwent anti-cancer treatment following stent placement. Stent migration is successfully managed by further intervention.

CLINICAL RELEVANCE/APPLICATION

Accurate knowledge of the pattern of stent migration is important for its successful management.

VIS272

Patency of Central Veins in Dialysis Patients with Tunneled PICC Lines (Station #3)

Shima Goswami MD (Presenter): Nothing to Disclose, Rosanne DeAngelis: Nothing to Disclose, Maryna Kuznetsova MD: Nothing to Disclose, Suken Shah MD: Nothing to Disclose, Jeffrey L. Lautin MD: Nothing to Disclose

PURPOSE

Determine the effect of tunneled peripherally inserted central venous catheter (PICC) lines on central vein patency in patients with chronic kidney disease (CKD).

METHOD AND MATERIALS

A prospective trial involving adults (>18 years old) who have CKD (GFR less than 30) and require long-term, non-dialysis, venous access. 5-French Bard Power PICC lines with small anchoring Dacron cuffs were placed under ultrasound and fluoroscopic guidance. Patients had an ultrasound prior to catheter placement and at removal to document jugular vein size, respiratory variation with Doppler waveforms, and imaging of the innominate vein patency. A paired t test was performed to analyze the data.

RESULTS

Fifty-two patients from our institution were enrolled into and completed the study over an 18 month period. Three patients died from unrelated causes prior to catheter removal and ten were lost to follow-up. Of the remaining 39 enrollees there was an 8.8 percent risk of developing narrowing of the central veins greater than 60 percent of the original diameter post tunneled PICC (3/39 patients, p=0.002). Furthermore, of the patients whose central veins remained even partially patent, only four even developed webs in the central veins post tunneled PICC, a proportion of patients so small as to not render them statistically significant (p=0.028).

CONCLUSION

The data supports our null hypothesis that central vein patency is rarely sacrificed in the setting of tunneled PICC line insertion. Considering the frequent need for tunneled and non-tunneled dialysis catheters in patients with CKD, tunneled catheters can be used safely for long-term, non-dialysis, venous access while preserving
Peripheral arm veins for dialysis access.

**CLINICAL RELEVANCE/APPLICATION**

Tunneled catheters allow preservation of peripheral arm veins in patients who will likely require future dialysis access and our data confirms central vein patency.

**Preliminary Comparative Study between Thyroidectomy and Radiofrequency Ablation on Nodular Goiter (Station #4)**

Che Ying MD (Presenter): Nothing to Disclose, Jung Hwan Baek: Nothing to Disclose

**PURPOSE**

1. to compare and evaluate the difference and efficacy of two treatment methods of nodular goiter, radiofrequency ablation and thyroidectomy; 2. to evaluate the clinical application value of RFA on nodular goiter

**METHOD AND MATERIALS**

200 nodular goiter patients underwent open surgery operation (group A) and 200 patients treated with radiofrequency ablation (group B) were selected and proceed one year of follow-up. The posttreatment complications, thyroid function, nodules residues and recurrence situation as well as hospital stays and cost were evaluated and compared.

**RESULTS**

The surgical complications incidence of group A was higher than that of group B (7.0%, 1.0%, P=0.002); 75.5% of the Group A patients removed more than 70% of their normal thyroid gland (unilateral or bilateral), 71.5% of whom need to exogenous thyroid hormone supplement, group B do not need the exogenous thyroid hormone; The focus were removed directly in group A group but inactivated in situ and absorbed gradually in group B with 12 months absorption rate 84.84±17.06%; The rate of multiple lesions residual nodules was 11.9% in group A and 2.9% in group B (P=0.004); One year recurrence rate was 2.5% in group A and 0.5% in group B, P=0.099, no statistically significant difference; Hospitalization days was 5-7 days of group A and 2-3 days of group B, the total cost was 15962.56±1073.27 yuan and 16535.78±2309.75 yuan in the above two groups but there was no statistically significant difference (P>0.05).

**CONCLUSION**

Both surgical resection and radiofrequency ablation are effective in the treatment of nodular goiter. Compared with surgery treatment, the radiofrequency ablation method shows the advantage of complete tumor inactivation, easy in operation, fewer complications, thyroid function maintenance, neck intact without scar, and shorter hospitalization time, which suggests a wide prospect of clinical application by this safe and effective minimally invasive treatment method.

**CLINICAL RELEVANCE/APPLICATION**

Radiofrequency ablation is a safe, effective and minimal invasive treatment method of nodular goiter with a wide prospect of clinical application.

**Screening MRI for Uterine Fibroids, Treatment Selection: MR-guided High Intensity Focused Ultrasound (MRgFUS), Uterine Artery Embolization (UAE) and Surgery. A per Group Analysis of Outcomes (Station #5)**

Federica Ciolina MD (Presenter): Nothing to Disclose, Fulvio Zaccagna MD: Nothing to Disclose, Francesco Sandolo: Nothing to Disclose, Carola Palla: Nothing to Disclose, Fabrizio Andriani: Nothing to Disclose, Alessandro Napoli MD: Nothing to Disclose

**PURPOSE**

To retrospectively evaluate the outcome of patients affected by uterine leiomyoma and treated using either Magnetic Resonance Focused Ultrasound (MRgFUS), Uterine Artery Embolization (UAE) and Surgery.

**METHOD AND MATERIALS**

451 women (group A) affected by uterine leiomyoma (mean age 39±5) referred our department for treatment of uterine fibroids with MRgFUS (July 2010-March 2014). Pre-treatment evaluation was done in order to assess symptoms and fibroids MR characteristics for MRgFUS viability. Patients not eligible for MRgFUS were addressed to UAE (group B) or surgery (group C). Primary endpoints were Symptoms Severity Score (SSS) (19.3±6.8), volume shrinkage (Group A and B) and the necessity for further treatment. Satisfaction related to different treatment was evaluated using a 5 point scale.

**RESULTS**

131/451 patients underwent MRgFUS (29%; Group A), 320 were excluded (70%) and therefore assigned to Group B (123/451, 27%) and Group C (157/451, 35%). Remaining 40% patients (8%) were lost at follow up or refused the proposed treatment. In group A 112/131 patients (86%) showed a decrease in SSS (19.3±6.8) an average NPV of 70±15% (P=0.001), a volume shrinkage of 20±15% and an excellent satisfaction related to treatment. In 7/131 (5%) treatment was stopped at the beginning (bowel loops interposition or absence of...
compliance). 4 patients had a pregnancy; 3 patients experienced minor adverse events. In 12/131 patients (9%) we obtained NPV < 60% and patients needed surgical treatment. In group B patients showed a decrease in SSS (15.3±5.6), an average NPV of 98% (P=0.001), a volume shrinkage of up to 70% and a good satisfaction related to treatment. The major dissatisfaction was related to post-procedural pain that needed analgesic therapy. No pregnancy was observed. In Group C 80 patients underwent myomectomy, 40 hysterectomy while the remaining refused other treatment. 3 pregnancy were observed.

CONCLUSION

MRgFUS treatment of uterine fibroids is a reliable, noninvasive method for treatment symptomatic uterine fibroids; clinical success is directly related to NPV ratio. Eligibility is limited to 30% of screened women with symptomatic fibroids. All patients not suitable for this treatment should necessarily undergo surgery or UAE both with significant lower patient tolerance.

CLINICAL RELEVANCE/APPLICATION

Screening MRI allow patients selection for successful MRgFUS treatment and enable to refer patients with uterine fibroids to the most appropriate kind of treatment.

VIS271

Experience of Diagnosis and Management of Splenic Steal Syndrome after Liver Transplantation (Station #6)

Chaolun Li (Presenter): Nothing to Disclose, Weiping Wang MD: Nothing to Disclose, Eunice Kim Moon MD: Nothing to Disclose, John Fung: Nothing to Disclose, Koji Hashimoto MD: Nothing to Disclose

PURPOSE

This retrospective study investigated the clinical presentations, diagnosis, and treatment of splenic steal syndrome (SSS) based on our one center experience.

METHOD AND MATERIALS

From January 2007 to August 2013, the clinical data records of patients with SSS confirmed by angiography were reviewed. A total of 51 patients (40 men, 11 women, average age of 57.7±9.9 years, age range 27-76 years) were enrolled in this study. Patients with hepatic artery stenosis or celiac artery stenosis were excluded.

RESULTS

A whole liver graft was used in 49 patients, and split right lobe of liver was used in the other two patients. TIPS was performed in 4 patients before OLT. The onset time varies from 1 to 192 days (median 4 days) after OLT. Forty-six patients (90.2%) presented this syndrome within 15 days after OLT. The most common clinical presentation is high resistance index and/or diastolic reversal flow in hepatic arteries detected by US, which was found in 35 patients. Persistent ascites was observed in 9 patients, in which 5 also presented high RI on US and another 1 had concomitant hyperbilirubinemia. Seven patients presented elevated aspartate aminotransferase (AST), alanine aminotransferase (ALT) and/or total bilirubin. Among the seven patients, five also presented high RI on US. Forty-three patients with SSS showed high RI (RI > 0.8) 24 hr after OLT. RI of the SSS group ranged from 0.67 to 1.0, with mean of 0.94±0.08. All the patients were diagnosed by celiac angiography showing sluggish flow in hepatic artery and brisk flow in splenic artery without any mechanical cause of vascular obstruction. All the patients were treated with splenic artery embolization (SAE) after the diagnosis was confirmed. Proximal SAE was performed in 42 patients. Middle to distal SAE was performed in 9 patients. In the 14 patients embolized with coils, coils migrated to the hilum of spleen in 3 patients. Patients showed improved hepatic blood flow on both angiography immediate after SAE and US post treatment. One patient developed hepatic artery thrombosis one day after SAE. Biliary stent was placed in 7 patients after SAE.

CONCLUSION

Splenic steal syndrome occurs shortly after liver transplantation. Persistent high RI detected in hepatic artery may lead to the clinical suspicion of this disease. It can be reversed by proximal SAE.

CLINICAL RELEVANCE/APPLICATION

Proximal SAE is an effective and safe method to treat SSS with very low rate of complication.

VIS273

Role of MRI Chest in the Assessment of Tumor Response Post Microwave Ablation of Pulmonary Metastases (Station #7)

Nour-Eldin Abdellehimen Nour-Eldin MD, MSc (Presenter): Nothing to Disclose, Nagy Naguib Naem Naguib MD, MSc : Nothing to Disclose, Julian Lukas Wichmann MD : Nothing to Disclose, Ahmed Fathy Emam MBCh : Nothing to Disclose, Mohammed Ahmed Alsubhi BMBS : Nothing to Disclose, Thomas Josef Vogl MD, PhD : Nothing to Disclose

PURPOSE

To determine the value contrast enhanced (CE-MRI) follow-up in the assessment of tumor response of microwave (MW) ablated pulmonary metastases by correlating the results with CE-CT.

METHOD AND MATERIALS

This prospective study included 130 ablation sessions for pulmonary metastases in 80 patients. CE-MRI Chest scanning was performed 1 week before the ablation and at 24 hours, 3, 6, 9 and 12 months post ablation. Thin section CT Volumetric measurement of the lesions was performed at the same time periods as a second
parameter for comparison. The lesion MRI enhancement intensity in each study was estimated, and the ratio to the paraspinal muscle enhancement intensity at the same level was measured (Lesion Muscle Signal (LMS ratio)). The correlations between post ablation follow-up CT volume of tumors and CE-MRI LMS ratio at the follow-up periods were assessed.

RESULTS

The preablation tumor volumes range: 0.30-6.1cm³ (mean: 1.5cm³, SD:1.3). LMS ratio < 1 was associated with post ablation reduction of tumor volume (denoting scaring), while LMS ratio > 1 were noted in: preablation due to high contrast enhancement of the tumor, 24h post ablation due to the inflammatory response associated with the thermal ablation and due to tumor residue or progress. Weak correlation was detected between the LMS-ratios and CT-volumetric changes in 24h post ablation. Strong correlation between the LMS ratios was estimated between the follow up periods of 3months (SpearmanR:0.62, p=0.0021), 6months (SpearmanR:0.66, p=0.001), 9months (SpearmanR:0.61, p<0.001) and 12months (Spearman R:0.7, p<0.00001).

CONCLUSION

CE-MRI follow up of the MW ablated lung tumors can be used effectively to assess the tumor response to ablation using LMS ratio as a parameter of assessment.

CLINICAL RELEVANCE/APPLICATION

CE-MRI may be used for the evaluation of tumor response post pulmonary ablation therapy.
**RC712C**

**Vascular Malformations**

Klaus D. Hagspiel MD (Presenter): Research Grant, Siemens AG

**LEARNING OBJECTIVES**

1) To review the classification of vascular malformations and tumors and their clinical and MRI features. 2) To review appropriate MR imaging protocols for the assessment and treatment follow up of these lesions.

**ABSTRACT**

Vascular malformations and tumors comprise a wide, heterogeneous spectrum of lesions that often represent a diagnostic and therapeutic challenge. Frequent use of an inaccurate nomenclature has led to considerable confusion. Since the treatment strategy depends on the type of vascular anomaly, correct diagnosis and classification are crucial. Magnetic resonance (MR) imaging is the most valuable modality for classification of vascular anomalies because it accurately demonstrates their extension and their anatomic relationship to adjacent structures. This presentation will review the clinical and MR imaging features that aid in diagnosis of vascular anomalies and their proper classification. MR imaging protocols suitable for comprehensive assessment of vascular anomalies including functional analysis of the involved vessels will be discussed.

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**RC810**

**Vascular Doppler (An Interactive Session)**

Refresher/Informatics

**VA**

**US**

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Fri, Dec 5 8:30 AM - 10:00 AM  Location: E353C

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**Sub-Events**

**RC810A**

**Challenges in Carotid Doppler**

Edward G. Grant MD (Presenter): Research Grant, Bracco Group Research Grant, General Electric Company Medical Advisory Board, Nuance Communications, Inc

**LEARNING OBJECTIVES**

1) Understand the various forms of extracranial pathology affecting the arteries serving the brain and their diagnostic appearance/criteria as seen by the ultrasound examination. 2) Be familiar with the indications for a cerebrovascular examination and its relationship to correlative imaging. 3) Know the criteria set forth by the Society of Radiologists in Ultrasound Consensus Conference for internal carotid artery stenosis and their rationale.

**active handout**

http://media.rsna.org/media/abstract/2014/13010314/RC810-a Sec .pdf

**RC810B**

**Vertebral Artery Ultrasound: A Gateway to the Great Vessels**

Mindy Meislich Horrow MD (Presenter): Spouse, Director, Merck & Co, Inc

**LEARNING OBJECTIVES**

1) Describe normal anatomy and spectral Doppler of the vertebral arteries. 2) Describe the spectrum of Doppler findings of the subclavian steal phenomenon: pre, partial and complete steal. 3) Detect proximal disease in the innominate vessels and aorta using vertebral artery waveforms in combination with carotid waveforms.

**ABSTRACT**

This lecture will demonstrate normal and variant duplex Doppler imaging of the vertebral artery. It will analyze the anatomy of the vertebral-basilar circulation and how it explains the spectrum of subclavian steal syndrome. It will further demonstrate the combination of findings in vertebral and carotid circulations that indicates brachiocephalic disease.

**RC810C**

**Upper and Lower Extremity Veins**

Leslie M. Scoutt MD (Presenter): Consultant, Koninklijke Philips NV

**LEARNING OBJECTIVES**

1) Describe the US criteria for diagnosis of DVT in the upper and lower extremities. 2) Discuss common pitfalls in US evaluation of DVT. 3) Discuss current controversies in the US evaluation of DVT such as: acute vs chronic (residual) DVT; use of the D-dimer assay; should the calf veins be evaluated; is it appropriate to do unilateral exams. 4) Describe the role of US in identifying other causes of extremity pain and swelling.
ABSTRACT

This lecture will describe the technique and diagnostic criteria for the US diagnosis of DVT in the upper and lower extremities. Common pitfalls in sonographic assessment of DVT will be described as well as current clinical questions in US evaluation of patients suspected of harboring DVT such as: what is the importance of pre-test probability?, what is the role of the D-dimer assay?, how to differentiate acute from chronic DVT?, and should the calf veins be routinely examined? In addition, the US appearance of other causes of extremity pain and swelling will be described as US has been shown to be useful in making alternative diagnoses, which are often important for patient management, in up to 10% of cases.
or rupture of an ascending aortic aneurysm. Aortic, cardiac and coronary artery imaging are integral to the
evaluation and management of these patients. A particular subset of the “symptomatic aneurysm” is
post-trauma aortic disruption, usually thoracic in which diagnosis of traumatic aneurysm is critical and the
aneurysm is associated with additional sites of soft tissue and skeletal trauma. Guidelines for endovascular
or surgical intervention or non invasive management with serial CT Angiographic imaging will be discussed.

RC812C

Mesenteric Ischemia

Iain Donald Craik  Kirkpatrick  MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the various categories of mesenteric ischemia (arterial occlusive, embolic, venous thrombotic, and
nonocclusive), and the pathophysiologic basis behind the imaging findings in each case. 2) Understand the
basis behind modern CT protocols for mesenteric ischemia, particularly the biphasic examination with CT
mesenteric angiography. 3) Demonstrate techniques to rapidly analyze a mesenteric CT angiographic dataset.
4) Review the CT signs of mesenteric ischemia and their sensitivity and specificity. 5) Evaluate the current
literature on mesenteric ischemia and discuss optimal diagnostic criteria.

ABSTRACT

Acute mesenteric syndrome (AMS) is a life-threatening condition said to affect up to 1% of patients presenting
with an acute abdomen, and it carries a mortality rate ranging between 59-93% in the published literature.
Time to diagnosis and surgical treatment are the only factors which have been shown to improve mortality, and
evidence shows that the clear test of choice for AMS is now biphasic CT. Water is preferably administered as a
negative contrast agent, followed by CT mesenteric angiography and then a portal venous phase exam.
Diagnostic accuracy is significantly improved by analysis of the CT angiogram for arterial stenoses or
occlusions, evidence of emboli, or angiographic criteria of nonocclusive ischemia. It is the use of CT angiography
in addition to routine portal phase imaging which has pushed the sensitivity and specificity of the test to >90%
in recent published articles. Other nonangiographic CT findings that are relatively specific for AMS in the
appropriate clinical setting include pneumatosis intestinalis, portal or mesenteric venous gas or thrombosis, and
decreased bowel wall enhancement. Bowel wall thickening, mesenteric stranding, ascites, and mucosal
hyperenhancement are more nonspecific findings which may also be seen. Nonocclusive schema may be the
most difficult form to diagnose, and findings of shock abdomen can aid in identification. Knowledge of the
patient's clinical history is critical not only for the selection of an appropriate study protocol but also for
interpretation of the imaging findings in context.

RC812D

CTA of Gastrointestinal Bleeding

Jorge A.  Soto  MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To review the appropriate implementation of CT angiography in the evaluation of patients presenting with
acute lower intestinal bleeding. 2) To describe the technical details that are necessary for acquiring good
quality CT angiography examinations. 3) Illustrate the characteristic CT angiographic findings of active or recent
bleeding with specific examples of multiple etiologies.

ABSTRACT

Acute gastrointestinal bleeding is a serious condition that may threaten a patient’s life depending on the
severity and duration of the event. Precise identification of the location, source and cause of bleeding are the
primary objective of the diagnostic evaluation. Implementation of colonoscopy in the emergency setting poses
multiple challenges, especially the inability to adequately cleanse the colon and poor visualization owing to the
presence of intraluminal blood clots. Scintigraphy with technetium 99m-labeled red blood cells is highly
sensitive but also has some limitations, such as the inability to precisely localize the source of bleeding and
determine its cause. Properly performed and interpreted CT angiography examinations offer logistical and
diagnostic advantages in the detection of active hemorrhage. A three-phase examination (non-contrast, arterial
and portal venous) is typically performed. Potential technical and interpretation pitfalls should be considered
and will be explained. The information derived from CT angiography helps direct therapy and select the most
appropriate hemostatic intervention (when necessary): endoscopic, angiographic, or surgical. Precise anatomic
localization of the bleeding point also allows a targeted endovascular embolization. The high diagnostic
performance of CT angiography makes this test a good alternative for the initial emergent evaluation of patients
with acute lower intestinal bleeding.
**SST04-01**

Quantification of MRI Derived Regional Pulmonary Parenchymal Perfusion and Cardiac Function for Assessment of Hemodynamic Changes before and after Pulmonary Endarterectomy in Patients with Chronic Thromboembolic Pulmonary Hypertension

Christian Olaf Schoenfeld MD (Presenter): Nothing to Disclose, Serghei Cebotari MD: Nothing to Disclose, Jan Hinrichs MD: Nothing to Disclose, Julius Renné MD: Nothing to Disclose, Marcel Gutberlet DiplPhys: Nothing to Disclose, Andreas Voskrenzenz: Nothing to Disclose, Tobias Welte MD: Nothing to Disclose, Marius Hoeper: Nothing to Disclose, Axell Haverich: Nothing to Disclose, Frank K. Wacker MD: Research Grant, Siemens AG, Research Grant, Pro Medicus Limited, Jens Vogel-Claussen MD: Nothing to Disclose

**PURPOSE**

An established method for treatment of patients with chronic thromboembolic pulmonary hypertension (CTEPH) is pulmonary endarterectomy (PEA). The aim of the study is to evaluate the surgical success after PEA by means of cardio-pulmonary MRI.

**METHOD AND MATERIALS**

16 patients (53±17 years; 9 male) with CTEPH were examined with a 1.5T MRI before and 17±12 days after PEA. After contrast medium bolus administration the lung was evaluated with a dynamic 3D FLASH sequence (TWIST) with an update rate of 1.2s per 3D data set and the pulmonary blood flow (PBF) was determined using a deconvolution algorithm. Furthermore, the left (LV), right ventricular (RV) function and cardiac mass were determined. Mean pulmonary artery pressure (mPAP) was measured before and after PEA by right (r.) heart catheterization. Means ± SD, paired t-test.

**RESULTS**

Regional PBF after PEA increased significantly in: total lung parenchyma by 48% (37.3±12.8 to 55.1±19.4ml/min/100ml, p=0.001), r. upper lobe (UL) by 29% (p=0.048) (cardiac output (CO) adjusted: 2% (p=0.873), the middle lobe by 70% (p=0.003)(CO adjusted: 30%, p=0.079), the r. lower lobe (LL) to 74% (p=0.003) (CO adjusted: 5% (p=0.653) and the ILL by 59% (p=0.001) (CO adjusted: 25% (p=0.008). After PEA RV mass decreased by 17% (46.5 to 38.5g/m², p=0.006). Ventricular mass index decreased by 19% (0.69 to 0.56, p=0.001) and RV function increased: RV end-diastolic volume by -14.6% (91.0 to 77.7ml/m², p=0.037), RV end-systolic volume by -38% (63.7 to 39.5ml/m², p=0.0008), RV ejection fraction by +25% (40.2 to 50.2%, p=0.0004). Cardiac index increased by 28% (2.8 to 3.3l/min/m², p=0.001) and LV systolic eccentricity index decreased by 19% (1.84 to 1.49, p=0.02) as a sign of improved pulmonary hemodynamics after PEA. Mean mPAP decreased significantly by 44% (45.4 to 25.4 mmHg, p<0.0001) after PEA.

**CONCLUSION**

Improvement of PBF is observed predominantly in the lower lungs 2 weeks after PEA: Even after adjusting for CO regional PBF improved in bilateral lower lobes and ML. Increased flow after PEA in bilateral upper lobes was proportional to increased CO in response to decreased pulmonary pressures in our patient cohort.

**CLINICAL RELEVANCE/APPLICATION**

In patients with CTEPH quantitative cardio-pulmonary MRI is a novel noninvasive clinical tool for comprehensive patient assessment pre and post PEA.

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**SST04-02**

Evaluation of Monoenergetic Reconstruction on Pulmonary Angiography Using Spectral Detector CT

Andrew Sher MD: Research Grant, Koninklijke Philips NV, Abed Ghandour MD: Nothing to Disclose, Amar Dhanantwari: Employee, Koninklijke Philips NV, Luis Alberto Landeras MD: Institutional Grant support, Koninklijke Philips NV, Prabhakar Rajiah MD, FRCR (Presenter): Institutional Research Grant, Koninklijke Philips NV

**PURPOSE**

Utilize the novel Spectral Detector CT (SDCT) system to retrospectively augment pulmonary artery enhancement on routine chest CT and assess whether resulting image sets enable diagnostic evaluation of pulmonary vasculature.

**METHOD AND MATERIALS**

29 patients underwent routine contrast-enhanced chest scans with SDCT (Philips Healthcare) following 70 ml IV contrast. 21 studies not in ideal angiographic phase were chosen, defined as not achieving attenuation greater than 200 HU in the main pulmonary artery. Monoenergetic image sets from 40 to 180 keV were retrospectively created. Images were assessed at fixed window level (30) and width (450). A 5-point scale measured subjective evaluation of central and peripheral arterial enhancement and image noise (1=Non-diagnostic, 5=Excellent). An ideal image set was chosen, defined as the highest energy set with attenuation greater than 200 HU in the main PA and a subjective image evaluation of diagnostically acceptable. At ideal energy, mean attenuation, noise, and signal-to-noise ratios of 9 ROIs throughout the pulmonary vasculature as well as subjective image quality were compared to the standard 120 kVp study. Paired t-test and Wilcoxon signed-rank test were used for analysis.

**RESULTS**
The mean optimal monoenergetic level was 53 keV ± 7.3. Optimal reconstructions showed higher attenuation than 120 kVp studies (241 ± 81 vs. 133 ±53 HU; p<.001). Image noise was significantly higher in monoenergetic studies (47.7±86.4 vs. 22.6 ±23.7; p<.001), while overall SNR remained significantly higher (13.1 ± 9.3 vs. 10.3 ± 6.4; p <.05). Subjective vascular enhancement within monoenergetic images was higher than 120 kVp images (Central: 4.2 ± .4 vs. 1.9 ± .8; p<.001, Peripheral: 4.6 ± .5 vs. 1.6 ± .7, p<.001). Subjective image noise was higher on monoenergetic images (4.4 ± .7 vs. 4.9 ± .3, p<.05) however all studies maintained diagnostic acceptability.

CONCLUSION
Optimal monoenergetic energy reconstruction of routine chest CT obtained on SDCT significantly increased pulmonary arterial enhancement and SNR, achieving attenuation levels comparable with pulmonary angiographic exams and maintaining diagnostic acceptability.

CLINICAL RELEVANCE/APPLICATION
SDCT enables creation of an optimal image set of the pulmonary vessels that can allow creation of CTPA from a routine or low-dose chest CT.

SST04-03
Comparison of 35-second and 100-second Scan Delays for Contrast Enhanced Routine Dual Energy CT of the Chest: Lesion and Vascular Enhancement

Alexi Otrakji MD (Presenter): Nothing to Disclose, Subba Rao Digumarthy MD : Nothing to Disclose, Roberto Lo Gullo MD : Nothing to Disclose, Jo-Anne O. Shepard MD : Consultant, Agfa-Gevaert Group, Cristy Savage RT : Nothing to Disclose, Mannudeep K. S. Kalra MD : Nothing to Disclose

PURPOSE
To compare performance of routine dual energy chest CT (DECT) for lesion and vascular enhancement at 35 and 100 seconds scan delays following administration of intravenous iodinated contrast media.

METHOD AND MATERIALS
Our study included 52 adult patients who underwent contrast enhanced routine DECT CT of the chest on dual source MDCT(Somatom Definition Flash,Siemens) or single source 64-row MDCT(GE 750HD Discovery,GE). Of these 26 patients (mean age 64±11years,M:F12:14,mean weights75 ±19 kg)received 80 ml of 370mg% iodinated intravenous contrast(2-3 cc/seconds) and were scanned at 35 second fixed delay. The remaining sex- and gender-matched 26 patients(mean age 67±12years,M:F 12:14,mean weights74 ±19 Kg) were scanned at 100 second delay following administration of the same contrast agent(370mg%,80 ml,44ml of contrast injected at 0.6ml/second followed by 36ml contrast at 1.8ml/second) using the identical DECT technique. Blended, monoenergetic(60 kev), and material decomposition image (iodine/pulmonary blood volume and virtual non contrast (VNC)) were generated for all patients. HU (in main pulmonary artery (MPA)), CTDI vol and DLP were recorded.

RESULTS
There was no significant difference between weights and radiation dose of the patients undergoing DECT at 35- or 100-second scan delay (p>0.1). DECT at 100 seconds demonstrated significantly better contrast enhancement compared to prior CT examinations (in 20/53 pulmonary abnormalities) as compared to DECT at 35-second scan delay (better in 16/20). Optimal to excellent quality was noted in DECT at 100 seconds for all image types (100% Mono60 KeV, iodine, and VNC images) With none to minimal contrast related artifacts in most patients. There was superior iodine subtraction on VNC images on DECT performed with 100 seconds delay compared to those at 35 seconds (p<0.0001). Vascular contrast enhancement in MPA at 100 second scan delay 333±137 HU.

CONCLUSION
DECT of the chest at 100 second scan delay allows better lesion enhancement, fewer artifacts and superior quality of material decomposition images as compared to standard 35 second scan delay. Pulmonary arterial enhancement is not compromised due to split bolus contrast injection technique used for longer scan delays.

CLINICAL RELEVANCE/APPLICATION
Fixed delay split bolus DECT gives enough time for lung lesions to enhance which improves the diagnostic characterization of these lesions, without compromising the vascular enhancement.

SST04-04
Spectral CT Characteristics of Iodine, Bismuth, and Tungsten Based Contrast Media with an Energy-Resolving Photon-Counting Detector


PURPOSE
Recently developed energy resolved photon-counting detectors allow high Z materials to be effectively separated based on their absorption characteristics in the energy range of interest. Importantly, this allows contrast agents (CA) that contain different materials to be separated based on the incident X-ray spectrum.
The aim of this study was to evaluate the characteristics and optimal combination of three different contrast agents by using a research prototype CT unit with small pixel counting photon detectors.

**METHOD AND MATERIALS**

To demonstrate proof-of-principle, experimental bismuth, tungsten and iodine CA were introduced into a chest phantom utilizing a two-threshold energy resolved photon-counting detector. Standard tube voltage (120kV) and tube current (80mAs) were applied with a photon counting detector using energy thresholds of 25keV and 65keV allowing reconstruction into three energy bins: 25keV to 120keV, 65keV to 120keV and 25keV to 65keV. Region of interest analysis was performed to assess attenuation patterns, contrast to noise ratios and identify optimal contrast agent combination for discrimination by the photon counting detector.

**RESULTS**

The CT acquisitions revealed strong contrast enhancement within the chest phantom with excellent contrast to noise ratios and differentiation of photon energies for each contrast agent by the photon counting detectors. Contrast materials could be uniquely identified by their characteristic attenuation profile at each energy threshold. Based on attenuation characteristics and contrast to noise ratios, the optimal contrast agent combination for scanning with photon counting detector CT technology appears to be iodine and tungsten with energy bins corresponding to an average X-ray energy of 62.5keV and 73keV.

**CONCLUSION**

The separation of three simultaneously administered contrast agents is feasible with the use of an energy selective, photon counting detector in CT. Spectral CT has the potential to enable distinct characterization of contrast agents in a chest phantom with the optimal contrast agent pair being iodine and tungsten with detector energy bins corresponding to an average X-ray energy of 62.5keV and 73keV.

**CLINICAL RELEVANCE/APPLICATION**

The separation of contrast agents with different pharmacokinetics utilizing photon counting technology may lend itself to a variety of beneficial applications in future contrast enhanced CT.

**Diagnostic Quality and Limitations of Dual Energy CT of the Chest in Large Adult Patients**

Alexi Otrakji MD (Presenter): Nothing to Disclose, Mannudeep K. S. Kalra MD: Nothing to Disclose, Efren Jesus Flores MD: Nothing to Disclose, Roberto Lo Gullo MD: Nothing to Disclose, Jo-Anne O. Shepard MD: Consultant, Agfa-Gevaert Group, Subba Rao Digumarthy MD: Nothing to Disclose

**PURPOSE**

There are little data to support use of DECT of chest in large patients. The purpose of our study was to evaluate the performance of dual energy routine chest CT in large patients for providing required diagnostic information and image quality.

**METHOD AND MATERIALS**

Our study included 45 patients (M:F 31:14, mean age 53±13 years, mean weight 130±14kg) who underwent contrast enhanced chest CT using dual energy protocol on 128-slice dual source MDCT (Somatom Definition Flash, Siemens) or single source 64-row MDCT (GE 750HD Discovery) scanners. Inclusion criteria for the study included consecutive patients over 114 Kg (>250 lbs) who underwent routine contrast enhanced CT of the chest with DECT. Following DECT image series were generated for each patient - monoenergetic 60 keV, 100 keV, pulmonary blood volume (PBV) and virtual non contrast (VNC). All image series were assessed qualitatively for thoracic abnormality, level of pulmonary arterial enhancement, diagnostic quality, image noise, and artifacts. The CTDIvol and DLP were recorded and compared to 60 weight matched patients who underwent routine chest CT with single energy on the same scanners.

**RESULTS**

Radiation dose for patients who underwent chest DECT (10 ±2.4mGy, 350±67mGy.cm) was significantly lower as compared to the weight matched single energy chest CT (15±2.6mGy, 576±147mGy.cm) (p<0.001). Pulmonary arterial enhancement was optimal to excellent in 84% patients (38/45) up to lobar level and in 71% (32/45) patients in segmental branches. There was significant reduction in image noise and artifacts at the level of the tracheal carina and diaphragm on 100 keV images compared to the 60 keV images (p<0.001). There was a significant improvement in acceptable diagnostic quality with 100 KeV (93%) compared to 60 keV images (76%). Excellent or optimal diagnostic quality was noted in 80% of patients on PBV and VNC images, but was limited or suboptimal in other larger patients due to marked beam hardening artifacts.

**CONCLUSION**

Routine chest CT with dual energy technique can provide optimal diagnostic information and diagnostic quality in most large patients at lower radiation dose compared to the single energy chest CT. 100 kev images are helpful in reducing noise and artifacts.

**CLINICAL RELEVANCE/APPLICATION**

Routine chest CT with dual energy technique needs additional higher kev (100) images for obtaining optimal diagnostic information in large patients.
**SST04-07**

**Iodine Content Measurement with Spectral CT Imaging as a New Quantitative Tool? Assess the Esophageal Microcirculation in Patients with Liver Cirrhosis**

**Ruyi Bao MD (Presenter): Nothing to Disclose , Zhiyong Li : Nothing to Disclose , Ailian Liu MD : Nothing to Disclose**

**PURPOSE**

To quantitatively investigate the blood flow of esophageal wall and its change induced by liver cirrhosis by measuring effective iodine content (eIC) in the lower esophagus with spectral CT imaging.

**METHOD AND MATERIALS**

Thirty-five patients with liver cirrhosis (including 15 cases compensated cirrhosis and 20 cases decompensated cirrhosis) and sixteen normal volunteers, who had no detectable intrinsic lung and heart disease, underwent GSI scanning to collect iodine-water concentrations with a standard injection protocol. We measured eIC values of the esophageal wall in the lower esophagus. The hepatic artery index (HAI) was then calculated by the changes of the iodine-water concentrations in liver parenchyma from the artery to portal vein phase. We quantitatively evaluated the difference of eIC values between normal volunteers and different type cirrhosis by T-test and the correlation between eIC values and HAI with pearson correlation test.

**RESULTS**

Mean eIC values of the esophageal wall in the lower esophagus in compensated cirrhosis group, compensated group, normal control group were 38.00±11.72, 15.64±9.60 and 11.18±4.62 mg/ml, respectively. Mean eIC values in compensated cirrhosis group was significantly higher than that in compensated group (t=5.13, p=0.00) and that in normal group (t=7.14, p=0.00), indicating more blood flow of the esophageal wall by decompensated cirrhosis. Mean HAI in compensated and compensated group was 0.28±0.20 and 0.15±0.90 respectively. There was strong positive correlation between HAI and eIC values (r=0.43, P=0.04).

**CONCLUSION**

The findings of this study suggest that effective iodine content of the esophageal wall may reflect esophageal blood perfusion, which is useful to quantitatively evaluate esophagus blood flow change and esophageal varices in patients with liver cirrhosis.

**CLINICAL RELEVANCE/APPLICATION**

Esophageal varices have been recognized as an important complication in patients with cirrhosis. A better quantitative evaluation of pathophysiological change underlying cirrhosis helps to guide its treatment. Spectral CT imaging may become a new quantitative tool.

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**SST04-06**

**Detection of Pulmonary Embolism on CT: Improvement Using a Model-based Iterative Reconstruction Algorithm Compared to a Filtered Back Projection Algorithm**


**PURPOSE**

To determine if a model-based iterative reconstruction (MBIR) improves diagnostic confidence and detection of pulmonary embolism (PE) compared to hybrid iterative reconstruction (HIR) and filtered back projection (FBP) reconstructions in patients undergoing CT pulmonary angiography (CTPA).

**METHOD AND MATERIALS**

The study had IRB approval and was HIPPA compliant. 50 patients underwent CTPA at 100kV using departmental protocol. 22/50 patients had studies positive for PE as determined by two radiologists not involved in the reader study. The 50 studies were reconstructed with FBP, HIR (iDoseL3, Philips), and MBIR (IMR, Philips). Noise, attenuation, and contrast-to-noise (CNR) were recorded. After image randomization, five thoracic radiologists and two thoracic radiology fellows graded each study on a scale of 1 (very poor) to 5 (ideal) in four categories: diagnostic confidence, noise, PA enhancement and plastic appearance. Readers also marked each study for the presence or absence of PE. Parametric and non-parametric data were analyzed with a repeated measures ANOVA and Friedman’s ANOVA, respectively. After Bonferroni correction, significance of pairwise comparisons was set at p<0.0167.

**RESULTS**

CNR of MBIR (19.7) was significantly higher than CNR of FBP (7.1) and HIR (10.3, p<0.0001 for both). Pooled sensitivity for detection of PE was 76% (117/154), 78.6% (121/154) and 82.5% (127/154) using FBP, HIR, and MBIR, respectively. With MBIR, detection of PE significantly increased compared to FBP (p=0.016). Detection of PE was not significantly higher with MBIR than HIR (p=0.045). Due to the non-significant increase in FP studies using HIR and MBIR (p=0.153), accuracy with MBIR (88.6%), HIR (87.1%), and FBP (87.7%) was similar. Compared to FBP, MBIR led to a significant subjective increase in diagnostic confidence, noise, and enhancement in 6/7, 6/7, and 7/7 readers, respectively. Compared to HIR, MBIR led to significant subjective increase in diagnostic confidence, noise, and enhancement in 5/7, 5/7, and 5/7 readers, respectively. All seven readers graded MBIR as having a significantly increased plastic appearance compared to both FBP and HIR.

**CONCLUSION**
MBIR led to a significant increase in PE detection compared to FBP. MBIR led to qualitative improvements in diagnostic confidence compared to both FBP and HIR.

**CLINICAL RELEVANCE/APPLICATION**

In CTPA, MBIR can be safely integrated into clinical practice and can increase detection of PE

**SST04-08**

**Enhancement Characteristics of the CTPA Test Bolus Curve: Use in Predicting Right Ventricular Dysfunction and Mortality in Patients with Acute Pulmonary Embolism**

Li Caiying MD, PhD : Nothing to Disclose, Cheng Ting Lin MD : Nothing to Disclose, Seth Jay Kligerman MD : Author, Reed Elsevier, Susie N Hong : Nothing to Disclose, Charles S. White MD (Presenter): Nothing to Disclose

**PURPOSE**

To evaluate the value of CT pulmonary angiography (CTPA) test bolus curve data to predict mortality in patients with pulmonary embolism (PE) in comparison with conventional methods of right ventricular (RV) dysfunction.

**METHOD AND MATERIALS**

The study was approved by our IRB and is HIPAA-compliant. We consecutively evaluated each CTPA study performed with a test bolus technique in a 2-year period. Time-density curve was derived from each test bolus. For comparison, left and right ventricular dimensions (area, diameter) were measured using CT data. A cardiologist blinded to the clinical and other imaging data reviewed a subset of the corresponding echocardiographic images to assess for RV dysfunction. Demographic data, mode of treatment, and patient outcome information were gathered using electronic medical records. Test bolus and anatomic data were correlated with PE-related mortality.

**RESULTS**

71 patients (34 men and 37 women, average age 54.4 years) who had a CTPA performed using a test bolus technique were diagnosed with acute pulmonary embolism. Factors that were significantly correlated with PE-related mortality were: age > 60 years, RV/LV diameter > 1.5, RV/LV area > 1, bolus curve upslope time > 6 seconds, and 50% downslope time > 6 seconds. Sensitivity/specificity for the last two parameters were 100%/69% and 80%/86%, respectively.

**CONCLUSION**

Data from the CTPA timing bolus curve provides predictive power similar to that of conventional methods of assessing right ventricular dysfunction for PE-related mortality.

**CLINICAL RELEVANCE/APPLICATION**

To the best of our knowledge, scant attention has been paid to the characteristics of the test bolus curve and their implications in assessing the severity of pulmonary embolism. Thus, the purpose of this study is to determine whether test bolus parameters obtained in conjunction with CTPA have predictive value equal to or greater than image-based anatomical parameters for predicting PE-related mortality.

**SST04-09**

**Assessment of Regional Xenon-ventilation, Perfusion and Ventilation-perfusion Mismatch Using Dual-energy Computed Tomography in COPD Patients**

Hye Jeon Hwang MD (Presenter): Nothing to Disclose, Joon Beom Seo MD, PhD : Nothing to Disclose, Sang Min Lee MD : Nothing to Disclose, Sang Young Oh MD : Nothing to Disclose, Namkug Kim PhD : Stockholder, Coreline Soft, Inc, Taekjin Jang : Nothing to Disclose, Jae Seung Lee : Nothing to Disclose, Sei Won Lee : Nothing to Disclose, Yeon-Mok Oh MD, PhD : Nothing to Disclose

**PURPOSE**

To assess the feasibility of combined xenon-enhanced ventilation (V) and iodine-enhanced perfusion (Q) dual-energy CT (DECT) for the evaluation of regional V and Q status in COPD.

**METHOD AND MATERIALS**

Fifty-two male patients with COPD (mean age 67.9) were prospectively enrolled. Combined V and Q DECT imaging was performed. Virtual noncontrast image, V map, and Q (pulmonary blood volume) map were anatomically co-registered with deformable registration and evaluated with in-house software. After the normalization of the V and Q values of each pixel, V/Qratio map and VQmin map, which is a map of smaller value between V and Q in each pixel, were additionally generated. For visual analysis, regional V, Q, and V/Qratio pattern was determined as decreased, normal and increased, in combination of the regional disease patterns including emphysema, bronchial wall thickening and normal at each segment. Mean V, Q, V/Qratio, VQmin values and standard deviation of V/Qratio (V/Qsd) of each patient were quantified and compared with PFT parameters, such as FEV1, FEV1/FVC, and DLco with Pearson correlation test.

**RESULTS**

Not included in this abstract. Further details are included in the PDF file accompanying this abstract.
At visual analysis, while segments with normal parenchyma showed matched V/Q ratio pattern, segment with bronchial wall thickening commonly showed mismatched pattern. There was no dominant V/Q ratio pattern at emphysema area. At quantitative analysis, mean V, Q, V/Q ratio, VQmin values showed significant positive correlation with PFT parameters ($r = 0.290 \sim 0.815$, $p < 0.05$). V/Qsd showed significant negative correlation with PFT parameters ($r = -0.439 \sim -0.736$, $p < 0.001$). VQmin values showed the best correlation with PFT ($r = 0.483 \sim 0.815$, $p < 0.001$).

**CONCLUSION**

Visual and quantitative assessment of regional V, Q, V/Q ratio, VQmin is feasible with combined V and Q DECT imaging, with significant correlation with PFT results in COPD patients. Assessment of disease pattern at conventional CT images may not represent regional V, Q and V-Q mismatch.

**CLINICAL RELEVANCE/APPLICATION**

Regional structural abnomities, ventilation and perfusion status can be assessed simultaneously with combined xenon-enhanced ventilation and iodine-enhanced perfusion DECT.

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**SST09**

**Neuroradiology (Cerebrovascular Imaging)**

**Scientific Papers**

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ARRT Category A+ Credits: 1.50
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**Participants**

**Moderator**
Jay J. Pillai MD : Medical Advisory Board, Prism Clinical Imaging, Inc

**Moderator**
Jalal Badi Andre MD : Consultant, Hobbitview, Inc Research Grant, Koninklijke Philips NV

**Sub-Events**

**SST09-01 Intracranial Arterial Calcifications as a Prognostic Factor for the Subsequent Occurrence of Mixed Adverse Cardiovascular Events (MACE)**

Frederik Franz Strobl MD (Presenter): Nothing to Disclose, Beatrice Kuhlin : Nothing to Disclose, Fabian Bamberg MD, MPH : Speakers Bureau, Bayer AG Speakers Bureau, Siemens AG Research Grant, Bayer AG Research Grant, Siemens AG, Christopher Uebelis MD : Nothing to Disclose, Maximilian F. Reiser MD : Nothing to Disclose, Tobias Saam MD : Research Grant, Diamed Medizintechnik GmbH Research Grant, Bayer AG

**PURPOSE**

The aim of this study was to evaluate the association of intracranial arterial calcifications (ICAC) as detected in non-contrast-enhanced CT scans of the head with the subsequent occurrence of mixed adverse cardiovascular events (MACE).

**METHOD AND MATERIALS**

We included a cohort of consecutive patients with an age >60 years who underwent a non-contrast-enhanced CT scan of the head due to minor trauma or neurological disorders. Only patients without acute pathological findings in the CT scan were included. A calcified plaque score (CPS) with the range 0-4 was determined in each of the following arteries: Both internal carotid arteries, both mid cerebral arteries, both vertebral arteries, basilar artery. To obtain clinical follow-up information, all patients and their general practitioners were contacted with a questionnaire and/or telephonically. Only patients in whom definite information about clinical follow-up or cause of death could be obtained were included in this study. Major cardiovascular adverse events (MACE) were defined as myocardial infarction, revascularization, stroke or death due to a cardiovascular event.

**RESULTS**

We included 175 patients (89 male, mean age 78.2 years). Mean follow-up time was 40.4 months, resulting in 7070 patient-years of follow-up. Overall 36 MACE occurred in the cohort during follow-up (12 myocardial infarctions or revascularizations, 6 strokes, 18 cardiovascular deaths; event rate =xx%/year). CPS was significantly higher in subjects with compared to subjects without MACE ($6.8\pm3.5$ vs. $4.5\pm3.4$, $p=5$ ($p$-value).

**CONCLUSION**

Patients with an age >60 years and a burden of intracranial artery calcification have an increased risk for the occurrence of cardio- or cerebrovascular events.

**CLINICAL RELEVANCE/APPLICATION**

Intracranial artery calcifications, which can be easily detected on non-contrast-enhanced CT scans of the head, might be a prognostic factor to determine the risk for a future cardio- or cerebrovascular events in older patients.
CONCLUSION

Dynamic-IR-MRI scan without any adverse effects, or expressing discomfort. Several minutes post injection (Fig. 1b). All recruited patients completed the NS injection plus the periventricular white matter were observed in the 10-30% range and these enhancement effects lasted for extra-cranial tissues and also in periventricular white matter. Relative signal change in cortical gray matter and NS injection-related enhancement effects were observed in all patients, particularly in highly vascular intra- and periventricular white matter. All of these hemodynamic properties are simultaneously inferred by our new technique.

RESULTS

The model was applied to a pilot series of patients with Moyamoya disease and CNS malignancy. In patients with Moyamoya disease, the MTT derived by standard deconvolution is confounded by bolus delay. However, the local AIF technique directly accounts for delayed BAT, and the resulting MTT prolongation is reduced compared to the standard approach. In patients with glioblastoma multiforme, tumors demonstrate variable heterogeneity with some components characterized by pronounced hyperperfusion, and other components characterized by increased vascular permeability. All of these hemodynamic properties are simultaneously inferred by our new technique.

CONCLUSION

A new local AIF technique that incorporates leakage effects has been developed, and it is broadly applicable to the evaluation of both ischemia and malignancy.

CLINICAL RELEVANCE/APPLICATION

This work outlines a new local AIF technique for MR Perfusion that corrects for the effects of contrast leakage and is broadly applicable to the evaluation of both ischemia and malignancy.

PURPOSE

MR Perfusion Weighted Imaging (MR-PWI) supplements anatomic sequences by providing functional information regarding the hemodynamic status of the brain. Standard MR-PWI protocols employ singular value decomposition to deconvolve the arterial input function (AIF) from the relaxivity time curve. However, standard models are limited by their inability to account for differences in bolus arrival time (BAT), bolus dispersion, and contrast leakage. Local AIF techniques have addressed the problems associated with delayed BAT and bolus dispersion (Lee et al, 2010, MRM 63: 1305), but have not addressed leakage, an important hemodynamic parameter in the imaging of CNS malignancies (Boxerman et al, 2006, AJNR 27: 859). In the present work, we introduce a new fully automated local AIF perfusion technique that incorporates leakage effects, making it broadly applicable to both ischemia and malignancy.

METHOD AND MATERIALS

A per-voxel AIF was modeled with a gamma-variate function. The residue function was modeled with a mono-exponential. Leaking contrast was defined to be proportional to the cumulative integral of the intravascular concentration time curve. Parameter values were inferred with Bayesian Markov Chain Monte Carlo simulations. The automated algorithm was implemented in C/C++ and parallelized with the Message Passing Interface to execute in parallel on a user-defined number of CPUs.

RESULTS

The model was applied to a pilot series of patients with Moyamoya disease and CNS malignancy. In patients with Moyamoya disease, the MTT derived by standard deconvolution is confounded by bolus delay. However, the local AIF technique directly accounts for delayed BAT, and the resulting MTT prolongation is reduced compared to the standard approach. In patients with glioblastoma multiforme, tumors demonstrate variable heterogeneity with some components characterized by pronounced hyperperfusion, and other components characterized by increased vascular permeability. All of these hemodynamic properties are simultaneously inferred by our new technique.

CONCLUSION

A new local AIF technique that incorporates leakage effects has been developed, and it is broadly applicable to the evaluation of both ischemia and malignancy.

CLINICAL RELEVANCE/APPLICATION

This work outlines a new local AIF technique for MR Perfusion that corrects for the effects of contrast leakage and is broadly applicable to the evaluation of both ischemia and malignancy.

 PURPOSE

Gadolinium-based contrast agents can have risks including nephrogenic systemic fibrosis, allergic reactions and limitation of use during pregnancy. Normal saline (NS) is a nontoxic sodium chloride water solution that can significantly increase the MR relaxation times of blood via hematocrit reduction. The purpose of this study was to test in-vivo the potential of NS as a safer, brain perfusion exogenous contrast agent.

METHOD AND MATERIALS

This HIPAA compliant prospective study was approved by the IRB of our hospital. MRI was performed at 1.5T (Achieva, Philips Healthcare): head array and body coil for RX/TX. Three and five patients were scanned with an IR-EPI and IR-TSE sequence, respectively. The IR pulse sequence was run during and after the NS injection for up to 5min: 100cc of NS were power injected into antecubital veins at 3-4cc/s. Images were processed with Mathcad (2001i, PTC, Needham, MA) algorithms to map maximum enhancement (maxENH), area under the curve (AUC), time-to-peak (TTP), and mean-transit-time (MTT) (Fig. 1a). These maps were used to identify visually the areas showing significant NS injection related signal. Regions of interest (ROI) were drawn in areas of high injection related effects as well as areas without these effects and graphed as a function of time.

RESULTS

NS injection-related enhancement effects were observed in all patients, particularly in highly vascular intra- and extra-cranial tissues and also in periventricular white matter. Relative signal change in cortical gray matter and periventricular white matter were observed in the 10-30% range and these enhancement effects lasted for several minutes post injection (Fig. 1b). All recruited patients completed the NS injection plus the dynamic-IR-MRI scan without any adverse effects, or expressing discomfort.

CONCLUSION

This HIPAA compliant prospective study was approved by the IRB of our hospital. MRI was performed at 1.5T (Achieva, Philips Healthcare): head array and body coil for RX/TX. Three and five patients were scanned with an IR-EPI and IR-TSE sequence, respectively. The IR pulse sequence was run during and after the NS injection for up to 5min: 100cc of NS were power injected into antecubital veins at 3-4cc/s. Images were processed with Mathcad (2001i, PTC, Needham, MA) algorithms to map maximum enhancement (maxENH), area under the curve (AUC), time-to-peak (TTP), and mean-transit-time (MTT) (Fig. 1a). These maps were used to identify visually the areas showing significant NS injection related signal. Regions of interest (ROI) were drawn in areas of high injection related effects as well as areas without these effects and graphed as a function of time.

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A measurable perfusion effect of up to 30% change relative to baseline has been demonstrated in-vivo in the human brain using NS as a contrast agent. The contrast mechanism is believed to be an alteration of the T1 relaxation time resulting from hematocrit reduction. To the best of our knowledge, this is the first report of the use of NS for dynamic contrast enhanced MRI.

**CLINICAL RELEVANCE/APPLICATION**

This demonstrates the viability of NS as a measurable, safe, practical, and inexpensive T1 contrast agent for dynamic perfusion MRI. The described methodology could be used with patients with Gd contraindications.

**SST09-04**

**Progression of Brain Atrophy and White Matter Hyperintensities in Cerebral Small Vessel Disease. Estimates of Sample Size to Detect Treatment Effects**

Philip Benjamin MBBS (Presenter): Nothing to Disclose, Andrew J. Lawrence: Nothing to Disclose, Andrew Mackinnon MD, MRCP: Nothing to Disclose, Eva Zeestraten: Nothing to Disclose

**PURPOSE**

Brain volume and white matter lesions have been suggested as a surrogate marker of disease progression for use in clinical trials in cerebral small vessel disease (SVD). If these MRI findings are to be used as a reliable surrogate markers in clinical trials, power calculations are required not only to determine the sample sizes needed to show therapeutic efficacy, but also to help identify the most feasible outcome measures. We used serial brain magnetic resonance imaging (MRI) to prospectively evaluate the rate of brain atrophy and white matter hyperintensity (WMH) growth in SVD and investigated the sample sizes required to demonstrate a reduction in the rate of disease progression.

**METHOD AND MATERIALS**

Data from the prospective SCANS study of patients with SVD was used for this analysis (n=121). SVD was defined as a clinical lacunar stroke with an anatomically corresponding MRI defined lacunar stroke as well as confluent leukoaraiosis. Multimodal MRI was performed yearly for a period of 3 years. Percentage whole brain volume change relative to baseline was measured directly using a registration based method (SIENA). WMHs were segmented and volumes were calculated at each timepoint in individual subject space by summing binarised corrected segmentations.

**RESULTS**

For a 3 year trial duration the mean (SD) rate of whole brain atrophy was -1.985%(1.958). The mean (SD) percentage growth of WMH (WMHp) was 1.912% (1.168). Based on these figures, to detect a 25%, 20% and 15% treatment effect on brain atrophy at 80% power the minimum sample sizes required were 494 (247 in each arm), 766 (383 in each arm) and 1358 (679 in each arm) respectively. For WMH growth, the minimum sample size required to detect a 25%, 20% and 15% treatment effect at 80% power was 172 (86 in each arm), 270 (135 in each arm) and 476 (238 in each arm) respectively.

**CONCLUSION**

Whole brain volume change is measurable prospectively in SVD and is higher than the reported rate of atrophy in normal ageing. Whole brain volume change is therefore a feasible outcome measure for use in clinical trials in SVD although sample sizes are still moderate. Considerably smaller sample sizes are required if WMH volume is used as an outcome measure, however the impact of WMHs on cognitive impairment and disability in SVD remains uncertain.

**CLINICAL RELEVANCE/APPLICATION**

Markers of disease progression in cerebral small vessel disease

**SST09-05**

**Intracranial Hypotension and Sinus Vein Thrombosis - Causal or Casual Association?**

Ruth Eliahou MD (Presenter): Nothing to Disclose, Asaf Honig MD: Nothing to Disclose, Ronen Leker MD: Consultant, MedyMatch Technology Ltd, John Moshe Gomori MD: Consultant, Medymatch Technology Ltd

**PURPOSE**

Intracranial hypotension (IH) is an increasingly recognized clinical entity with distinct clinical and imaging features. The associated venous distention and sluggish venous flow in IH has been linked to sinus vein thrombosis (SVT). Iatrogenic direct lumbar punctures (LP), spinal anesthesia (SA) or indirect punctures due to epidural anesthesia (EA) are common causes of IH. We studied the occurrence of SVT in patients post LP.

**METHOD AND MATERIALS**

We retrospectively reviewed the imaging and clinical findings of post LP patients with SVT in our institution between 2003 and 2013.

**RESULTS**

Eighty patients who presented to our institution in the past 10 years with acute sinus vein thrombosis were identified. Ten of them, all females (ages 22 -52) were found to have an LP 3-7 days before developing SVT. 8
women were post-partum with EA, and two had SA for meniscal surgery and hysterectomy. All patients had postural headaches. CT and MR scans of all ten patients were positive for SVT. In addition, five patients (50%) also showed one or more IH related MR findings: low cerebellar tonsils, decreased mamillo-pontine distance, diffuse pachymeningeal enhancement, thin bilateral subdural fluid collections. Post-partum and postoperative states are known to be hypercoagulable conditions. Subsequent coagulograms revealed underlying hypercoagulable tendencies in all ten patients.

CONCLUSION

Clinical and imaging data point to a direct association between IH and SVT. In post-partum women who underwent recent spinal or epidural anesthesia, with diagnosis of SVT one should look for IH. Coexistence of underlying IH may have therapeutic implications.

CLINICAL RELEVANCE/APPLICATION

There is a strong association between postpartum SVT and IH, caused by recent spinal anethesia Postpartum SVT should initiate imaging and clinical search for underlying IH.

SST09-06

Evaluation of the Atherosclerotic Wall of intracranial Aneurysms Using Hybrid of Opposite-contrast Magnetic Resonance Angiography (HOP-MRA)

Yuji Akiyama (Presenter): Nothing to Disclose, Toshinori Matsushige : Nothing to Disclose, Yosiko Iwakado : Nothing to Disclose, Yoko Kaichi : Nothing to Disclose, Tokunori Kimura PhD : Nothing to Disclose, Kazuo Awai MD : Research Grant, Toshiba Corporation Research Grant, Hitachi Ltd Research Grant, Bayer AG Research Consultant, DAIICHI SANKYO Group Research Grant, Eisai Co, Ltd

PURPOSE

Hybrid of opposite-contrast magnetic resonance angiography (HOP-MRA) is a new technique that combines the advantages of 3D time-of-flight (TOF) MRA and flow-sensitive black-blood (FSBB) MRA. Theoretically, HOP-MRA demonstrates atherosclerotic plaques including fat as high- and the blood space as low-signal intensity areas in intracranial aneurysms. The purpose of this study was to investigate whether HOP-MRA demonstrates atherosclerotic plaques in intracranial aneurysms.

METHOD AND MATERIALS

This prospective study included 13 patients (6 men, 7 women; median age 63 years, range 24-76 years) with 15 aneurysms. The same neurosurgeon with 15 years of experience confirmed the macroscopic findings on all aneurysms. The median maximum diameter of the aneurysms was 5.1 mm (range 2.8-14.1 mm). All images were acquired on a commercially available 3T MR scanner (Vantage Titan 3T; Toshiba Medical Systems) with a 16-channel head coil. For HOP-MRA we used a 3D GRE double-echo sequence. The scan parameters were: TR, 21 ms; TE1, 3.3 ms; TE2, 13.9 ms; flow dephasing gradient (b=0.3s/mm2); flip angle, 20; field of view, 24 cm; slice thickness, 1 mm; number of partitions, 60; 192 Χ 256 matrix; and 2 NEX. We measured the relative signal intensity (RSI) of the high-intensity area to the background low-intensity area inside the aneurysm.

RESULTS

During surgery, 6 aneurysms were classified as grade A, 4 as grade B, and 5 as grade C. The mean RSI for grade A, B, and C was 4.65±1.53 (standard deviation), 1.42±0.69, and 0.93±0.16, respectively. There was a statistically significant difference between grade A and B (p=0.028, Steel-Dwass multiple comparison), grade A and C (p=0.017), and grade B and C aneurysms (p=0.038).

CONCLUSION

The relative signal intensity in intracranial aneurysms on HOP-MRA images accurately correlated with the presence and extent of atherosclerotic plaques.

CLINICAL RELEVANCE/APPLICATION

HOP-MRA is a promising modality for predicting the degree of atherosclerotic change in the cerebral arteries.

SST09-07

One-step-Stroke CT Imaging – Part I: Optimization of Interleaved Acquisition of Cerebral CT Perfusion and Neck CT Angiography

Marcel Oei (Presenter): Researcher, Toshiba Corporation, Rashinda Manniesing : Research funded, Toshiba Corporation, Rieneke van den Boom MSC : Research Grant, Toshiba Corporation, Willem Jan Van der Woude : Research Grant, Toshiba Corporation, Bram Van Ginneken PhD : Stockholder, Thirona BV Co-founder, Thirona BV Research Grant, MeVis Medical Solutions AG Research Grant, Canon Inc Research Grant, Toshiba Corporation Research Grant, Riverain Technologies, LLC, Frederic Jan Anton Meijer MD : Nothing to Disclose, Mathias Prokop MD, PhD : Speakers Bureau, Bayer AG Speakers Bureau, Bracco Group Speakers Bureau, Toshiba Corporation Speakers Bureau, Koninklijke Philips NV Research Grant, Toshiba Corporation

PURPOSE

One-Step-Stroke imaging is a CTP acquisition in which one volumetric scan is substituted by volumetric neck CTA, using a toggling table technique and a single dose of contrast agent (see figure). It is not clear how missing one time point of the CTP acquisition to obtain the neck CTA will affect the perfusion maps and which time point is best suited for neck CTA. We determined the optimum timing of neck CTA with the least effect on cerebral perfusion maps.
20 consecutive patients with suspicion of ischemic stroke were scanned with a clinical CTP head protocol using a 320-row CT scanner. A neck CTA takes maximal 4s, therefore omitting one time point of the CTP with 2s scan interval is sufficient. The One-Step-Stroke protocol was simulated from the original protocol by eliminating one acquisition at various time points. The elimination of one acquisition of CTP simulates the acquisition of the neck CTA. For every patient one volumetric acquisition was deleted, starting from the bolus arrival time up to the fifth time point after the arterial peak determined from the middle cerebral artery (MCA). Corresponding perfusion maps were calculated. Percentage errors were calculated for all perfusion parameters (CBF, CBV, MTT) in basal ganglia and white matter per time point and per patient. Bolus tracking is simulated by using the enhancement curves in the MCA to derive relative thresholds (40-100HU). The relative thresholds were used to determine the time point resulting in the smallest error across all patients.

RESULTS
A volumetric CTP scan deleted 2s after reaching a threshold of 40-70HU kept the absolute percentage errors of all perfusion parameters below 10% in all patients. A relative threshold of 70HU for bolus tracking of the CTA gave the lowest absolute percentage errors for CTP parameters (mean <3.0%, maximum always <7.5%) for acquiring the neck CTA. Estimated average enhancement at CTA, measured in the MCA, was 302HU (range 198-408HU).

CONCLUSION
Our simulations suggest that the One-Step-Stroke protocol does not significantly alter absolute perfusion values and creates high enhancement in the carotids, if the neck CTA is acquired 2s after a threshold of 70HU in the MCA.

CLINICAL RELEVANCE/APPLICATION
One-step stroke imaging is a single exam sequence where the neck CTA is part of the CTP. One-Step-Stroke imaging has the potential to replace CTA and CTP which saves radiation dose and contrast agent dose.
promising technique for assessment of hemodynamics. The purpose of our study was to validate the accuracy of hemodynamics and wall shear stress (WSS) obtained from MRFD using two phantoms.

**METHOD AND MATERIALS**

We ran blood-mimicking fluid through a 3 mm-diameter straight tube with a steady flow measuring about 2.50 ml/sec and performed 3D cine PC MRI using 3T MR system. We performed MRFD by Flova software and compared analyzed time averaged volume flow rates (VFRs) with values measured with a digital Coriolis flowmeter and also compared WSS with theoretical values. We also performed MRFD for a left internal carotid artery-posterior communicating artery aneurysm (IC-PC An) model with blood mimicking fluid for three different steady VFRs in an internal carotid artery (ICA) set at 7.59 ml/sec, 4.63 ml/sec and 2.84 ml/sec. We compared analyzed time averaged VFRs in ICA, anterior cerebral artery (ACA) and middle cerebral artery (MCA) with values measured with the flowmeters. We also compared our software-calculated velocity components and WSS with values obtained from computational fluid dynamics (CFD) and calculated correlation coefficients. We also compare MRFD and CFD streamlines.

**RESULTS**

In the straight tube phantom, relative errors of time averaged VFR and WSS were 4 % and 6 %, respectively. In the cerebral artery phantom, relative errors of time averaged VFRs in ICA, ACA and MCA were 10 %~30 %. Correlation coefficients of velocity components in ICA were 0.60~0.94 and those of WSS in ICA were 0.68~0.72. Correlation coefficients of velocity components in IC-PC An were 0.58~0.94, and that of its WSS was 0.34~0.63. Distribution of WSS and streamlines in MRFD and CFD were similar.

**CONCLUSION**

Accuracy of time averaged VFR obtained from MRFD was relatively good in this phantom study. Although accuracy of WSS obtained from MRFD was poor in IC-PC An in the model, it was good in a straight tube phantom and ICA. WSS and streamlines patterns obtained in MRFD were similar in CFD.

**CLINICAL RELEVANCE/APPLICATION**

(Dealing with MRFD using 3D cine PC MRI) Although WSS might not be accurate; VFR, distribution of WSS and streamlines were relatively good in MRFD in cerebral arteries.

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**SST16**

**Vascular/Interventional (IR: GI and Hepatobiliary Interventions)**

**Scientific Papers**

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<td><strong>PURPOSE</strong></td>
<td>To determine the success rate of colonic stenting (CS) and describe positive/negative factors predictive of CS deployment.</td>
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<td>To determine the complication rate of colonic stenting and describe these encountered in the early and late phase.</td>
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<td>To define the average survival and stent patency/intervention free period in patients with inoperable metastatic disease (M1) and determine when palliative surgery may be preferable to CS.</td>
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**METHOD AND MATERIALS**

All patients undergoing CS between November 2007 and October 2013 were identified from the departmental radiology electronic database. Clinical data was obtained from retrospective casenote review.

**RESULTS**

178 colonic stents were deployed in 165 patients. 143 patients had primary colonic malignancy, 102 of these...
SST16-03

A Percutaneous Transhepatic Cholangiography Needle Prototype That Utilizes the Unique Electrical Conductivity of Bile to Alert the Operator That the Needle Tip Has Entered a Bile Duct

Hersh Desai : Nothing to Disclose, ravi mahadevan : Nothing to Disclose, Jackson Bruce Morton BS : Nothing to Disclose, Matt Nagle : Nothing to Disclose, Mark Palmeri MD, PhD : Nothing to Disclose, Paul Vincent Suhocki MD (Presenter) : Nothing to Disclose

PURPOSE

Percutaneous cholangiography technique has changed little over the decades and is associated with prolonged fluoroscopy times. The purpose of this research was to develop a needle prototype that would reduce procedure time and, therefore, radiation exposure to the patient and operator.

METHOD AND MATERIALS

The needle prototype was created from an 18 gauge needle shaft and a 20 gauge stylet, separated by an insulating layer of non-conductive polyurethane and glue. Current travels from the tip of the 18 gauge needle shaft, across surrounding fluid and into the stylet tip. The needle functions as a leg of a Wheatstone Bridge, insulating layer of non-conductive polyurethane and glue. Current travels from the tip of the 18 gauge needle shaft and across the surrounding fluid to the stylet tip. The needle prototype was created from an 18 gauge needle shaft and a 20 gauge stylet, separated by an insulating layer of non-conductive polyurethane and glue.

METHOD AND MATERIALS

Retrospective review of all colonic stents placed in our institution between February 2006 and December 2013 was undertaken. This yielded 271 stents placed in 249 patients. Radiological and medical records were examined and a wide range of data collected, including patient demographics, nature, location and length of stricture, duration of symptoms, technical and clinical success, complication and 30 day mortality.

RESULTS

Technical and clinical success were 80.1% and 68.3% respectively. Clinical success was significantly lower in strictures longer than 5cm (53.4% vs 71.3%, p=0.0216). Clinical success was also lower in lesions at anatomical flexures (59.6% vs 75.6%, p=0.0096). A longer duration of symptoms (more than one week) was associated with lower technical success (69.2% vs 85.4%, p=0.0086). Overall complication rate was 27.1% (17.2% perforations, 6.6% stent migration and re-occlusion in 3.3%) and in line with other series. Analysis of the cases with perforation showed that only half of the perforations were related to stent placement. There was a non statistically significant trend toward increased perforation rate in benign strictures over malignant (2.8% vs 11.1%, p=0.0602). No significant trends relating to patient age or 30 day mortality were shown. The length and site of stricture were not shown to be related to complication rate.

CONCLUSION

This study represents the largest published series of colonic stents to date. It has identified statistically significant trends in clinical success and lesion length and location, with lower technical success in patients with symptoms for longer than one week. These findings should be taken into account when choosing a treatment strategy for patients presenting with large bowel obstruction to optimise technical and clinical outcomes.

CLINICAL RELEVANCE/APPLICATION

Limited quality evidence exists around colonic stenting for bowel obstruction. The current study represents that largest single cohort of patients undergoing stenting for large bowel obstruction to date. We have identified patient, clinical and anatomical factors to stratify risk and predict outcomes. We present new evidence to refine decision making in relation to the management of colonic obstruction.

SST16-02

Technical and Clinical Outcomes of Colorectal Stenting in Large Bowel Obstruction

James Henry Briggs MBChB, FRCR : Nothing to Disclose, Thomas Oakley MBBS, MA (Presenter) : Nothing to Disclose, Mark William Little MBBS, MSC : Nothing to Disclose, Joe Benson Woodhouse MBBS : Nothing to Disclose, Shaheen Dixon MBBS, FRCR : Nothing to Disclose, Charles Ross Tapping MBChB, FRCR : Nothing to Disclose, Raman Uberoi MBChB, FRCR : Nothing to Disclose

PURPOSE

The aims of this study are to determine anatomical and clinical factors which affect outcome following stenting for large bowel obstruction, allowing improved treatment selection for patients.

METHOD AND MATERIALS

Retrospective review of all colonic stents placed in our institution between February 2006 and December 2013 was undertaken. This yielded 271 stents placed in 249 patients. Radiological and medical records were examined and a wide range of data collected, including patient demographics, nature, location and length of stricture, duration of symptoms, technical and clinical success, complication and 30 day mortality.

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CLINICAL RELEVANCE/APPLICATION

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shaft, across surrounding fluid and into the stylet tip. The needle functions as a leg of a Wheatstone Bridge, with the fluid at the needle tip acting as a variable resistor. It utilizes a BeagleBone Black microprocessor for its software computational needs. The BeagleBone Black stores a Python based code. Battery, circuit and microprocessor are housed inside a box equipped with USB and HDMI outputs for data display. The output is compatible with most medical display monitors and continuously updates output voltage values. The needle was tested in-vitro, using salt and deionized water solutions of differing electrical conductivities matching those of blood, bile and liver.

RESULTS

This needle prototype successfully transduced changes in relative electrical conductivity in fluids surrounding the needle tip. It accurately detected entry of the needle tip into a salt solution that has the same conductive properties as bile. In the range of biologically relevant conductivities, generally below 2 S/m, the response of the system allowed for differentiation between the electrical conductivities of bile, blood and liver tissue.

CONCLUSION

This percutaneous cholangiography needle prototype utilizes the unique electrical conductivity properties of bile to alert the operator that the needle tip has entered a bile duct. Further testing in animal models will be necessary before determining its clinical utility for this and other applications.

CLINICAL RELEVANCE/APPLICATION

This needle prototype can reduce radiation exposure associated with percutaneous transhepatic cholangiography by eliminating the need for fluoroscopy during much of the procedure. This technology shows potential for use in other medical procedures as well, utilizing the unique electrical conductivities of body fluids not discussed here.

SST16-04

Primary Hepatic Arterial Stenting in Patients after Liver Transplantation: 1 Year Patency Rates and Long Term Clinical Outcomes

Ammar Sarwar MD (Presenter): Nothing to Disclose, Ian Martin Brennan MBChB, BMedSc: Nothing to Disclose, Olga Rachel Brook MD: Research Grant, Guerbet SA, Felipe Birchal Collares MD: Nothing to Disclose, Salomao Faintuch MD: Nothing to Disclose, Barry A. Sacks MD: Nothing to Disclose, Muneeb Ahmed MD: Nothing to Disclose

PURPOSE

To determine clinical outcome in patients who underwent primary stent placement for hepatic artery (HA) stenosis after liver transplantation.

METHOD AND MATERIALS

A retrospective review of all adult liver transplant patients needing HA stent (2003-2013) was performed. All imaging studies and clinical outcomes were recorded. Primary clinical outcomes (mortality, graft dysfunction) were assessed. As a secondary endpoint, primary patency was assessed using available imaging at 1 month and 1 year.

RESULTS

20 pts (mean age: 54±11y, 10 male) fit inclusion criteria and had 26 HA stents, (mean 185±213 days (d)) after transplant. Overall, 20/26 stents in 16/20 patients were patent within the time period reviewed. Clinical follow-up was available in 18/20 patients (Mean 1173±1040d). Two patients were alive with no graft dysfunction but lost to follow-up at 1323 and 1742 days. Overall mortality was 77% (14/18). Graft dysfunction related mortality was 0%. Re-transplantation related to HA stenosis was needed in 1 patient who required 3 separate stents. In patients with at least 2 years (n=15) and 5 year clinical follow-up (n=4), none had HA-related graft dysfunction or HA-related mortality. Of the 5 patients with less than 2 year clinical follow-up, 1 required re-transplantation due to HA thrombosis and 2 died due to non-graft dysfunction related causes. At least 1 year imaging follow-up was available in 24/26 stents. Primary patency was 96% at 30 days and 75% at 1 year. Primary assisted patency was 79% at 1 year. In 3 patients with hepatic arterial occlusion on imaging, one needed re-transplantation (occlusion 14 days post-stenting) and two are doing well with no graft dysfunction (occlusion 44 days and 728 days post-stenting).

CONCLUSION

Primary stenting for HA stenosis has very good clinical outcomes and high primary patency rates. Late occlusions (>30d) do not necessarily lead to graft dysfunction.

CLINICAL RELEVANCE/APPLICATION

Hepatic arterial stenosis is an uncommon complication after liver transplantation. Successful percutaneous therapy with good long term outcomes may preclude need for surgical revision.

SST16-05

Survival Benefit of TIPS in Patients with Refractory Ascites: A Single Institution Case-Control Analysis

Ahmad Parvinian MD (Presenter): Nothing to Disclose, Leigh Casadaban BS: Research Grant, Guerbet SA, Jeet Minocha MD: Nothing to Disclose, Martha-Gracia Knuttin MD, PhD: Nothing to Disclose, James Thuan Bui MD: Nothing to Disclose, Charles E. Ray MD, PhD: Nothing to Disclose, Ron Charles Gaba MD: Nothing to Disclose

PURPOSE

Ascites is a leading cause of morbidity and mortality among cirrhotic patients: it occurs in 50% within 10 years...
of diagnosis and becomes medically refractory in 5-10%, which entails a 1-year mortality rate of up to 50%. Transjugular intrahepatic portosystemic shunt (TIPS) is a safe and effective treatment for ascites secondary to portal hypertension. While the benefits of this procedure are well documented, data regarding the effect of TIPS on survival remain unproven. To that end, this study aims to quantify the impact of TIPS creation on survival in the setting of ascites.

**METHOD AND MATERIALS**

In this single-institution retrospective study, 79 patients who underwent TIPS for refractory ascites from 2001-2014 were compared with a cohort of 80 patients with refractory or recidivant ascites due to decompensated liver disease who underwent serial paracentesis procedures during the same time period. Data pertaining to demographic and liver disease characteristics, Model for End Stage Liver Disease (MELD) scores, and survival outcomes were obtained from electronic medical record review and the social security death index. Survival outcomes were analyzed using Kaplan-Meier statistics with log-rank comparison.

**RESULTS**

The TIPS cohort comprised 56 men and 23 women (mean age 54 years, mean MELD 15); the no-TIPS cohort comprised 46 men and 34 women (mean age 54 years, mean MELD 22.5). Survival was enhanced with TIPS: median survival was 1100±371 days in the TIPS cohort and 262±121 days in the no-TIPS cohort (P=0.021). Median survival among patients with MELD scores ≤18 was 1219±436 days versus 262±77 days (P=0.01) in the TIPS versus no-TIPS cohorts, respectively. Survival was similar in patients with MELD >18 (130± 602 versus 322± 220 days, P=.829). There was no significant difference in mortality between the TIPS and no-TIPS groups at 30 days (13.2% versus 12.5%, P=1.0) or 90 days (21.1% versus 28.8% P=0.58), indicating short-term procedure safety.

**CONCLUSION**

TIPS creation enhances long-term survival without significantly impacting short-term mortality in patients with ascites.

**CLINICAL RELEVANCE/APPLICATION**

TIPS imparts a quantifiable survival benefit on patients with ascites. A precise understanding of this benefit may aid in temporal optimization of TIPS allocation as a bridge to definitive therapy.

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**SST16-06**

Migration of Retrievable, Expandable Metallic Stents Inserted for Malignant Esophageal Strictures: Incidence, Management, and Prognostic Factors in 332 Patients

Wei-Zhong Zhou (Presenter): Nothing to Disclose, Ho-Young Song MD: Nothing to Disclose, Jung-Hoon Park MS, RT: Nothing to Disclose, Ji Hoon Shin MD: Nothing to Disclose, Jin Hyung Kim MD: Nothing to Disclose, Young Chul Cho BS: Nothing to Disclose, Ji Hoon Jang: Nothing to Disclose, Eun Jung Jun PhD: Nothing to Disclose

**PURPOSE**

Focused on evaluating the factors that influence stent migration following placement of single design stent was not previously reported. The purpose of this study was to evaluate the incidence, prognostic factors, and secondary management of stent migration in patients with malignant esophageal strictures.

**METHOD AND MATERIALS**

A retrospective cohort study was performed in a single, tertiary-referral, university hospital to identify the incidence, management, and prognostic factors for stent migration in 332 consecutive patients with placement of a retrievable, expandable, metallic stent for malignant esophageal strictures. Stent migration was classified into four patterns as locations of a migrated stent when migrated stents were detected. A multivariate logistic regression model was used to identify the independent predictive factors associated with stent migration.

**RESULTS**

Stent migration occurred in 42 (12.6%) of 332 patients. Migration was partial (n=21) or complete (n=21), and nine, 12, 11, and 10 patients had patterns I, II, III, and IV, respectively. Multivariate analysis identified the following prognostic factors: esophagogastric junction strictures caused by cancer of the gastric cardia (OR, 3.330; 95% CI, 0.156-9.698; p = 0.004), patients who underwent anti-cancer treatment after stent placement (OR, 17.514; 95% CI, 7.094-43.235; p < 0.001), and patients with a longer survival time (OR, 2.994; 95% CI, 0.991-7.996; p < 0.001). Secondary management was needed for 33/42 (79%) patients. The strictures in the remaining nine patients improved throughout the follow-up.

**CONCLUSION**

Stent migration occurs most commonly in patients with cancer of the gastric cardia, longer survival time and who underwent anti-cancer treatment following stent placement. Stent migration is successfully managed by further intervention.

**CLINICAL RELEVANCE/APPLICATION**

Accurate knowledge of the pattern of stent migration is important for its successful management.

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**SST16-07**

Approach of Image-Fusion from Pre-procedural Computed Tomography Angiography in an Interventional Vascular Procedure: The Portal Vein Puncture during Transjugular Intrahepatic Portosystemic Shunt (TIPS)

SST16-07
**SST16-08**

**Early, Unexpected, Liver Failure after TIPS Placement in Cirrhotic Patients with Relatively Preserved Liver Function (MELD ≤12): Incidence, Outcome and Prognostic Factors**

Angelo Luca MD : Nothing to Disclose, Roberto Miraglia MD : Nothing to Disclose, Luigi Maruzzelli MD (Presenter): Nothing to Disclose, Giovanni Vizzini : Nothing to Disclose, Mario D’Amico MS : Nothing to Disclose, Fabio Tuzzolino : Nothing to Disclose

**PURPOSE**

To evaluate incidence, outcome and prognostic factors of early liver failure (LF) after TIPS in cirrhotic patients with relatively preserved liver function.

**METHOD AND MATERIALS**

We retrospectively reviewed 217 consecutive cirrhotic patients with baseline MELD ≤12 who underwent TIPS for portal hypertensive complications. TIPS indications were recurrent variceal bleeding (47.9%), refractory/recurrent ascites (41.5%), other (10.6%). Early LF defined as presence of death, liver transplantation (LT) or MELD >18 within 3-months after TIPS was assessed. The Kaplan-Meier method and the Log-rank test were used to look for predictors of early LF. Independent predictors were assessed using a multivariate Cox proportional hazards model.

**RESULTS**

Twenty (9.2%) out of 217 patients developed early LF after TIPS (10 patients died, 1 patient required LT and 9 patients increased the MELD to more than 18). In the latter group, two patients died at 6 and 9.8 months, two underwent LT at 7.8 and 11.9 months, 4 patients decreased the MELD≥12 from 4.3 to 12 months after TIPS and one patient maintained a stable MELD. One patient had bi-segmental hepatic necrosis on computed tomography; no other procedure-related technical complications were associated with early LF. Early LF was associated with significantly lower transplant free survival 97% vs. 40% at 6-months (p< 0.05) and 88% vs. 24% at 12-months (p< 0.0001) compared with patients without LF. Multivariate analysis revealed that refractory ascites (OR 4.6; CI 1.37-15.5; p=0.01) and pre-TIPS MELD ≥11 (OR 3.2; CI 1.07-9.5; p=0.01) were independently associated with the risk of early LF. In the subgroup of 95 patients with refractory ascites early LF occurred in 15 patients (16%), multivariate analysis disclosed that platelets level (OR 0.9; CI 0.99-0.99; p=0.01) was an additional independent predictors of early LF.

**CONCLUSION**

Early LF is not uncommon in cirrhotic patients with MELD≤12 undergoing TIPS especially in patients with refractory ascites and those with MELD ≥11. In the subgroup of patients with refractory ascites, platelet count was identified as additional prognostic factor. In more than two third of cases early LF causes death or requires LT.

**CLINICAL RELEVANCE/APPLICATION**
Early LF is not uncommon in cirrhotic patients with MELD ≤12 undergoing TIPS especially in patients with refractory ascites and those with MELD ≥11.

Outcome Following a Negative CT Angiogram for Gastrointestinal Haemorrhage

Victoria Chan MBChB (Presenter): Nothing to Disclose, Donald Man Lap Tse MRCP, FCR: Nothing to Disclose, Shaheen Dixon MBBS, FCR: Nothing to Disclose, Vivek Shrivastava MBBS: Nothing to Disclose, Charles Ross Tapping MBCh, FCR: Nothing to Disclose, Rafiuddin Patel MBChB, FCR: Nothing to Disclose, Mark Bratby MRCP, FCR: Nothing to Disclose, Suzie Anthony FCR: Nothing to Disclose, Raman Uberoi MBChB, FCR: Nothing to Disclose

PURPOSE

To evaluate the role of a negative computed tomography angiogram (CTA) in patients who present with gastrointestinal (GI) haemorrhage.

METHOD AND MATERIALS

A review of all patients who had CTAs for GI hemorrhage over an eight-year period from January 2005 to December 2012 was performed. Data on patient demographics, location of hemorrhage, hemodynamic stability and details of angiograms and/or the embolization procedure were obtained from the CRIS/PACS database, interventional radiology database, secure electronic medical records and patient’s clinical notes.

RESULTS

202 CTAs were performed in 180 patients over the eight-year period. 87 CTAs were performed for upper GI hemorrhage (18 positive for active bleeding, 69 negative) and 115 for lower GI hemorrhage (37 positive for active bleeding, 78 negative). 58.7% (37/63) of patients with upper GI bleed and 77.4% (48/62) of patients with lower GI bleed who had an initial negative CTA did not rebleed without the need for radiological or surgical intervention. This difference was statistically significant (p = 0.04). The relative risk of rebleeding, following a negative CTA, in lower GI bleeding vs upper GI bleeding patients is 0.55 (95% confidence interval 0.32 - 0.95).

CONCLUSION

Patients with upper GI bleed who had negative CTAs usually require further intervention to stop the bleeding. In contrast, most patients presenting with lower GI hemorrhage who had a negative first CTA were less likely to rebleed.

CLINICAL RELEVANCE/APPLICATION

Negative CTA is a good indicator that patients with lower GI hemorrhage with a negative first CTA are much more likely to settle spontaneously without the need for intervention, compared with patients with upper GI hemorrhage.