BRE001-b

Mucinous Lesions of the Breast: Spectrum of Disease and Imaging-pathologic Correlation

Education Exhibits
Location: BR Community, Learning Center

Participants
Seo Yeon Park (Presenter): Nothing to Disclose
Hyo Soon Lim MD: Nothing to Disclose
Sook Hee Heo: Nothing to Disclose
Jin Woong Kim MD: Nothing to Disclose
Sang Soo Shin MD: Nothing to Disclose

TEACHING POINTS
Teaching Points 1. To demonstrate the spectrum of breast diseases that contains mucin. 2. To illustrate the mucinous breast lesions with radiologic-pathologic correlation. 3. To know that core biopsy results of mucin extravasation or mucocele like lesion warrant close radiologic-pathologic correlation and should consider excision.

TABLE OF CONTENTS/OUTLINE
A. The spectrum of breast diseases with mucin
B. Diseases with extracellular mucin
   1. Mucocele-like lesions
   2. Mucocele-like lesions with atypical ductal hyperplasia (ADH)
   3. Mucocele-like lesions with ductal carcinoma in situ (DCIS)
   4. Mucocele-like lesions with invasive mucinous carcinoma
   5. Mucinous carcinoma
   C. Diseases with stromal mucin
      1. Fibroadenoma with myxoid stroma
      2. Pleomorphic adenoma
      3. Adenoid cystic carcinoma
      4. Matrix producing metaplastic carcinoma
   D. Diseases with intracellular mucin
      1. Mucinous metaplasia
      2. Lobular neoplasia
      3. Ductal carcinoma in situ
      4. Invasive lobular carcinoma
   E. Clinical significance and management of mucin extravasation in breast core biopsy.

BRE002-b

Unusual Benign Breast Lesions: Imaging-pathologic Correlation

Education Exhibits
Location: BR Community, Learning Center

Participants
Hyo Soon Lim MD: Nothing to Disclose
Seo Yeon Park: Nothing to Disclose
Go Eun Kim (Presenter): Nothing to Disclose
Jin Woong Kim MD: Nothing to Disclose
Suk Hee Heo MD: Nothing to Disclose
Sang Soo Shin MD: Nothing to Disclose

TEACHING POINTS
1. To overview the imaging findings of unusual benign breast lesions with clinical manifestations. 2. To demonstrate the radiologic-pathologic correlation in various benign breast masses. 3. To know the imaging findings of benign breast lesions to avoid the unnecessary biopsy procedure.

TABLE OF CONTENTS/OUTLINE
A. Overview of WHO Classification of tumors of the breasts
B. Unusual benign breast lesions: Clinical manifestation and Imaging findings
   1. Tubular adenoma
   2. Lactating adenoma
   3. Microglandular adenosis
   4. Radial scar/complex sclerosing lesion
   5. Adenomyoepithelioma
   6. Fibroadenomatoid hyperplasia
   7. Mucocele-like lesion
   8. Lipomatous tumors
   9. Angiolyoma
   10. Hamartoma
   11. Pseudoangiomatous stromal hyperplasia (PASH)
   12. Hemangioma
   13. Malignant fibroblastic tumor
   14. Neurofibroma
   15. Mondor’s disease
   16. Diabetic mastopathy
C. Summary of useful radiologic findings in differential diagnosis

BRE003-b

Gynecomastia vs Pseudogynecomastia: Imaging Diagnosis, Cause and Treatment

Education Exhibits
Location: BR Community, Learning Center

Participants
Woo Jin Yang (Presenter): Nothing to Disclose
Jung Kyu Ryu MD, PhD: Nothing to Disclose
Sun Jung Rhee MD: Nothing to Disclose
Jeong Yoon Song: Nothing to Disclose

TEACHING POINTS
1) To review the imaging findings of gynecomastia and pseudogynecomastia. 2) To review various causes of gynecomastia and pseudogynecomastia. 3) To review the difference in treatments of gynecomastia and pseudogynecomastia.

TABLE OF CONTENTS/OUTLINE
1. Imaging features of normal male breast, gynecomastia and pseudogynecomastia
   A. Mammography
   B. Ultrasonography
   C. CT, MR
   2. Cause of gynecomastia and pseudogynecomastia
   A. Physiologic gynecomastia: neonates, pubertal boys, and elderly men
   B. Pathologic gynecomastia: a increase in estrogen, a decrease in testosterone, medication or drug and idiopathic
 Cause of pseudogynecomastia (Excessive fat tissue with a lack of actual breast tissue): obesity, lipomatosis 3. Treatment strategies for gynecomastia and pseudogynecomastia A. Medical: Selective estrogen-receptor modulator (Tamoxifen) II. Surgical: Often require “excisional surgery” B. Pseudogynecomastia: I. Conservative: Weight reduction II. Surgical: Can be treated with “liposuction alone”

BRE004-b

Radiologic Pathology Correlation is the Key for the Management of Unusual and Challenging Suspicious Breast Lesions

Education Exhibits

Location: BR Community, Learning Center

Participants
- Samy Ammari (Presenter): Nothing to Disclose
- Laurent Dercle MD: Nothing to Disclose
- Clarisse Dromain MD: Nothing to Disclose
- Martin Schlumberger: Nothing to Disclose
- Sandra Canale: Nothing to Disclose
- Salima Hibat: Nothing to Disclose
- Corinne Balleyguier MD: Nothing to Disclose

TEACHING POINTS
- Determining if pathology is concordant with image findings - Learning the management of discordant cases

TABLE OF CONTENTS/OUTLINE

Introduction: The management of suspicious breast lesions is increasingly based on image-guided percutaneous biopsies. It is becoming a key procedure for the diagnosis and is a valuable tool in a preoperative setting (providing prognostic and predictive parameters). The radiologist must identify the lesion, perform the biopsy, determine if pathology is concordant with image findings and learn the management of discordant cases. Teaching points: This pictorial essay describes unusual benign and malignant breast lesions, uncommon radiological (mammography and/or ultrasonography) and pathological findings. It includes numerous malignant lesions: tubular, mucinous, papillary and medullary carcinomas, cystic glandular carcinoma, angiosarcoma, apocrine carcinoma, breast lymphoma, breast fibromatosis, Paget breast disease and Abrikossof tumor. Conclusion: A proper management requires a close collaboration of the radiologist with an interdisciplinary team and an active involvement in correlating pathologic and radiologic findings. Indeed, there is an overlap in imaging between the benign and the malignant lesions and radiologists must be aware of unusual and challenging diagnosis.

BRE005-b

Bloody Nipple Discharge: Is Breast MRI the Way of the Future?

Education Exhibits

Location: BR Community, Learning Center

Participants
- Kristin Leigh Harris DO (Presenter): Nothing to Disclose
- Vanessa Van Duyn Wear MD: Nothing to Disclose

TEACHING POINTS

Evaluation of bloody nipple discharge is a frequent diagnostic dilemma for many breast imagers. When standard imaging is non-diagnostic, breast MRI is a non-invasive modality that has been proven to increase the sensitivity of identifying intraductal pathology. The purpose of this exhibit is: 1. To illustrate benign and malignant causes of bloody nipple discharge, including a multimodality pictorial review of common intraductal pathology. 2. To review the traditional imaging approach and potential pitfalls that may limit the standard evaluation of nipple discharge, including: mammography, ultrasound, and ductography. 3. To emphasize the emerging role of breast MRI in the evaluation of pathologic nipple discharge

TABLE OF CONTENTS/OUTLINE


BRE007-b

Comprehensive Review of the Anatomy and Disease in the Axilla: A Multimodality Approach

Education Exhibits

Location: BR Community, Learning Center

Participants
- Hyo Soon Lim MD (Presenter): Nothing to Disclose
- Seo Yeon Park: Nothing to Disclose
- Sook Hee Heo: Nothing to Disclose
- Jin Woong Kim MD: Nothing to Disclose
- Sang Soo Shin MD: Nothing to Disclose

TEACHING POINTS

1. To illustrate the normal anatomy of axilla with multimodality approach. 2. To demonstrate the radiologic-pathologic correlation in various axillary disease. 3. Awareness of normal anatomy and the spectrum of various axillary diseases can facilitate differential diagnosis of axillary masses.

TABLE OF CONTENTS/OUTLINE

A. Anatomy of axilla B. Usefulness and limitation of various imaging modalities C. Accessory breast in axilla and accessory

BRE009-b
Fat Injections for the Reconstructed Breast: Clinical and Imaging Features

Education Exhibits
Location: BR Community, Learning Center

Certificate of Merit

Participants
Emily Marie Brown MD (Presenter): Nothing to Disclose
Jason K. Mann MD : Nothing to Disclose
Sally Goudreau MD : Nothing to Disclose
Stephen Jacob Seiler MD : Nothing to Disclose

TEACHING POINTS
1. Fat injection (or lipofilling) is an increasing popular adjunct technique utilized by plastic surgeons to improve breast symmetry and contour following reconstruction.
2. Patients may have delayed symptoms following the procedure, including focal pain and/or a palpable lump.
3. Fat injections have a characteristic sonographic appearance of a complex ovoid mass with peripheral hyperechoic material and central anechoic fluid. Alternate findings mirror the classic spectrum of fat necrosis.
4. Knowledge of the characteristic features of fat injections permits a more confident diagnosis while relieving patient anxiety and avoiding unnecessary workup.

TABLE OF CONTENTS/OUTLINE
Overview of the surgical technique:
- Indications
- Illustration of procedure (to be created by our medical illustrator)
Review of the presenting signs/symptoms (at follow-up):
- Common symptoms
- Typical physical exam findings
Multimodality review of the imaging findings (with case examples):
- Ultrasound (the primary modality utilized for diagnostic evaluation)
- Mamography
- MRI
Clinical Implications
Summary

BRE010-b
Accelerated Partial Breast Irradiation: What the Radiologist Needs to Know

Education Exhibits
Location: BR Community, Learning Center

Participants
Carrie Margaret Rochman MD (Presenter): Nothing to Disclose
Shayna Showalter: Nothing to Disclose
Timothy Norman Showalter MD : Nothing to Disclose
Heather Renee Peppard MD : Consultant, Siemens AG Research Grant, Hologic, Inc
Brandi Tamara Nicholson MD : Stockholder, Hologic, Inc
Jennifer A. Harvey MD : Researcher, Hologic, Inc Researcher, VuCOMP Inc Researcher, Volpara Solutions, Ltd Shareholder, Volpara Solutions, Ltd Shareholder, Hologic, Inc

TEACHING POINTS
Accelerated Partial Breast Irradiation (APBI) is a group of rapidly evolving techniques for the delivery of localized radiation therapy to a lumpectomy bed following breast conservation for breast cancer. APBI is gaining popularity as an alternative to whole breast irradiation due to shortened length of treatment and decreased toxicity to the breast, heart, and lung. As the entire breast will not receive radiation, it is essential to exclude multicentric disease. The radiologist plays a critical role in patient selection and follow up. The purpose of this exhibit is to review current data available on APBI techniques, review criteria for patient selection, and review spectrum of post treatment imaging findings. Images from our institution will illustrate teaching points.

TABLE OF CONTENTS/OUTLINE
PET-MRI in Evaluation of Breast Cancer

Participants

Nelly Salem MD (Presenter): Nothing to Disclose
Peter F. Faulhaber MD : Speaker, Koninklijke Philips NV Grant, Koninklijke Philips NV Medical Advisor, MIM Software Inc
Raymond Muzic PhD : Research Grant, Koninklijke Philips NV
Kuan-Hao Dylan Su : Nothing to Disclose
Donna M. Plecha MD : Advisory Board, Hologic, Inc Research Grant, SuperSonic Imagine

TEACHING POINTS

1. Utilization of an integrated PET-MRI system enables visualization of PET and MRI data with the patient in the same position. This allows direct comparison of PET and MRI images.
2. The MRI component allows for superior soft-tissue contrast.
3. The PET component provides information about tumor metabolic activity.
4. The high sensitivity of MRI coupled with high specificity of PET could provide accurate evaluation of extent of disease, staging and follow-up after treatment.

BRE012-b

Uncommon Malignant Breast Tumors: Differential Diagnosis and Findings on MRI

Participants

Hazuki Takishima MD (Presenter): Nothing to Disclose
Kohei Inoue MD, PhD : Nothing to Disclose
Ken Motoori MD : Nothing to Disclose
Takashi Uno : Nothing to Disclose

TEACHING POINTS

1. To understand their radiological findings and collerate with pathological features.
2. To use this knowledge for differential diagnosis.

TABLE OF CONTENTS/OUTLINE

Purpose and aim The vast majority of invasive breast carcinomas are invasive ductal carcinoma, not otherwise specified (IDC-NOS) and invasive lobular carcinoma and the others are uncommon. Each of the uncommon types does not always have the same frequency of lymph node metastasis or the same prognosis in terms of the differentiation of the pathological or immunohistological feature. Because they don't always show a characteristic radiological feature, it is difficult to distinguish some cases from benign tumors. So it is very important to recognize the character of these tumors. The purpose of this paper is to understand the radiological findings for differential diagnosis. Content organization We present MRI images of uncommon breast tumors (mucinous carcinoma, neuroendocrine tumors, invasive micropapillary carcinoma, apocrine carcinoma, metaplastic carcinoma, sebaceous carcinoma) and examined radiological findings as compared with pathological features. Summary Uncommon types of breast carcinoma are not seen very frequently, but their radiological features often overlap. Thus, it is necessary to have a sufficient understanding of the radiological findings of each tumor.

BRE013-b

Prevalent Round Interval Breast Cancers: Radiological and Pathological Characteristics

Participants

Rebecca Geach BMBCh, BSC (Presenter): Nothing to Disclose
Elisabeth Kutt FRCR : Nothing to Disclose
Alexandra M. Valencia MD, FRCR : Nothing to Disclose

TEACHING POINTS

1) Review the radiological findings of our interval breast cancers at the time of screening and diagnosis for women in their first (prevalent) screening round. 2) Review the histopathological subtypes/grade of our interval cancers and correlation with radiographic findings including both mammography/ultrasound/MRI. 3) Present our interval data with regard to learning points for cancers that were deemed to either have minimal signs or suspicious abnormalities on their screening mammograms that were not reported.

TABLE OF CONTENTS/OUTLINE

Description of current UK NHS breast screening programme (NHSBSP)/definition of prevalent interval breast cancers Presentation of 71 interval cancers in our institution between 2005 and 2009 including: - Interval year of diagnosis -- Radiological findings at diagnosis on mammography/ultrasound/MRI - Histopathological review of interval cancers - MRI/ultrasound findings in mammographically occult interval cancers - Pictorial review of our interval cancers that had minimal signs/suspicious lesions on screening mammography that were not reported by two independent readers: a learning experience
BRE014-b
Various Different Looks of Fat Necrosis of the Breast: Spectrum of Imaging Findings at Multi-imaging Modalities

Education Exhibits
Location: BR Community, Learning Center

Participants
Jin Hee Moon MD (Presenter): Nothing to Disclose
Joo Yeon Chung MD : Nothing to Disclose
Kyoonsoo Jung : Nothing to Disclose

TEACHING POINTS
Fat necrosis is a common benign entity that may pose a challenge to clinicians and breast radiologists. Radiologists should become familiar with various different looks of fat necrosis to avoid unnecessary biopsies. The purpose of this exhibit is to review imaging findings of fat necrosis of the breast at multi-imaging modalities, including mammography, ultrasound, MR imaging, CT and PET/CT.

TABLE OF CONTENTS/OUTLINE
1. Clinical features of fat necrosis: Many clinical factors to the cause of fat necrosis and patient’s symptoms 2. Pathologic findings: Understanding the etiology and pathogenesis of fat necrosis 3. Imaging findings 1) Mammography: variable mammographic presentation and alteration of fat necrosis 2) Ultrasound and MRI: variable sonographic and MR imaging appearances and its correlation with mammography 3) PET/CT: variable looks of fat necrosis as incidental findings and its correlation with other breast imaging 4. Conclusion: There is a wide range of manifestations of fat necrosis from typically benign to worrisome for malignancy. To understand the etiology, pathogenesis and to familiar with imaging appearances of fat necrosis can help radiologists to avoid unnecessary biopsies.

BRE016-b
"All that Glisters is not Gold"... or Cancer: Discriminating among Positive Findings in PEM (Positron Emission Mammography)

Education Exhibits
Location: BR Community, Learning Center

Participants
Mariana Barbara Jimenez Bernal MD (Presenter): Nothing to Disclose
Maria Lara MD : Nothing to Disclose
Mary Carmen Herrera-Zarza MD : Nothing to Disclose
Regina De La Mora Cervantes MD : Nothing to Disclose
Luis Alberto Ruiz Elizondo MD : Nothing to Disclose
Gisela Estrada MD : Nothing to Disclose
Jose Luis Criales Cortes MD : Nothing to Disclose

TEACHING POINTS
1. Understand the basic principles of PEM. 2. Describe the differences between PEM and PET. 3. Clinical indications for PEM. 4. Depict variants of 18 FDG uptake and it’s histopathologic correlation, as wellasto describe the spectrum of imaging findings of diverse breast pathological entities. (Staging detection of breast cancer is crucial for an effective treatment. PEM provides complementary information to mammography being a functional noninvasive imaging method with a higher spatial resolution detecting lesions measuring less than 2 mm. We demonstrate illustrative diverse cases with mammography correlation).

TABLE OF CONTENTS/OUTLINE
1. Basic principles of PEM using 18 FDG. 2. Advantages of PEM vs PET 3. PEM indications 4. Spectrum of imaging findings and their correlation with mammography. -The great mimics: Mastitis, fat necrosis, post-surgical changes. -Analysis of illustrative cases according to the 18 FDG uptake levels. -PEM utility as an emerging new tool for breast imaging and it’s impact on therapeutic decisions.

BRE017-b
Imaging War on Breast Cancer Goes Nuclear... Positron Emission Mammography: A Conscientious Approach for an Emerging Diagnostic Weapon

Education Exhibits
Location: BR Community, Learning Center

Participants
Luis Azpeitia MD (Presenter): Nothing to Disclose
Gisela Estrada MD : Nothing to Disclose
Mariana Barbara Jimenez Bernal MD : Nothing to Disclose
Daniela Angulo Salazar MD : Nothing to Disclose
Luis Alberto Ruiz Elizondo MD : Nothing to Disclose
Mary Carmen Herrera-Zarza MD : Nothing to Disclose
Regina De La Mora Cervantes MD : Nothing to Disclose
Jose Luis Criales Cortes MD : Nothing to Disclose
Maria Lara MD : Nothing to Disclose

TEACHING POINTS
Breast cancer remains the most prevalent in women of developed countries. Although mammography is the gold standard system for breast cancer surveillance it isn’t a infallible method and we must continue improving our imaging screening and staging techniques. Devices that could more precisely map the extent of invasive and noninvasive disease would lead to more accurate actions. Positron Emission Mammography is an emerging molecular technology that provides high-resolution images
of hypermetabolic lesions in the breasts merging both morphological and functional features with remarkable sensitivity, specificity and accuracy. The purpose of this exhibit is: 1-Getting the PEM to be considered as a truly powerful adjunct to conventional breast imaging and to promote its usage. 2-To make clear the advantages, disadvantages, indications and contraindications in PEM imaging. 3-To identify and interpret the PEM imaging findings using the proposed lexicon and classification in order to achieve consistent, standardized reporting and management.

TABLE OF CONTENTS/OUTLINE

BRE018-b
Practical Assessment of Positron Emission Mammography (PEM) Descriptors: Radiologist Perspective

Education Exhibits
Location: BR Community, Learning Center

Participants
Jorge Andres Abreu MD : Nothing to Disclose
GLORIA PALAZUELOS : Nothing to Disclose
Juliana Ocampo MD (Presenter): Nothing to Disclose
Carolina Rumie Valois : Nothing to Disclose
Andres Vasquez MD : Nothing to Disclose
Javier Andres Romero MD : Nothing to Disclose

TEACHING POINTS
To study and evaluate the impact of new imaging technologies, as Positron Emission Mammography PEM, in the diagnosis and management of common diseases of breast. To review the utility of PEM in the study of patients with high suspicion of malignancy in mammography and ultrasound (BI-RADS categories 4c and 5). To explain the application of the descriptors in PEM studies To identify the characteristics of breast lesions detected by PEM: Size, Uptake and localization.

TABLE OF CONTENTS/OUTLINE
Explain the use of descriptors in cases of PEM at our institution, compared with findings in Ultrasound and mammography. Explain an easy and correct way to interpret a PEM.

BRE019-b
Establishing a Radioactive Seed Localization Program

Education Exhibits
Location: BR Community, Learning Center

Certificate of Merit

Participants
Michele Beth Drotman MD : Nothing to Disclose
Anna Starikov BS (Presenter): Nothing to Disclose
Janine T. Katzen MD : Nothing to Disclose
Timothy D'Alfonso MD : Nothing to Disclose
Allison Dana Levy MD : Nothing to Disclose

TEACHING POINTS
Discuss the advantages of radioactive seed localization over the traditional needle localization for pre-operative patients Outline the steps to establishing such a program and solutions that can ease the transition to this relatively new technique

TABLE OF CONTENTS/OUTLINE
Radioactive seed localization is an alternative to needle localization of breast lesions both of which serve as a guide to assist the surgeon in the operating room. Seed localizations offer the advantages of flexibility of scheduling and patient comfort. The initial step is organizing a multidisciplinary approach involving the breast surgeons, pathologists and radiologists. Next, a safety protocol must be in place including radiation safety and handling of the radioactive I-125 seeds. Finally, the program can be instituted once all of the medical specialties and associated staff have had the proper training and certification. Establishing such a program involves many steps but has the potential to improve quality of patient care.

BRE020-b
Intraductal Papilloma: Accuracy of Needle Biopsy

Education Exhibits
Location: BR Community, Learning Center

Participants
Andre Queiroz de Morais (Presenter): Nothing to Disclose
Marcelo Menezes Medeiros : Nothing to Disclose
Juliana Alves Souza : Nothing to Disclose
Luciana Karla Lira Franca : Nothing to Disclose
Almir Bitencourt MD : Nothing to Disclose
Luciana Graziano MD : Nothing to Disclose
Camila Guatelli : Nothing to Disclose
Elvira Ferreira Marques : Nothing to Disclose

TEACHING POINTS
- Intraductal Papilloma presents with a wide spectre of lesions, varying from benign to atypical papillomas until invasive
papillary carcinoma. Due to morphological resemblance between the papillary lesions, the interpretation and the histological differentiation are difficult. Biopsies with inadequate material increase the underestimation rate. Objective: a literature review, evaluating the accuracy of the percutaneous needle biopsy for papillary lesions, identifying the underestimation rate and the radiological malignity signs. Some clinical and radiological aspects are useful to predict the chances of malignancy associated with papillary lesions: BIRADS® classification (underestimation rate around 25% for 4C or 5 category), patients older than 50 years old, lesion size above 1.5 cm and more than 3 cm of distance to the breast nipple. The majority of studies suggests a surgical excision for atypical papillomas. Regarding the intraductal papillomas without atypia, there are controversies on its management, however, the concordance between the radiological and histopathological findings can make the imaging follow-up a possible choice.

TABLE OF CONTENTS/OUTLINE

- Breast papillary lesions
- Diagnosis
- Treatment
- Follow-up
- Management
- Percutaneous needle biopsy
- Histopathological-Imaging correlations
- Safe follow-up

BRE101

Breast Imaging Findings Related to Interventions: Complications, Recurrences, and Rare Findings

Education Exhibits
Location: BR Community, Learning Center
Cum Laude

Participants

- Eren D. Yeh MD (Presenter): Nothing to Disclose
- Elisabeth P. Frost MD: Nothing to Disclose
- Catherine Streeter Giess MD: Nothing to Disclose
- Sughra Raza MD: Consultant, Seno Medical Instruments, Inc
- Robyn L. Birdwell MD: Nothing to Disclose

TEACHING POINTS

1. Radiologists should be aware of potential pitfalls during procedures. 2. Radiologists should be familiar with usual and unusual patterns of recurrence following treatment for breast cancer. 3. Radiologists should be familiar with rare and unusual clinical presentations following breast interventions.

TABLE OF CONTENTS/OUTLINE

- Using a case based review format, we will present and discuss examples from our teaching files of problematic imaging findings related to breast interventions. Cases to be presented will include examples of errors of technique and interpretation at wire localization, and core biopsy under mammographic, sonographic, and MRI guidance, as well as cases of unusual and rare findings following breast surgery and treatment for breast cancer.

BRE102

Breast Magnetic Resonance: A Useful Tool for Marking Tumors Previous to Conservative Surgery

Education Exhibits
Location: BR Community, Learning Center

Participants

- Vicente Martinez De Vega MD (Presenter): Nothing to Disclose
- Susana Linares Gonzalez MD: Nothing to Disclose
- Janeth Heralia Oyola Tovar MD: Nothing to Disclose
- Diana Carina Mollinedo MD: Nothing to Disclose
- Leire Alvarez Perez BMedSc: Nothing to Disclose
- Miguel Chiva De Agustin: Nothing to Disclose
- Manuel Recio Rodriguez: Nothing to Disclose

TEACHING POINTS

1. MRI is a useful technique for localizing preoperatively breast cancers that are not visualized with ultrasound or mammogram. 2. Titanium hook wires guided with MRI can be used to mark single or multiple tumors or to localise the anterior and posterior margins of a large tumor. 3. Marking lesions, displayed only with MRI, by injecting radiotracer 99mTc-nanocolloid guided with MRI (MR ROLL technique) can be used to localise the sentinel lymph node (SNOLL technique). 4. Interventional procedures guided with MRI are very useful techniques to mark breast tumors. This techniques are accurate, sure and fast.

TABLE OF CONTENTS/OUTLINE

Breast MRI is more sensitive for detecting breast cancer than mammography and ultrasound. There are breast cancers that are only detected by MRI. Histological diagnosis is made by MRI-guided vacuum assisted biopsy. To perform conservative surgery, it is necessary to mark the lesion with a hook wire guided by mammography (over a titanium marker placed after the MR biopsy) or guided with MRI directly (more accurate). Another method is marking the tumor by injection of a nanocolloid radiotracer guided with MRI (ROLL-SNOLL technique). 1. General description of interventional procedures guided with breast MRI used for presurgical marking of breast tumors (titanium hook wires or MRI ROLL technique) 2. Indications 3. Results 4. Advantages
Breast Model for Teaching the Needle Localization Procedure

**Education Exhibits**

**Location:** BR Community, Learning Center

**Participants**
- Neil Thayil MD (Presenter): Nothing to Disclose
- Jeffrey Brooks MD: Nothing to Disclose

**PURPOSE**

With regards to mammographic needle localization procedures, it is felt that speed and accuracy are of the essence to have a successful procedure and to minimize the degree of pain/discomfort experienced by the patient. Since acquisition of these procedural skills requires hands-on experience and since it is not ideal for any inexperienced resident to practice such procedures on patients, it is strongly believed that a well constructed breast simulation model can serve as an important educational tool to help residents attain the skills necessary to perform these procedures in an efficient and competent manner while limiting possible harm/discomfort to patients.

**METHOD AND MATERIALS**

To simulate the breast, we purchased turkey products and injected them with a suspension of crushed egg-shells to mimic breast calcifications. A curriculum was provided to the senior residents at our institution. This included a powerpoint lecture that was aimed at providing information pertaining to adequate procedural pre-planning as well as step-by-step instructions on how to skillfully execute a mammographic needle localization procedure. The residents then received hands-on experience by practicing needle localization procedures with the created breast simulation models. The residents also completed pre and post surveys that were used to assess their experience with regards to the effectiveness of the curriculum and their overall comfort levels with performing mammographic needle localization procedures.

**RESULTS**

Evaluation of pre and post surveys is currently underway, but initial analysis reveals that the residents overwhelmingly considered their experience with the breast simulation models to be very educationally useful. In particular, early analysis indicates that after completing the curriculum, the majority of residents reported an increase in their overall confidence level in being able perform accurate needle localizations.

**CONCLUSION**

Breast simulation models are useful educational tools that, when used effectively, can allow residents to become comfortable and skilled with mammographic needle localization procedures before performing them on patients.

**CLINICAL RELEVANCE/APPLICATION**

Models for procedures are important so physicians can gain experience and confidence. Development of a model for teaching needle localization procedures will benefit both patients and doctors.

Challenges, Precautions and Mishaps in Breast MRI Procedures and Outcomes: Strategies to Optimize Success

**Education Exhibits**

**Location:** BR Community, Learning Center

**Certificate of Merit**

**Participants**
- Sona Ajit Chikarmane MD (Presenter): Nothing to Disclose
- Catherine Streeto Giess MD: Nothing to Disclose
- Robyn L. Birdwell MD: Nothing to Disclose

**TEACHING POINTS**

MRI-guided breast procedures are a safe and increasingly routine method for evaluating suspicious MRI-detected breast lesions. Despite this, MRI-guided procedures can be challenging, with relatively high biopsy cancellation rates ranging from 8-17%. Our objective is to 1) review problematic factors in breast MRI procedures and 2) provide strategies for optimizing success and subsequent lesion management.

**TABLE OF CONTENTS/OUTLINE**

1) Provide a brief review of breast MRI procedure indications and technical considerations, including set-up strategies (i.e. positioning, grid pressure) 2) Discuss optimizing timing of breast MRI procedures to minimize potential hormonal influences, particularly in pre-menopausal women 3) Address reasons for and strategies to prevent procedure cancellations 4) Demonstrate challenging lesion locations, particularly posterior and medial lesions, and discuss the role of supplemental tools for biopsy (i.e. use of targeted ultrasound and mammography localization after clip placement with MRI guidance rather than MRI core biopsy) 5) Review the importance of pathology correlation (no specimen, discordant or non-specific results) and follow-up strategies of benign biopsies (six-month follow-up and when to re-biopsy or surgically excise) 6) Display challenging cases and review potential mishaps, strategies for success, and management

Decision Making Strategies to Recommend MRI Biopsy. Will You Biopsy this Lesion? Yes or No? A Radiology-Pathology Correlation
**BRE106**

**Hello Old Friend, What's New? Revisiting Fibroadenomas and Emerging Management Options**

**Education Exhibits**

**Location: BR Community, Learning Center**

**Participants**

- Melissa Marie Joines MD (Presenter): Nothing to Disclose
- Stephanie Anne Lee-Felker MD: Nothing to Disclose
- Simin Bahrami MD: Nothing to Disclose

**TEACHING POINTS**

- The purpose of this exhibit is: 1. To review the spectrum of multimodality imaging characteristics of breast fibroadenomas. 2. To highlight patient and clinical factors in addition to imaging characteristics with a specific emphasis on treatment implications. 3. The indications and selection criteria for cryoablation of breast fibroadenomas.

**TABLE OF CONTENTS/OUTLINE**

1. Overview of fibroadenomas including pathology
2. Comprehensive review of breast fibroadenoma imaging characteristics on Mammography, Ultrasound, and MRI
3. Review of fibroadenoma mimics
4. Delineation of patient and clinical factors relevant to the management of breast fibroadenomas, including patient risk factors, patient preference, and physical exam findings
5. Brief overview of treatment options for breast fibroadenomas such as conservative management/imaging follow-up, surgical resection, and breast cryoablation
6. Overview of ultrasound guided cryoablation technique

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**BRE111**

**Real-time Virtual Sonography-guided Vacuum-assisted Breast Biopsy for Lesions Initially Detected with Breast MRI; Why and How to Do It**

**Education Exhibits**

**Location: BR Community, Learning Center**

**Participants**

- Takayoshi Uematsu MD, PhD (Presenter): Nothing to Disclose
- Shogo Nakano: Nothing to Disclose

**TEACHING POINTS**

- The purpose of this educational exhibit is to describe the principles of and useful tips for identifying and correlating lesions initially detected with breast MRI when performing real-time virtual sonography (RVS)-guided vacuum-assisted breast biopsy. We discuss and illustrate RVS-guided vacuum-assisted breast biopsy techniques, indications for the procedure, technical considerations, and associated complications.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction
2. Review of MRI-directed (second-look) ultrasound examination for lesions initially detected with breast MRI
3. RVS technique for MRI-sonography correlation
4. RVS-guided vacuum-assisted breast biopsy procedure
5. Discussion
6. Summary

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**BRE112**

**Redefining Radiologic Breast Localization with Radioactive Seeds**

**Education Exhibits**

**Location: BR Community, Learning Center**

**Participants**

- Sara Ann Majewski MD (Presenter): Nothing to Disclose
- Prasanna R. Kumar MBBS, MD: Nothing to Disclose
TEACHING POINTS

To describe the technique of preoperative imaging-guided radioactive seed localization of the breast, present advantages of radioactive seed localization and highlight distinct features of radioactive seeds in comparison to conventional needle localization.

TABLE OF CONTENTS/OUTLINE

A. Explain Radioactive Seed Localization Technique B. Review Indications and Contraindications C. Present Advantages and Disadvantages of Radioactive Seed Localization Compared to Conventional Needle Localization D. Show Examples E. Present Potential Pitfalls

BRE113

Step-by-Step: Planning a Needle Localization Procedure

Education Exhibits

Location: BR Community, Learning Center

Participants

Megan Jenkins Kalambo MD (Presenter): Nothing to Disclose
Basak Erguvan Dogan MD: Nothing to Disclose
Lumarie Santiago MD: Nothing to Disclose
Sarah DeSnyder MD: Nothing to Disclose
Michael Gilcrease MD, PhD: Nothing to Disclose
Gary J. Whitman MD: Nothing to Disclose

TEACHING POINTS

1. Lesion size, type and configuration play an important role in localization planning. 2. Localization of lesions with associated calcifications need to be performed under mammographic guidance, non-calcified single masses can be localized with ultrasound using a single wire. 3. Post-neoadjuvant therapy, the footprint of residual disease must be localized. 4. Localization of intraductal lesions: galactography and methylene blue injection followed by needle localization ensures excision of entire ductal system.

TABLE OF CONTENTS/OUTLINE

This exhibit will review steps involved in planning successful image-guided preoperative needle localization. Case-based review will include: 1. Planning Stage: Determining approach, number and type of needles, need for bracketing or localization of the targeted lesion, by illustrating various lesion types and challenging lesions. 2. Procedure Stage: review of patient positioning, imaging steps and preoperative communication with the surgeon. MRI, ductogram and Tomosynthesis-guided localization. 3. Post-procedure Stage: specimen radiography in assessing successful excision, margin status and the need to obtain additional tissue. 4. Illustration of potential complications, including wire migration, fractured wire, clip migration during localization with management suggestions.

BRE114

The Cosmetically Altered Breast: Review of Surgical Techniques and Benign Radiological Findings to Aid in Interpretation of Mammography

Education Exhibits

Location: BR Community, Learning Center

Participants

Lane M. Roland MD: Nothing to Disclose
Mohammed Imran Quraishi MD (Presenter): Nothing to Disclose
Donald R. Herdt MD: Nothing to Disclose
Nana Mizuguchi MD: Nothing to Disclose
Sarah Greer Mizuguchi MD: Nothing to Disclose
Elizabeth Riley MD: Speakers Bureau, Amgen Inc Speakers Bureau, F. Hoffmann-La Roche Ltd

TEACHING POINTS

As elective cosmetic breast procedures are among the most commonly performed procedures in the United States, we will review the spectrum of imaging findings to familiarize the radiologist interpreting mammograms. 1. Review surgical techniques and how they translate into findings seen on mammography 2. Review normal and benign imaging findings seen in the cosmetically altered breast 3. Understand when additional imaging may be indicated

TABLE OF CONTENTS/OUTLINE

1. Diversity of surgical techniques seen with elective cosmetic breast surgery: *augmentation *expplantation *reduction mammoplasty *mastopexy *free silicone 2. Spectrum of findings encountered when imaging the cosmetically altered breast: Review the range of normal appearance and benign findings with sample cases 3. When additional adjunctive breast imaging may be indicated for a cosmetic breast patient Review the current FDA recommendations for patients with silicone breast implants

BRE115

The In's and Out's of Ductography: A Quiz-based Review for Residents (and All Radiologists!)

Education Exhibits

Location: BR Community, Learning Center

Certificate of Merit

Participants

Laura Suzanne Sheiman MD (Presenter): Nothing to Disclose
Laura Suzanne Sheiman MD (Presenter): Nothing to Disclose
Paul H. Levesque MD: Nothing to Disclose

TEACHING POINTS

Although the ductogram provides valuable information, there is much confusion about the indications for the exam and how it is performed. As ductograms do not occur frequently at our institution, many residents lack a familiarity with the procedure. This exhibit is intended to review the indications, technique and potential imaging findings of ductography with multiple case examples.

TABLE OF CONTENTS/OUTLINE

The exhibit will be presented in quiz format. Quiz content will include: - Indications for ductography - Technique (with tips and tricks of an experienced radiologist) - Potential imaging findings - Further management

BRE116

Therapeutic Application of Ultrasound Guided Vacuum Irrigation and Drainage In Challenging Abscesses and Seromas

Education Exhibits

Location: BR Community, Learning Center

Participants

William Wei Lian Teh MBChB, FRCP: Speaker, Hologic, Inc Speaker, Devicor Medical Products, Inc
Sophie Harriet Pattison MBChB, FRCP (Presenter): Nothing to Disclose
Mia Morgan MBBS, FRCP: Nothing to Disclose

TEACHING POINTS

The current gold standard for the treatment of breast abscesses is for percutaneous aspiration repeated as clinically necessary. If this method fails then formal surgical incision and drainage may be required. This may result in cosmetic morbidity and also requires the general sequelae of an operation i.e. general anesthetic, and hospitalisation. Following surgery for breast cancer, patients can develop haematomas or loculated seromas that do not resolve with simple aspiration. This can delay post operative radiotherapy. In order to avoid surgical incision and drainage for these two categories, we have been successfully performing ultrasound guided vacuum irrigation and drainages at our institution.

TABLE OF CONTENTS/OUTLINE

Introduction Technique Figure 1: Vacuum biopsy introduced into abscess following local anaesthetic administration. Figure 2: Device in use: US image of the sampling notch in septations of abscess Figure 3: A large septated postsurgical seroma. Conventional drainage was hindered by the thick fibrous septae and viscous content. Figure 4.: Utilising the biopsy function, the septae were divided. A saline washout through the vacuum bore followed by suction permitted irrigation and drainage of the contents. Figure 5: A small residual fibrous cavity remained. Video Experience Conclusion

BRE118

Tomosynthesis-guided Breast Biopsy: Nuts and Bolts

Education Exhibits

Location: BR Community, Learning Center

Participants

Monica Liwen Huang MD (Presenter): Nothing to Disclose
Beatriz E. Adrada MD: Nothing to Disclose
Marion Elizabeth Scoggins MD: Nothing to Disclose
Deanna Lynn Lane MD: Nothing to Disclose
Basak Erguvan Dogan MD: Nothing to Disclose

TEACHING POINTS

1) With increasing implementation of digital breast tomosynthesis (DBT) and detection of mammographically and sonographically occult tomosynthesis lesions, tomosynthesis-guided breast biopsy is now a necessity. 2) A tomosynthesis-identified suspicious breast lesion should undergo targeted breast ultrasound for ultrasound-guided biopsy if possible, with clip placement within the lesion and post-biopsy tomosynthesis confirmation. 3) Principles of tomosynthesis-guided breast biopsy and stereotactic biopsy share similarities but have many differences. 4) With detailed planning and creativity, tomosynthesis-guided biopsy without dedicated tomosynthesis guidance software may be performed when the basic principles of tomosynthesis-guided biopsy are understood.

TABLE OF CONTENTS/OUTLINE

1) Basic principles of digital breast tomosynthesis. 2) Principles of tomosynthesis-guided breast biopsy. 3) Equipment and software necessary to perform tomosynthesis-guided breast biopsy. 4) Indications and breast lesion selection process for tomosynthesis-guided biopsy. 5) Step by step instructions in performing a tomosynthesis-guided breast biopsy with tomosynthesis-guidance software. 6) Alternative tomosynthesis guided biopsy methods utilized or may be attempted to obtain tissue diagnosis in the absence of tomosynthesis guidance software.

BRE119

All You Have to Know about Imaging of Male Breast Diseases

Education Exhibits

Location: BR Community, Learning Center

Participants

SILVIA LLIVERIAS BORRELL (Presenter): Nothing to Disclose
Jaime Isern MD: Nothing to Disclose
Ana Maria Martinez Jimenez: Nothing to Disclose
Maria Jose Conde Martinez: Nothing to Disclose
TEACHING POINTS

1) To describe and illustrate radiological features of breast male diseases. 2) To learn about the differential diagnosis and diagnostic difficulties. 3) To correlate the imaging with histology of benign and malignant lesions. 4) To discuss the appropriate clinical management.

TABLE OF CONTENTS/OUTLINE

It is important for radiologists to understand the appearances of both benign and malignant male breast lesions. We will present a pictoral essay of our experience, including clinical and imaging findings (mammograms, US and CT) with pathologic correlation. 1) We first review the normal anatomy of male breast. 2) The list of cases includes: Benign conditions: Pseudogynecomastia, Gynecomastia (glandular, dendritic and nodular pattern), Diabetic Fibrous Mastopathy; Epidermoid Cyst Inclusion; Myofibroblastoma; Mastitis: Mondor’s disease; Lipoma and Fibroadenolipoma. Malignant lesions: Ductal Carcinomas, Papillary Carcinoma and costal Chondrosarcoma (detected on mammogram). Finally we show an unusual anatomical variant corresponding to the Sternalis muscle which can induce to errors on mammograms 3) Summary of main points to remember. 3) At the end of the exhibit the viewer will be familiarized with the diagnosis of male breast disorders.

BRE121

Architectural Distortion Revisited: Benign and Malignant Etiologies Unmasked by Tomosynthesis

Education Exhibits

Location: BR Community, Learning Center

Participants

Amado B. Del Rosario DO (Presenter): Nothing to Disclose
Cathleen P. Hendershot MD: Nothing to Disclose
Gary Tozbikian MD: Nothing to Disclose
Jeffrey Robert Hawley MD: Nothing to Disclose
Mitva J. Patel MD: Nothing to Disclose
Adele Lipari DO: Nothing to Disclose
Selin Carkaci MD: Consultant, Hologic, Inc

TEACHING POINTS

1. Review the causes of architectural distortion (AD)
2. Review the multimodality imaging features of AD
3. Demonstrate how AD can present subtly and be detected accurately by tomosynthesis for biopsy purposes
4. Provide histopathological correlation
5. Determine appropriate management and follow-up

TABLE OF CONTENTS/OUTLINE

1. Architectural Distortion (AD) background including, but not limited to radial scar, LCIS, papilloma, dense stromal fibrosis, and DCIS
2. Multimodality imaging review of AD
3. Role of tomosynthesis and tomosynthesis guided biopsy
4. Pathophysiology of uncommon lesions causing AD
5. Radiological-Pathological Concordance for appropriate management and follow-up 6. Summary

BRE122

BI-RADS 5th Ed: Asymmetries Decoded

Education Exhibits

Location: BR Community, Learning Center

Certificate of Merit

Participants

Geraldine Kang: Nothing to Disclose
Ifeanyi C. Onyeacholem MD: Nothing to Disclose
Joanne Shimogaki Bae: Nothing to Disclose
Youn Jeong Kim MD: Nothing to Disclose
Jade De Guzman MD: Nothing to Disclose
Haydee Ojeda-Fournier MD (Presenter): Nothing to Disclose

TEACHING POINTS

Mammographic asymmetries may represent a spectrum of benign to malignant lesions. There has been a refinement in the asymmetry lexicon nomenclature over the last several editions of the BI-RADS manual, including a new term in the 5th Ed of BI-RADS. It is important for the radiologist involved in breast imaging to understand what these terms mean and how to manage the findings related to mammographic asymmetries. At the end of this educational exhibit the learner will: Define the meaning of asymmetries; Provide imaging examples for each of the asymmetry descriptors; Present an algorithm for the management of mammographic asymmetries; Self assessment with image case review and questions in multiple choice format.

TABLE OF CONTENTS/OUTLINE

Introduction; Historical perspective; Definitions: Asymmetry, Global asymmetry, Focal Asymmetry, Developing asymmetry;
**BRE123**

**Breast Tomosynthesis Screening: A Pictorial Review of Benign and Malignant Pathology**

*Education Exhibits*

Location: BR Community, Learning Center

Certificate of Merit

**Participants**

Abraham Hyeon Jeon MD (Presenter): Consultant, Hologic, Inc

**TEACHING POINTS**

The aim of this pictorial review is to provide an overview of digital breast tomosynthesis in the screening population. 1. The learner should be able identify and confidently diagnosis benign pathology on screening breast tomosynthesis without need for additional imaging. 2. The learner should be able to recognize suspicious and malignant features on screening breast tomosynthesis and how to tailor a more focal diagnostic workup based on tomosynthesis findings (e.g., additional mammographic imaging versus breast ultrasound). 3. A brief overview of implementation of digital breast tomosynthesis in the screening setting will be presented.

**TABLE OF CONTENTS/OUTLINE**

Overview of Digital Breast Tomosynthesis (DBT) technology and clinical data
- Bening masses seen on DBT
- Benign calcifications seen on DBT
- Malignant pathology seen on DBT
- Implementation of DBT in the Screening population
- Future developments in DBT and summary

**BRE124**

**Can You Detect It? Missed Breast Cancers in Breast Imaging**

*Education Exhibits*

Location: BR Community, Learning Center

Magna Cum Laude

**Participants**

Anubha Wadhwa MD (Presenter): Nothing to Disclose
Mary Beth Gonyo MD: Nothing to Disclose

**TEACHING POINTS**

The main causes of missed cancers on mammography are dense breasts, subtle asymmetries, slow developing densities and poor positioning or technique. False negative ultrasound may be related to detection errors or interpretation errors, especially with isoechic masses, nearly circumscribed masses or subtle areas of architectural distortion. This is a quiz based presentation reviewing cases of missed breast cancer on mammography and ultrasound and understanding radiologic pathologic correlation.

1. Old comparison mammograms are our best friend in mammography. Comparison with at least two or three prior mammograms is necessary, especially to identify subtle changes and developing densities.
2. Isoechoic masses and subtle areas may be missed on ultrasound if proper ultrasound parameters are not used and adjusted during the exam.
3. It is important to have a good quality control program and a good audit system in every breast imaging section.

**TABLE OF CONTENTS/OUTLINE**

1. Quiz based presentation of various causes of undetected cancers on mammography and identification of learning points from each case.
2. Cases of missed cancers on ultrasound. Understanding mammographic-sonographic correlation and correlation of ultrasound with clinical findings.

**BRE125**

**Contrast Enhanced Spectral Mammography (CESM) - Indications, Protocol, Interpretation and Pitfalls**

*Education Exhibits*

Location: BR Community, Learning Center

**Participants**

Lydia Liao MD, PhD (Presenter): Nothing to Disclose
Luna Li MD, PhD: Nothing to Disclose
Pauline Germaine DO: Nothing to Disclose
Elizabeth Tinney RRA: Nothing to Disclose

**TEACHING POINTS**

CESM is a new FDA approved diagnostic study using CT contrast to detect breast cancer by providing morphologic and functional information detecting abnormal anatomic structures and angiogenesis. CESM has a shorter test time, an increased accessibility and is relatively inexpensive when compared to breast MRI. Our institution is one of the first few centers in the country acquired CESM and we have done more than 1,000 exams including 100 cases of tissue diagnosis proven breast cancer from the end 2012 to present. The focus of this presentation is to discuss CESM mechanism, indications of the protocol, pitfalls including artifacts. The illustration cases in cooperating with history, other imaging study findings and tissue diagnosis focus on the morphology and the enhancement characteristics of both malignant and benign lesions on CESM.
CESM is one of the contrast studies and provides both morphologic and functional information of breast lesions. Malignant lesions demonstrate most medium to strong enhancement with morphologic characteristics that could be distinguished from benign lesions. CESM sometime pick up abnormal enhancing lesions even though regular digital mammography and ultrasound are negative. CESM has some unique artifacts. The most common artifacts are breast-within-breast, halo, and ripple artifact.

**BRE126**

**Cracking the Cluster Conundrum: Practical Applications of Digital Breast Tomosynthesis in the Characterization of Breast Calcifications**

*Education Exhibits*

*Location: BR Community, Learning Center*

**Participants**

Danea Johnette Campbell MD (Presenter): Nothing to disclose
James Henderson MD: Nothing to disclose
Hilda Theresa Tejero MD: Nothing to disclose
Monica M. Yepes MD: Nothing to disclose
Geetika Klevos MD: Nothing to disclose
Fernando Collado-Mesa MD: Nothing to disclose
Jorge Andres Infante Mendez MD: Nothing to disclose
Jose Miguel Net MD: Nothing to disclose

**TEACHING POINTS**

Digital breast tomosynthesis (DBT) has been shown to improve detection and characterization of breast lesions that would otherwise be obscured on full field digital mammography (FFDM) leading to decreased recall rates. Despite these advantages, DBT falls behind FFDM in the detection of calcifications. However, DBT can be useful in accurately characterizing calcifications when seen. The goal of this educational exhibit is to show: 1. DBT can be used effectively in the characterization of breast calcifications. 2. Dermal calcifications can be confirmed by evaluating the 'bookend' slabs. 3. DBT can elucidate additional diagnostic features of the calcifications not readily apparent on full field mammography, for example DBT is useful in demonstrating scattered calcifications which appear clustered on FFDM. 4. DBT may result in reduced need for additional images after screening mammography, thereby reducing diagnostic mammograms and additional radiation.

**BRE127**

**Dense Breasts: More than Cancer Camouflage**

*Education Exhibits*

*Location: BR Community, Learning Center*

**Participants**

Clayton R. Taylor MD (Presenter): Nothing to disclose
Mitva J. Patel MD: Nothing to disclose
Selin Carkaci MD: Consultant, Hologic, Inc

**TEACHING POINTS**

- Classification and multimodality evaluation of breast density
- Implications of breast density for screening mammography
- Increased relative risk of malignancy seen with dense breasts
- Current state laws governing breast density reporting and their implications
-Supplemental screening, including whole breast screening ultrasound and MRI

**TABLE OF CONTENTS/OUTLINE**

- Brief discussion of history of breast density
- Breast density evaluation with digital mammography, breast tomosynthesis, magnetic resonance imaging and computed tomography
- Updated BI-RADS lexicon for mammographic density and ultrasound tissue composition reporting
- Subjective versus semi-automated and automated breast density evaluation
- Implications of dense breast tissue for screening and breast cancer risk
- State laws regarding breast density reporting and insurance coverage
- Supplemental screening – current and potential future role of ultrasound and MRI

**BRE128**

**Developing Asymmetries on Mammography: A Multi-modality Approach to Assessment and Management**

*Education Exhibits*

*Location: BR Community, Learning Center*

- Selected for RadioGraphics

**Participants**

Allyson Louise Chesebro MD (Presenter): Nothing to disclose
Catherine Streeto Giess MD: Nothing to disclose
Nicole S. Winkler MD: Nothing to disclose
Robyn L. Birdwell MD: Nothing to disclose

**TEACHING POINTS**

The purpose of this exhibit is:

1. To review the BIRADS definitions for mammographic asymmetry (one-view) and focal asymmetry (two view) with...
To review the various etiologies of developing mammographic asymmetries
To outline a protocol for comprehensive diagnostic mammographic evaluation for developing asymmetries
To discuss the role and limitations of correlative ultrasound (US), magnetic resonance imaging (MRI) and digital breast tomosynthesis in the assessment and management of developing asymmetries

TABLE OF CONTENTS/OUTLINE
Review and illustrate the BIRADS definition of mammographic "asymmetry" and "focal asymmetry" Outline the various etiologies of mammographic asymmetries - benign and malignant Discuss the diagnostic work up of developing one or two view asymmetries, including appropriate and inappropriate utilization of targeted breast US, digital breast tomosynthesis, and diagnostic breast MRI in assessment and management Illustrate examples of mammographic developing asymmetries with multi-modality imaging and histopathologic correlation Discuss the potential for delayed diagnosis because of negative correlative US

BRE130
Digital Breast Tomosynthesis Revealed: What You See Only with 3D

Education Exhibits
Location: BR Community, Learning Center

Participants
Dorothy Amy Sippo MD (Presenter): Nothing to Disclose
Anjuli A. Shah MD : Nothing to Disclose
Lisa A. Mullen MD : Nothing to Disclose
Cecilia Margaret Brennecke MD : Nothing to Disclose
Sally D. Hershorn MD : Stockholder, Hologic, Inc Spouse, Stockholder, Hologic, Inc
Ashley Cimino-Mathews MD : Nothing to Disclose
Susan Caroline Harvey MD : Nothing to Disclose

TEACHING POINTS
1) To review how 3D digital breast tomosynthesis (DBT) and subsequent synthesized 2D images are obtained and interpreted.
2) To discuss how 3D DBT and synthesized 2D images can improve screening recall rate and cancer detection rate. 3) To identify changes in diagnostic breast imaging workflow when using 3D DBT and synthesized 2D techniques compared with 2D mammography.

TABLE OF CONTENTS/OUTLINE
3D DBT and 2D synthesized imaging techniques: Overview of image acquisition and interpretation Findings identified with 3D DBT and 2D synthesized imaging not visible with conventional 2D mammography: -Breast cancer: -Invasive ductal carcinoma -Ductal carcinoma in situ -Invasive lobular carcinoma -High risk lesions: -Complex sclerosing lesion -Intraductal papilloma -Benign lesions: -Cyst -Fibroadenoma -Dense stromal fibrosis Ways that 3D DBT reduces screening mammography recall rate: -Demonstration of asymmetries to be summation of normal tissue -Localization of skin lesions, including calcifications -Identification of vascular calcifications Workflow changes in the diagnostic setting with 3D DBT: -Fewer additional views -Improved localization and characterization of masses -Evaluation of extent of disease using 3D DBT for newly diagnosed cancer Summary

BRE131
Digital Breast Tomosynthesis-guided Wire Localization: A Guide to Surgical Excision of Mammographically and Sonographically Occult Lesions

Education Exhibits
Location: BR Community, Learning Center

Participants
Margaret Ann Mays MD (Presenter): Nothing to Disclose
Grace Ingram MD : Nothing to Disclose
Surekha Salil Joshi MD : Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is to: -Discuss method of Digital Breast Tomosynthesis-guided (DBT-guided) wire localization -Demonstrate the utility of DBT-guided wire localizations in mammographically and sonographically occult lesions.

TABLE OF CONTENTS/OUTLINE
1. Review of Digital Breast Tomosynthesis. 2. Description of method used in DBT-guided wire localization. 3. Clinical utility and Indications for Tomosynthesis-guided wire localizations. 4. Discuss two cases of DBT-guided wire localizations performed at our institute with radiologic pathologic correlation. 5. Future directions and summary: With increasing use of 3D imaging, previously occult lesions will be more frequently detected. In such occult suspicious lesions, DBT-guided wire localization could be used to guide surgical excision.

BRE132
Lactational Calcifications on Mammography: An Educational Review

Education Exhibits
Location: BR Community, Learning Center

Participants
Cathleen Clare Heffernan MD : Nothing to Disclose
Elizabeth Victoria Geffen MD (Presenter): Nothing to Disclose
Cecilia Luz Mercado MD : Nothing to Disclose

TEACHING POINTS
As more women delay childbearing, a larger percentage of them are entering the screening population and, as a result,
As more women delay childbearing, a larger percentage of them are entering the screening population and, as a result, mammography is capturing new calcifications that have developed during lactation. We will use cases from our database and outline a variety of appearances of lactational calcifications on mammography to familiarize radiologists with its spectrum of appearances. 1) Lactational calcifications are most commonly diffuse or scattered; occasionally regional or rarely grouped. 2) They can be bilateral or unilateral. If unilateral, we have noted that the calcifications often correlate with the side of dominant milk production. 3) Morphology is most often round or punctate, sometimes rim. Amorphous or coarse heterogeneous is less commonly seen. 4) Management recommendations are usually short interval follow-up.

TABLE OF CONTENTS/OUTLINE
1) Pathophysiology of lactational calcifications. 2) Illustrative cases demonstrating the range of appearances of lactational calcifications. 3) Review of our database citing most common imaging findings including morphology and distribution using the BI-RADS lexicon. 4) Review of management recommendations.

BRE133
Mammographic BIRADS 3 Lesions Upgraded During Imaging Surveillance: Common Errors in Initial/Subsequent Assessment and How to Avoid Them

Education Exhibits
Location: BR Community, Learning Center
Cum Laude
Selected for RadioGraphics

Participants
- Aya Michaels MD (Presenter): Nothing to Disclose
- Catherine Streeter Giess MD : Nothing to Disclose
- Chris Sungwon Chung MD : Nothing to Disclose
- Elisabeth P. Frost MD : Nothing to Disclose
- Robyn L. Birdwell MD : Nothing to Disclose

TEACHING POINTS
1. To review mammographic criteria for probably benign (BIRADS 3) lesions according to the BIRADS lexicon
2. To discuss the complementary but occasionally conflicting roles of mammographic change versus morphology in assessing and managing BIRADS 3 lesions
3. To illustrate challenging clinical situations affecting assessment and management, including lesion location, lack of prior studies, US correlation, and effect of technology on assessment of stability
4. To present a pictorial review of upgraded BIRADS 3 lesions, benign and malignant, with assessment and management lessons

TABLE OF CONTENTS/OUTLINE
1. A brief overview of the mammographic criteria for a probably benign (BIRADS 3) lesion on mammography 2. Discuss the balance between imaging morphology and demonstrable imaging change or increased lesion conspicuity 3. Illustrate the role and limitations of diagnostic US in evaluation of mammographic BIRADS 3 lesions 4. Illustrate benign and malignant cases upgraded from probably benign to suspicious during imaging follow-up that demonstrate important teaching points

BRE134
Noninfectious Inflammatory and Reactive Breast Disorders as Well as Their Mimics: A Spectrum of Diagnostic Imaging Features with Radiologic-Pathologic Correlation and Emphasis on Management

Education Exhibits
Location: BR Community, Learning Center

Participants
- Alena Levit MD (Presenter): Nothing to Disclose
- Rachel Shields MD : Nothing to Disclose
- Avice M. O'Connell MD : Nothing to Disclose

TEACHING POINTS
After completing reviewing this presentation, the reader will be able to:
1. Understand characteristic imaging features of breast abscess and inflammatory breast carcinoma
2. Discuss common radiologic manifestations and the value of different diagnostic procedures of uncommon breast disorders with pathologic correlation, where applicable, that can mimic carcinoma and lead to misdiagnosis
3. Describe the most relevant clinical features, diagnostic work-up, and management of these conditions

TABLE OF CONTENTS/OUTLINE
The content will be organized into groups according to their respective cause. Common breast conditions that may be mimicked by noninfectious inflammatory diseases: breast abscess and inflammatory breast carcinoma Systemic diseases: diabetic mastopathy, sarcoidosis, and amyloidosis Noninfectious inflammatory diseases: idiopathic granulomatous mastitis, fat necrosis, mammary duct ectasia Vascular disorders: Mondor disease A brief discussion of the disease and patient presenting symptoms will be followed by the images from the mammography and ultrasound workup. A discussion of the imaging findings and management, if applicable, will follow. Sections will end with pearls/learning points.

BRE135
Nonmalignant Architectural Distortion Detected only by Tomosynthesis: Imaging Findings, Pathological Correlation and Clinical Significance

Education Exhibits
Location: BR Community, Learning Center
Recognition of nonmalignant architectural distortion imaging findings on Tomosynthesis will help to distinguish benign from subtle malignant architectural distortion and reduce false positive biopsy rate.

TABLE OF CONTENTS/OUTLINE

Tomosynthesis detects both benign and malignant architectural distortion that is occult on 2D mammography. Being familiar with imaging features of benign and malignant architectural distortion can reduce false positive biopsy rate for benign architectural distortion. We demonstrate imaging features of patients with nonmalignant architectural distortion detected on Tomosynthesis (occult on 2D mammogram) and correlate with pathology. Six were radial scar/sclerosing complex lesions and 3 were sclerosing adenosis. Nonmalignant architectural distortion tends to be more symmetrically distributed without central high density and may be stable from prior studies, while malignant architectural distortion tends to be bigger in size, asymmetrically distributed with irregular central high density. The majority of nonmalignant architectural distortions are small in size and difficult to detect or subtle on ultrasound. Distinguishing imaging features between benign and subtle malignant architectural distortion may permit recommendation for 6 month followup rather than biopsy, improving specificity and accuracy of breast cancer screening with tomosynthesis.

BRE136

Optimizing Digital Mammographic Image Quality: Common Artifacts Encountered During the QC Process

Education Exhibits
Location: BR Community, Learning Center
Selected for RadioGraphics
Selected for RadioGraphics

Routine mammographic screening has been shown to reduce mortality from breast cancer by up to 30%. In order to maximize this benefit, close attention to image quality is critical. While quality control processes for analog mammography are well-established, given the increasing utilization of digital units, it is essential that breast specialists be familiar with the steps and the inherent challenges for digital mammography. The purpose of this exhibit is: 1) To review the steps of the quality control process for digital mammography with special attention to artifacts that might be encountered and their potential impact on image quality. 2) To delineate the specific roles of the imaging team in identification and remedy of commonly encountered digital artifacts.

TABLE OF CONTENTS/OUTLINE

The exhibit will be divided into three main components: 1. Artifacts encountered by the technologist or physicist during the routine QC (quality control) process including those related to daily QC (detector non-uniformity, detector cleanliness), weekly QC (flat field test, phantom malfunctions), and monthly QC (AOP and SNR checks). 2. Artifacts encountered by radiologist or technologist during daily workflow, such as defective detector pixels, ghosting and printer calibration. 3. Artifacts related to the patient such as skin ointment, antiperspirant or motion.

BRE137


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

The purpose of this exhibit is to review and compare the common clinical indications for breast MRI in two screening populations: one with digital mammography (DM) and the other with digital breast tomosynthesis (DBT). We will compare utilization rates and pictorially present examples of breast MRI used in the following clinical scenarios: high risk screening, breast cancer staging and problem solving prompted from mammographic findings.

TABLE OF CONTENTS/OUTLINE

1. Discuss the common clinical indications for breast MRI 2. Pictorial review of breast MRI following DBT or DM screening in the following patient categories: a. High risk screening b. Evaluation of abnormal findings c. Extent of disease in newly diagnosed breast cancer 3. Illustrative examples of both concordant and discordant MR and DM or DBT imaging and a comparison of rates of utilization for problem solving and staging MR will be shown from our experience of over 23,000 DBT screening exam as
BRE138

Relationship between Positioning, Radiation Exposure, Imaging Quality and the Effects on Diagnosis for Breast Imaging

Education Exhibits
Location: BR Community, Learning Center

Participants
Jie Zhang PhD (Presenter): Nothing to Disclose
Aurora Yvonne Luna MD: Nothing to Disclose
Margaret M. Szabunio MD: Nothing to Disclose

TEACHING POINTS
1. Learn appropriate breast positioning
2. Understand the effects of varying breast thickness on radiation exposure
3. Understand the effects of compression on image quality
4. Understand potential effects on diagnosis due to breast malpositioning

TABLE OF CONTENTS/OUTLINE
1. Review of correlation between breast positioning and the effect of the compressed breast thickness
2. Review of the effects of varying breast thickness on radiation exposure for various acquisition techniques (e.g., CC, MLO, tomosynthesis)
3. Description of the effects of compression on image quality (e.g., why some subtle tumors are better visualized)
4. Present of clinical cases demonstrating potential effects on diagnosis due to breast malpositioning.

BRE139

Synthesize or Acquire? - Do Synthesized 2D Images from a DBT Data Set Improve Breast Cancer Detection? Benefits and Concerns from the Viewbox

Education Exhibits
Location: BR Community, Learning Center

Participants
Laurie R. Margolies MD (Presenter): Consultant, FUJIFILM Holdings Corporation Consultant, Konica Minolta Group
Janet R. Szabo MD: Consultant, Siemens AG Consultant, FUJIFILM Holdings Corporation Consultant, Konica Minolta Group
Emily B. Sonnenblick MD: Nothing to Disclose

TEACHING POINTS
To understand the role of synthesized images in digital breast tomosynthesis, their benefits and potential pitfalls compared to FFDM by using a case based interactive approach.

TABLE OF CONTENTS/OUTLINE
1. FFDM vs. C-view: the FDA mandate. When DBT was first approved dual exposure was mandated and patients received about double the radiation dose. Subsequently, the FDA approved the use of a synthesized 2D image. 2. Dose reduction with C-view: when synthesized 2D images replace acquired 2D images, the patient only receives the dose of the tomosynthesis acquisition. 3. C-view and masses: some masses are easily seen on FFDM, DBT and synthesized images, but some, however, are less conspicuous on synthesized images. This will be illustrated with examples of benign and malignant masses. 4. C-view technical issues. Issues such as calcifications which are not seen on the synthesized view will be discussed. Examples of skin calcifications clearly seen on FFDM, but not on the synthesized image or DBT will illustrate the possibility that eliminating the FFDM may lead to missing some superficial abnormalities.

BRE140

The New BI-RADS for Mammography: A Pictorial Essay

Education Exhibits
Location: BR Community, Learning Center

Participants
Lorell Ruiz-Flores MD (Presenter): Nothing to Disclose
Karla A. Sepulveda MD: Nothing to Disclose
Tamara Ortiz-Perez MD: Nothing to Disclose
Alfred Beresford Watson MD, MPH: Stockholder, General Electric Company

TEACHING POINTS
Studies have shown that focused teaching about the BI-RADS lexicon leads to improved appropriate use of the lexicon. Mammographic images demonstrating the BI-RADS mammography lexicon characteristics will be displayed with the corresponding BI-RADS descriptor to promote appropriate use of the lexicon. This exhibit will: 1. Review the fifth edition of the ACR Breast Imaging Reporting and Data System for mammography via a pictorial essay. 2. Highlight the differences in the lexicon from prior editions. 3. Explain the new subdivision of BI-RADS category 4 according to percentage of likelihood of malignancy. 4. Discuss the different scenarios for which the new assessment-management uncoupling applies. 5. Consider the impact of eliminating BI-RADS category 3 from screening mammography.

TABLE OF CONTENTS/OUTLINE
Pictorial review of the updated BI-RADS lexicon for mammography with emphasis on differences from prior editions Breast composition Masses Calcifications Architectural distortion Asymmetries Location BI-RADS category 4 sub-divisions with pictorial
Tomosynthesis-detected Architectural Distortion: Management Algorithm with Imaging-Pathology Correlation

Education Exhibits
Location: BR Community, Learning Center

Certificate of Merit
Selected for RadioGraphics

Participants
Steven Y. Wang MD : Nothing to Disclose
Fattaneh Tavassoli : Nothing to Disclose
Melissa Angeline Durand MD (Presenter) : Nothing to Disclose
Madhavi Raghu MD : Nothing to Disclose
Regina J. Hooley MD : Nothing to Disclose
Liane Elizabeth Philpotts MD : Nothing to Disclose

TEACHING POINTS
1. As tomosynthesis use becomes more widespread, appropriate management of tomosynthesis-detected architectural distortion will be needed.
2. Workup should be directed towards sampling the lesion, and usually involves the use of another modality such as US or MRI.
3. The pathology of lesions that present as tomosynthesis-detected architectural distortion is variable and includes benign etiologies such as radial scars and proliferative fibrocystic changes, as well as malignant invasive ductal and invasive lobular cancers.

TABLE OF CONTENTS/OUTLINE
I Architectural Distortions Detected by Tomosynthesis a. Appearance of architectural distortions b. Optimizing visualization of architectural distortions II Management of Tomosynthesis-detected Architectural Distortion a. Ultrasound Correlation and Biopsy - Imaging and pathology correlation of benign and malignant cases - Morphologic features and histologic diagnoses of distortions that more consistently have an ultrasound correlate. b. MRI Correlation and Biopsy - Imaging and pathology correlation of benign and malignant cases - Morphologic features and histologic diagnoses of distortions that more consistently have an MRI correlate c. Architectural distortions with no US or MRI correlate - Stereotactic Biopsy - Needle Localization III Summary of Management Algorithm

Positron Emission Mammography: A Valued Molecular Imaging Exam for a Comprehensive Breast Center Program in a Community Hospital

Education Exhibits
Location: BR Community, Learning Center

Participants
Kathy J. Schilling Colletta MD (Presenter) : Nothing to Disclose
Judy Kalinyak MD, PhD : Nothing to Disclose

TEACHING POINTS
High resolution breast PET, often referred to as Positron Emission Mammography (PEM), is a molecular imaging technology that has significant value in the evaluation of patients with both newly diagnosed breast cancer as well as those with a concern for recurrence. The tool offers the opportunity to personalize the imaging of each patient while maintaining the sensitivity of MRI in the local staging of invasive and non-invasive breast cancer. This educational exhibit will review the capabilities of PEM, i.e., sensitivity and specificity in comparison with other breast imaging modalities as well as provide practical experience on how this technology integrates in a comprehensive breast imaging center.

TABLE OF CONTENTS/OUTLINE
1. Outline the current indications for PEM in breast cancer evaluation and management
2. Present and discuss the PEM imaging protocols
3. Provide a pictorial review of the use of PEM in imaging invasive and non-invasive breast cancer extent of disease
4. Provide correlation with other imaging modalities such as mammography, ultrasound and MRI
5. Provide a pictorial review of PEM guided breast biopsy

Added Value of Pre-operative Diffusion-weighted Imaging (DWI) and Apparent Diffusion Coefficient (ADC) Ratio in Predicting Axillary Lymph Node Status in Patients with Breast Cancer: Literature Review and Personal Experience

Education Exhibits
Location: BR Community, Learning Center
Participants
Ilana Bednarova MD (Presenter): Nothing to Disclose
Sandra Bednarova MD : Nothing to Disclose
Anna Linda MD : Nothing to Disclose
Viviana Londero MD : Nothing to Disclose
Chiara Zuiani MD : Nothing to Disclose
Massimo Bazzocchi MD : Nothing to Disclose

TEACHING POINTS
The application of DWI and ADC in pre-operative breast MRI might be a promising diagnostic tool for the differentiation of benign from metastatic axillary lymph nodes in patients with breast cancer.

TABLE OF CONTENTS/OUTLINE
1. The role of breast MRI in the assessment of axillary lymph nodes in breast cancer - morphologic criteria - cortical thickening, loss of fatty hilum, shape, size - enhancement - homogeneus, heterogeneus, rim-enhancement 2. The application of DWI and ADC in predicting axillary lymph nodes status - normal/reactive lymph node features - metastatic axillary lymph node features - the role of DWI and ADC in predicting lymph node status in malignant breast lesions - personal experience with case examples - diagnostic pitfalls - literature review on sensitivity and specificity of DWI and ADC in the assessment of lymph node status in patients with breast cancer

BRE144
Breast MRI for Equivocal Mammographic Findings: A Help or Hindrance?

Education Exhibits
Location: BR Community, Learning Center

Magna Cum Laude
Selected for RadioGraphics

Participants
Catherine Streeto Giess MD (Presenter): Nothing to Disclose
Sona Ajit Chikarmane MD : Nothing to Disclose
Dorothy Amy Sippo MD : Nothing to Disclose
Robyn L. Birdwell MD : Nothing to Disclose

TEACHING POINTS
Problem solving breast MRI for inconclusive mammographic findings has been reported to be a useful tool. Yet breast MRI is an expensive exam, and while sensitivity is high, specificity remains only moderate, with possible false positive and false negative results. Our teaching objectives are 1) to review situations in which diagnostic imaging may be equivocal; 2) to illustrate cases in which problem solving MRI could aid or potentially interfere with appropriate management; and 3) to discuss strategies for appropriate utilization of problem solving MRI.

TABLE OF CONTENTS/OUTLINE
1. To review mammographic diagnostic techniques, including digital tomosynthesis, to perform complete evaluation of questioned mammographic lesions, including one-view asymmetries, focal asymmetries, masses and architectural distortions 2. To discuss the complementary role of breast ultrasound in diagnostic evaluation, and the limitations of negative or equivocal ultrasound in determining management 3. To illustrate cases where MRI aided in appropriate BIRADS assessment and management of equivocal mammographic lesions 4. To illustrate false positive and false negative breast MRI cases, potentially impacting patient management 5. Discuss strategies for appropriate utilization of breast MRI in challenging, equivocal, or complicated mammographic abnormalities

BRE145
Common and Unusual Breast MRI Artifacts at 1.5 and 3 T: Causes and Fixes

Education Exhibits
Location: BR Community, Learning Center

Participants
Dustin Nguyen DO (Presenter): Nothing to Disclose
Richard S. Ha MD : Nothing to Disclose
Ralph Thomas Wynn MD : Nothing to Disclose
Victoria Mango MD : Nothing to Disclose

TEACHING POINTS
Breast MRI is gaining widespread acceptance in high risk screening, post treatment evaluation for recurrence, staging and cancer treatment response. It is critical for the radiologist to be aware of the various breast MRI artifacts and to know their causes in order to minimize potential negative impacts on image interpretation. Teaching points: (1) MRI artifacts in breast imaging. (2) Artifact causes. (3) How to eliminate or reduce the artifact.

TABLE OF CONTENTS/OUTLINE
Breast MRI introduction including indications and contraindications. Overview of typical breast MRI protocol. Various breast MRI artifacts and their causes. -Imaging findings of artifacts with sample cases. -Methods to minimize or eliminate artifact. Unknowns with multiple-choice questions. Pearls and pitfalls in encountering artifacts. Summary.

BRE146
Errors in the Interpretation of the Technique of DWI in the MRI of the Breast: Why do they Occur?

Education Exhibits
Participants
Alfonso Iglesias MD, PhD (Presenter): Nothing to Disclose
Mercedes Arias: Nothing to Disclose

TEACHING POINTS
To describe the technique of DWI To examine different breast benign and malignant lesions that can present as false positives or false negatives in the sequence of DWI To explain the possible cause of error based on pathological correlation

TABLE OF CONTENTS/OPTLINE
Technique of DWI Description How to quantify the ADC value in breast lesions on MRI Benign lesions that simulate malignancy Appearance on DWI and ADC map Morphology and enhancement pattern analysis Pathological characteristics Correlation between MRI and pathology to explain error in interpretation Malignant lesions that mimic benignancy Appearance on DWI and ADC map Morphology and enhancement pattern analysis Pathological characteristics Correlation between MRI and pathology to explain error in interpretation

BRE147
Imaging-Pathologic Correlation of Breast Cancer with Fusion Imaging between Readout-Segmented Echo-Planar Diffusion-weighted Imaging and 3T-DCE-MRI with 16 Channels Breast Coil

Education Exhibits
Location: BR Community, Learning Center

Participants
Hiroyuki Horikoshi MD (Presenter): Nothing to Disclose
Aya Okayama MD: Nothing to Disclose
Michiko Kobayashi MD, PhD: Nothing to Disclose
Takeshi Kawakami MD: Nothing to Disclose
Katsuya Maruyama: Nothing to Disclose

TEACHING POINTS
Diffusion-weighted imaging (DWI) using single-shot EPI can result in geometric distortions, image blurring, ghosting artifacts, and problems with fat suppression. The combination of readout-segmented echo-planar DWI (rs-DWI) and parallel imaging techniques permits the use of extremely short echo spacing independent of spatial resolution, thereby reducing the geometric distortions and image blurring. Fusion imaging between rs-DWI and DCE-MRI (rs-FDWI) in breast cancer patients is able to acquire the accurate fusion imaging and show both malignant tumors and anatomical information. The teaching points of this exhibit are: 1. to describe the readout-segmented echo-planar diffusion weighted imaging using parallel imaging technique with 16 channels breast coil at 3T. 2. to illustrate the fusion imaging technique between readout segmented diffusion-weighted imaging using and DCE-MRI (rs-FDWI). 3. to demonstrate the rs-FDWI-pathologic correlation of breast cancers.

TABLE OF CONTENTS/OPTLINE
The content organizations of this exhibit are: 1. Demonstration of the readout-segmented echo-planar diffusion-weighted imaging using parallel imaging technique with 16 channels breast coil at 3T. 2. Imaging technique of the rs-FDWI with 16 channels breast coil at 3T. 3. Demonstration of the rs-FDWI-pathologic correlation of breast cancers.

BRE150
Kinetic Parametric Imaging of Breast Cancer using Dynamic Contrast-Enhanced MRI with Routine Clinical Protocols

Education Exhibits
Location: BR Community, Learning Center

Participants
Hiroko Satake MD (Presenter): Nothing to Disclose
Satoko Ishigaki MD: Nothing to Disclose
Mariko Kitano: Nothing to Disclose
Hisashi Kawai: Nothing to Disclose
Shinji Naganawa MD: Nothing to Disclose

TEACHING POINTS
The purposes of this exhibit are:
- To review the principles and techniques of parametric imaging based on model-free and model-based pharmacokinetic analyses on breast dynamic contrast-enhanced MRI (DCE-MRI).
- To discuss the clinical feasibility of kinetic parametric data extracted from breast DCE-MRI with high spatial but ordinary temporal resolution routine protocol, and present our experience with visualized color maps which characterized breast cancer angiogenesis.

TABLE OF CONTENTS/OPTLINE
Basic techniques of kinetic parametric imaging on breast DCE-MRI MRI protocol Qualitative analysis Semiquantitative analysis Quantitative pharmacokinetic modelling analysis Clinical applications of kinetic parametric imaging with routine breast DCE-MRI protocols Cancer detection Visualization of angiogenesis in breast cancer Correlation with molecular subtypes of breast cancer Monitoring response of chemotherapy Discussion of feasibility and limitations

BRE151
MRI Findings of Complications after Surgical and Non-surgical Breast Interventions.

Education Exhibits
Participants
Anna Knobel MD (Presenter): Nothing to Disclose
Eva Guy Rodriguez MD: Nothing to Disclose
Kristin Colleen Byrne MD: Nothing to Disclose
Neal Francis Epstein MD: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To review imaging changes on breast MRI after interventions such as biopsy, lumpectomy, mastectomy with reconstruction, breast conservation surgery, and radiation therapy. 2. To demonstrate the importance of recognizing benign post-therapeutic imaging findings to try to avoid additional imaging or biopsy and to recognize true recurrences and distinguish them from post radiation and post surgical changes. 3. To review the mammographic and ultrasound appearance of the same benign and malignant findings as seen on MRI.

TABLE OF CONTENTS/OUTLINE
Imaging appearance of post-therapeutic changes on MRI with ultrasound and mammographic correlation. Review imaging findings of infection, fluid collections, fat necrosis, scar, hematoma, seroma, implant rupture, implant gel leak, recurrence and radiation induced changes. Present cases of these benign and malignant post-therapeutic MRI findings with mammographic and ultrasound correlate in order to review the different imaging appearances.

BRE152
Potential Pitfalls of Dynamic Breast MRI: Key Imaging Findings for Making Correct Diagnosis

Education Exhibits
Location: BR Community, Learning Center

Participants
Maki Kiba (Presenter): Nothing to Disclose
Mariko Goto MD: Research Grant, Bayer AG
Eiichi Konishi: Nothing to Disclose

TEACHING POINTS
1. To learn about the potential pitfalls of BI-RADS MRI in diagnosing malignant breast lesions on dynamic MRI.
2. To learn about the key imaging findings in correlation with pathologic findings to correctly diagnose these malignant breast lesions on dynamic MRI.

TABLE OF CONTENTS/OUTLINE
Contrast-enhanced breast MRI is known to have high sensitivity for detecting breast cancers and it has now become an essential modality for assessing breast lesions. Typical morphological appearance of breast cancers on dynamic MRI is now well established, and the Breast Imaging Reporting and Data System (BI-RADS) MRI demonstrates good correlation with the likelihood of malignancy. However, it is known that there are some malignant breast lesions which are difficult to be correctly diagnosed by using the BI-RADS MRI lexicon; for example, some of the breast cancers have similar morphology to benign lesions, some have poor enhancement, and there are other factors that may cause false negative results. In this article, we will review these malignant breast lesions that may morphologically mimic benign lesions and exhibit false negative results on dynamic MRI. In addition, we will perform the correlation between the imaging and pathological findings of these malignant lesions to avoid potential pitfalls on dynamic MRI.

BRE153
State Of The Art DWI In The Breast: Recommended Protocol

Education Exhibits
Location: BR Community, Learning Center

Certificate of Merit

Participants
Paul Martin Murphy MD, PhD: Nothing to Disclose
Rebecca Rakow-Penner MD, PhD: Nothing to Disclose
Jade De Guzman MD: Nothing to Disclose
Haydee Ojeda-Fournier MD (Presenter): Nothing to Disclose

TEACHING POINTS
1. Describe the value added for breast diffusion imaging in breast cancer screening, staging, and treatment monitoring.
2. Explain the basics of diffusion weighted imaging in the context of breast imaging.
3. Recommend a protocol for breast diffusion imaging with optimal MRI scanning parameters.
4. Discuss the technical challenges of breast diffusion imaging and potential solutions.

TABLE OF CONTENTS/OUTLINE
1. Introduction; a) Why perform diffusion imaging in the breast; b) Describe basics of diffusion MRI and introduce the value of the Apparent Diffusion Coefficient, as measured in the breast; 2. Recommend diffusion imaging protocol as utilized at our institute; 3. Provide several examples of diffusion MRI maps of breast images in patients with both normal breast tissue as well as pathology; 4. Discuss technical challenges of diffusion imaging in the breast, and possible fixes, a) Post procedural effects on the ADC, b) Relevant timing in using the ADC to provide early indication of treatment response, c) Distortion effects, and issues exacerbated by breast architecture; 5. Conclusion - discussion of future developments and applications of breast diffusion imaging
**BRE154**

**Staying Abreast of Breast MRI: A How-to Guide for Incorporating Breast Magnetic Resonance Imaging (MRI) into your Practice**

*Education Exhibits*

*Location: BR Community, Learning Center*

**Participants**

Jessica Langer MD (Presenter): Nothing to Disclose  
Mona Tarun Vakil MD: Nothing to Disclose  
Kara-Lee Pool MD: Nothing to Disclose  
Colin J. Wells MD: Nothing to Disclose  
Melissa Marie Joines MD: Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is to provide an overview of breast Magnetic Resonance Imaging (MRI) and the accreditation process in order to assist clinicians and institutions incorporating breast MRI into their practices.

**TABLE OF CONTENTS/OUTLINE**

This exhibit will: (1) Review the indications for breast MRI (2) Provide an overview of the physics behind breast MRI, including examples of commonly encountered artifacts with both 1.5 and 3 Tesla magnets (3) Describe breast MRI at our institution, including our protocols and quality control measures (4) Discuss the MRI accreditation process with regards to image preparation and submission as per ACR guidelines (5) Include examples of how suboptimal quality MRI images may mask and/or mimic disease.

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**BRE155**

**The 5th Edition BI-RADS MRI Lexicon: What is New?**

*Education Exhibits*

*Location: BR Community, Learning Center*

**Participants**

Kareem Rahbar MD: Nothing to Disclose  
Brandi Tamara Nicholson MD: Stockholder, Hologic, Inc  
Heather Renee Peppard MD: Consultant, Siemens AG Research Grant, Hologic, Inc  
Carrie Margaret Rochman MD: Nothing to Disclose  
Jennifer A. Harvey MD (Presenter): Researcher, Hologic, Inc Researcher, VuCOMP, Inc Researcher, Volpara Solutions, Ltd Shareholder, Volpara Solutions, Ltd Shareholder, Hologic, Inc

**TEACHING POINTS**

The 5th edition of the Breast Imaging Reporting and Data System (BI-RADS) was published in December 2013. The MRI section of the lexicon has considerable changes compared with the prior BI-RADS lexicon. In this exhibit, the changes in parenchymal enhancement definitions and descriptors of foci, mass, and non-mass lesions will be reviewed. Example cases will be provided to allow the application of the new lexicon descriptors in a multiple choice fashion.

**TABLE OF CONTENTS/OUTLINE**

- Understand the consolidation of MRI lexicon terms and how these relate back to the mammography and breast ultrasound lexicons,  
- Review and apply descriptors of amount of fibroglandular tissue and parenchymal enhancement  
- Review and apply new non-mass MRI lexicon descriptors to example cases  
- Review and apply descriptors of foci and mass lesions to example cases

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**BRE156**

**The Mischief-Makers; MRI Diagnosis of Luminal Breast Tumors after Neoadjuvant Chemotherapy with Pathological Correlation**

*Education Exhibits*

*Location: BR Community, Learning Center*

**Participants**

Jimena Cubero Carralero (Presenter): Nothing to Disclose  
Susana Gonzalez Cabestreros: Nothing to Disclose  
Rosario Vazquez Carnero: Nothing to Disclose  
Ana Isabel Montero Montero: Nothing to Disclose  
Carmen Ortiz Ibanez: Nothing to Disclose  
Juan Manuel Fernandez Gallardo: Nothing to Disclose

**TEACHING POINTS**

- The accuracy of breast MRI predicting the presence of residual disease after neoadjuvant chemotherapy depends on breast cancer subtypes, with less sensitivity and specificity in luminal tumors.  
- There are several causes of inaccurate diagnosis when monitoring with MRI tumors response to neoadjuvant chemotherapy  
  Overestimation includes: presence of sclerosis, reactive inflammation and ductal carcinoma in situ  
  Underestimation includes: lack of inflammation or vascularization and fragmentation of the tumor.

**TABLE OF CONTENTS/OUTLINE**

- Brief review of the literature.  
- Parameters used in contrast-enhanced MRI to monitor response to neoadjuvant chemotherapy.
BRE160

Breast Cancer Under 40: The Clinical Presentation and Spectrum of Ultrasound, Mammogram, and MRI Findings

Education Exhibits
Location: BR Community, Learning Center

Participants
Laurie R. Margolies MD (Presenter): Consultant, FUJIFILM Holdings Corporation Consultant, Konica Minolta Group
Janet R. Szabo MD: Consultant, Siemens AG Consultant, FUJIFILM Holdings Corporation Consultant, Konica Minolta Group
Emily B. Sonnenblick MD: Nothing to Disclose
Christina Weltz MD: Nothing to Disclose
Elisa Port MD: Nothing to Disclose
Paul Schmidt MD, PhD: Nothing to Disclose

TEACHING POINTS

Patients under 40 who present with breast signs and symptoms are often found to have benign disease, but breast cancers do occur in the under 40 population and it is important that these patients be imaged. The viewer of this exhibit will see many cancers in women under 40 and will learn that it is important to have a high degree of suspicion and promptly biopsy findings that do not meet strict BI-RADS 2 or 3 criteria. The viewer will also learn that it is important to educate our referring physicians so that imaging is ordered and not delayed because of patient age.

TABLE OF CONTENTS/OUTLINE

The cases will be presented in a quiz format. Key differential diagnostic points between findings that require biopsy and those that can be followed will be highlighted. The cases includes: • Breast cancer in an under 30 year old patient presenting for high risk screening misinterpreted as a fibroadenoma. • MRI demonstration of diffuse cancer in a patient in her 30's with an ultrasound read as equivocal • Mammogram and ultrasound images of an under 30 year old with bilateral cancer • Pregnancy associated breast cancer

BRE161

CT and MRI Appearance of Gynecomastia, with Mammographic and Sonographic Correlation

Education Exhibits
Location: BR Community, Learning Center

Participants
Beatriz Reig MD, MPH (Presenter): Nothing to Disclose
Celin Chacko MD: Nothing to Disclose
Tova C. Koenigsberg MD: Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is to familiarize the viewer with the CT and MR appearance of gynecomastia, which is a benign and common entity that may be incidentally identified in a wide range of patients. The body imager should be aware of the various appearances of this entity and not confuse it for a malignant lesion. We will:
1. Review the clinical features of gynecomastia, including presentation and risk factors.
2. Review the mammographic and sonographic appearance of the three patterns of gynecomastia.
3. Demonstrate the CT and MRI appearance of gynecomastia, with correlation to mammographic appearance.
4. Note cases in which this incidentally imaged entity may be safely considered benign, and requires no further imaging.

TABLE OF CONTENTS/OUTLINE

• Clinical features of gynecomastia • Presentation • Risk factors • Imaging atlas of gynecomastia • Mammographic appearance - Nodular, ductitic, diffuse patterns • Sonographic appearance • CT appearance - Pattern • Corresponding mammogram/ultrasound • MRI appearance - Features on T1- and T2-weighted imaging and contrast-enhanced imaging - Corresponding mammogram/ultrasound

BRE162

Current Concepts in Evaluation of Response to Neoadjuvant Chemotherapy in Breast Cancer

Education Exhibits
Location: BR Community, Learning Center

Participants
Selin Carkaci MD (Presenter): Consultant, Hologic, Inc
Beatriz E. Adrada MD: Nothing to Disclose
Amado B. Del Rosario DO: Nothing to Disclose
Gary J. Whitman MD: Nothing to Disclose

TEACHING POINTS

• Monitoring response to treatment is a key element in the management of breast cancer. • Assessing response to chemotherapy prior to surgery can provide prognostic information to help guide follow-up care. • Breast imaging plays a role in evaluating tumor response and clinical decisions in the neoadjuvant setting. • Breast MRI correlates more accurately with pathologic response when compared to clinical exam, ultrasound and mammography. • It is important to know the limitations of imaging modalities as well as false positives and false negatives when using imaging to monitor response. • Different histologic types of breast cancer respond to neoadjuvant chemotherapy to varying degrees. • Imaging protocols for evaluation of...
response should be tailored based on the histology and imaging features of the primary breast cancer. • Emerging technologies have the potential to provide specificity for assessing response to treatment.

TABLE OF CONTENTS/OUTLINE

• Introduction • Neoadjuvant chemotherapy • The Response Criteria in Solid Tumors (RECIST) • Comparison of imaging modalities to assess response to neoadjuvant chemotherapy • Challenges in assessing response: False negatives and false positives • Tumor response to neoadjuvant chemotherapy by histologic type • Emerging technologies and future directions • Conclusion

BRE163

Dual-energy CT of the Breasts for Evaluation of Silicone Implants with MRI and US Comparison

Education Exhibits
Location: BR Community, Learning Center

Participants
Katrina Nesta Glazebrook MBChB (Presenter): Nothing to Disclose
Shuai Leng PhD: Nothing to Disclose
Maria Shiung: Nothing to Disclose
Sandhya Pruthi: Nothing to Disclose
Robert T. Fazzio MD, PhD: Nothing to Disclose
Katie Noella Jones MD: Nothing to Disclose
Cynthia H. McCollough PhD: Research Grant, Siemens AG

TEACHING POINTS

1. Dual-energy CT performed at 100 and 140 kV allows identification of silicone within breast implants and also extra-capsular silicone within the breast tissue and in axillary nodes with dedicated breast MRI as the reference standard.
2. CT can evaluate for collapsed silicone envelopes within the fibrous capsule seen with intracapsular rupture.
3. CT allows evaluation of level 1 and extra-axillary nodes which may not be well visualized on dedicated breast MRI.

TABLE OF CONTENTS/OUTLINE

A. Description of the different types of silicone implants B. Outline of physics of dual-energy CT for identification of silicone C. Comparison of DECT silicone specific images with gold standard MRI for evaluation of intra and extracapsular rupture of silicone implants. D. Examples of US evaluation of silicone implants and extracapsular silicone within the breasts and axillary nodes - snowstorm appearance - with DECT comparison. E. Review of recommendations of the FDA for follow-up of newly placed silicone implants.

BRE164

Evaluation of Blended Learning in Radiology: A National Program of Training and Re-training in Breast Imaging

Education Exhibits
Location: BR Community, Learning Center

Participants
Andres Vasquez MD (Presenter): Nothing to Disclose
Javier Andres Romero MD: Nothing to Disclose
Gloria Palazuelos MD: Nothing to Disclose
Bibiana Pinzon MD: Nothing to Disclose

Background
Breast cancer affects millions of women worldwide. Radiologists fulfill the main role of screening, diagnosing and following this illness, which underlines the need to be well prepared for these tasks. The training and re-training opportunities in breast imaging available for Colombian radiologists included until now a few rotations during residency as well as information during scientific meetings, and we believe these are not enough to train for such a relevant matter with as much impact for public health. Blended e-learning combines the positive aspects of on-site learning with the best of distance learning.

Evaluation
Our institution along with the Colombian Association of radiology, instituted a national 5-week long training and re-training program in breast imaging, based on a blended learning model with 2 weeks of individual study using Web 2.0 tools, followed by two full days of theoretical lessons delivered by experts in the subject and hands-on session of interpretation. During the following three weeks they continued the process in a Web 2.0 environment where they had the opportunity to participate in online forums with experts and other participants, revise theoretical contents and develop experience interpreting these images using a digital online bank of over 200 cases. The program was developed in 7 cities with 260 participants of different backgrounds and experience between 25 and 66 years of age. Pre-test and post-test where developed covering the theoretical learning objectives and interpretative skills. The pre-test mean was 19/50 and the post-test mean 42/50. A complete statistical analysis was developed.

Discussion
The training and re-training of radiologists is a challenge of medical education, which is why it is necessary to develop innovative programs that allow an adequate acquisition of skills and knowledge in specific relevant topics like breast imaging where the role of the radiologist is pivotal, bringing about benefits for patients and the health system as a whole.

Conclusion
Training programs that use a blended methodology can be very useful in medical education, being particularly significant in developing countries.

BRE165

Imaging of Uncommon Site Metastases from Breast Cancer: A Pictorial Review
Participants

Masafumi Toguchi MD (Presenter): Nothing to Disclose
Mitsuru Matsuki: Nothing to Disclose
Tomoko Hyodo MD: Nothing to Disclose
Takamichi Murakami MD, PhD: Nothing to Disclose
Izumi Imaoka MD: Nothing to Disclose
Kazunari Ishii MD: Nothing to Disclose
Masakatsu Tsurusaki MD, PhD: Nothing to Disclose
Seishi Kumano MD: Nothing to Disclose

TEACHING POINTS
1. CT, MR and PET images of uncommon site metastases from breast cancer.
2. Diagnostic imaging and differential diagnosis of uncommon site metastases from breast cancer.

TABLE OF CONTENTS/OUTLINE

We present the following uncommon site metastases from breast cancer, and discuss the diagnostic imaging and differential diagnosis:
1. Dura
2. Orbit
3. Pituitary gland
4. Bronchus
5. Brachial plexus
6. Gastrointestinal tract: Stomach, Colon
7. Abdominal lymph nodes
8. Female reproductive system: Uterus, Ovary
9. Others

BRE166

Imaging the Reconstructed Breast: Post-surgical Anatomy, Postoperative Processes, Complications, and Malignancy

Participants

Julie R. Sullivan MD (Presenter): Nothing to Disclose
Carla Jean Shah MD: Nothing to Disclose
Mary Beth Gonyo MD: Nothing to Disclose
Kelly M. England MD: Nothing to Disclose
Anubha Wadhwa MD: Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is to:
1. Review reconstruction techniques currently available for patients undergoing mastectomy, with an emphasis on the expected post-surgical anatomy and its appearance on multimodality imaging, including mammography, ultrasound, and MRI.
2. Discuss common benign postoperative processes in reconstructed patients.
3. Examine other imaging findings post reconstruction and highlight features differentiating benign from malignant.

TABLE OF CONTENTS/OUTLINE

Briefly review surgical methods for breast reconstruction Expected imaging appearance of postoperative anatomy Frequently encountered benign findings on imaging following reconstruction: edema, hematoma, seroma, fat necrosis, and fibrosis Malignant findings of recurrent cancer and post treatment sarcoma Use of multimodality imaging to distinguish between benign and malignant post reconstruction processes

BRE170

Understanding your Mammography Medical Audit: An Interactive Quiz Focusing on What Residents and Radiologists Need to Know to Improve their Mammography Practice

Participants

Rachel O. McEachern MD (Presenter): Nothing to Disclose
Brandi Tamara Nicholson MD: Stockholder, Hologic, Inc
Carrie Margaret Rochman MD: Nothing to Disclose
Jennifer A. Harvey MD: Researcher, Hologic, Inc Researcher, VuCOMP, Inc Researcher, Volpara Solutions, Ltd Shareholder, Volpara Solutions, Ltd Shareholder, Hologic, Inc
Heather Renee Peppard MD: Consultant, Siemens AG Research Grant, Hologic, Inc

TEACHING POINTS

The medical audit in mammography is an established method to evaluate mammographic quality and accuracy of interpretation under Mammography Quality Standard Act (MQSA). The purpose of this exhibit is:
1. Define key components of mammography performance measures
2. Review updated performance benchmarks in published literature
3. Discuss how to use the data to identify both strengths and areas of improvement in an individual’s performance
4. Demonstrate potential impact of analysis of audit data as teaching tool for identification of key parameters to improve performance

TABLE OF CONTENTS/OUTLINE

Review major components of standard performance measures, data collection and analysis involved in an individual mammography medical audit Discuss analysis of data utilizing case examples of sample radiologist data to address performance measures in 3 practical key components of screening mammography: Is the cancer detection rate optimal? What proportion of these cancers identified when small and lymph node negative? Address potential improvement strategies using interactive example audit performance measures based allowing participants to better understand mammography audit information and implications for improvement
Benign Breast Inflammatory Disease: Case-Based Review

Education Exhibits
Location: BR Community, Learning Center

Participants
Fatima Regina Silva Reis MD : Nothing to Disclose
Luciano F. Chala MD : Nothing to Disclose
Tatiana Cardoso de Mello Tucunduva MD : Nothing to Disclose
Giselle Guedes Mello PhD : Nothing to Disclose
Nestor Barros : Nothing to Disclose
Marco Antonio Costenaro MD : Nothing to Disclose
Bruna Maria Thompson MD : Nothing to Disclose
Barbara Helou Bresciani MD : Nothing to Disclose
Andrea Maciel MD (Presenter): Nothing to Disclose

TEACHING POINTS
To review benign infectious and non-infectious inflammatory breast diseases. To learn about imaging, clinical and pathologic features of common and uncommon benign inflammatory breast conditions. To identify the differences and similarities in presentation of benign and malignant inflammatory breast conditions.

TABLE OF CONTENTS/OUTLINE
Brief classification of benign inflammatory breast disease. Epidemiology and clinical features of benign inflammatory breast conditions. Case-based review illustrating: - Imaging features and histological basis of benign inflammatory breast conditions including common and rare diseases like breast blastomycosis - Differences and similarities in presentation of benign and malignant inflammatory breast conditions Conclusion.

BRE172
Benign Mimics of Malignancy on Breast Imaging

Education Exhibits
Location: BR Community, Learning Center

Participants
Monique Marie Tyminski DO : Nothing to Disclose
Jade Watkins MD (Presenter): Nothing to Disclose
Erica Tyler Ghosh MD : Nothing to Disclose
Rebecca Hullman DO : Nothing to Disclose
Tom Stockl MD : Nothing to Disclose
Sue A. MacMaster MD : Nothing to Disclose

TEACHING POINTS
1. Demonstrate benign entities of the female breast that can have malignant imaging features. Imaging will include mammography, ultrasound, and MRI with pathology correlation. 2. Recognize that many benign lesions can mimic breast cancer and should be included in differential diagnoses. 3. Reinforce importance of radiology and pathology correlation for these lesions in an effort to obviate unnecessary surgical intervention.

TABLE OF CONTENTS/OUTLINE
Cases will be presented with clinical history, radiology and pathology imaging correlation, followed by a short discussion of the diagnosis and management for each entity. The following benign processes will be examined: Intraductal papilloma Papillomatosis Sclerosing adenosis Stromal Fibrosis Radial Scar Tubular adenoma Granular cell tumor Diabetic mastopathy Granulomatous mastitis Fat necrosis Fibroadenoma

BRE173
Breast and Axillary Lymph Node Response to Neoadjuvant Chemotherapy: How Radiologic-Pathologic Correlation Informs Interpretation

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

Participants
Rosa M. Lorente-Ramos MD, PhD (Presenter): Nothing to Disclose
Javier Azpeitia Arman MD : Nothing to Disclose
Teresa Rivera Garcia : Nothing to Disclose
Isabel Casado Farinas : Nothing to Disclose
Miguel Angel Lara Alvarez : Nothing to Disclose

TEACHING POINTS
1) Understand the basic pathological changes in advanced breast cancer and lymph nodes after neoadjuvant chemotherapy. 2) Correlate pathologic changes with imaging (MR, mammograms, US). 3) Learn an approach to the assessment of the postneoadjuvancy breast.

TABLE OF CONTENTS/OUTLINE
We present: 1-Pathologic description of the residual lesion at surgery with comparison with the pretreatment tumor biopsy. -Macroscopy. Size of tumor bed, and residual tumor. -Microscopy. Presence and size of infiltrating carcinoma, number of foci,Histologic Appearance and Tumor Grade, lymphovascular involvement, presence of DCIS, Miller Payne classification of response, margins, 2-Imaging findings in breasts of patients with advanced breast cancer undergoing neoadjuvant chemotherapy (NAC): mammograms, US and MR, dynamic contrast-enhanced and diffusion weighted imaging. -Tumor size,
Change in size, - Type of response: complete response, mass shrinkage, fragmentation. 3- Pathologic response in lymph nodes.
- Number of nodes - Number of affected nodes - Extramodal involvement - Miller-payne system. Presence of metastases in nodes and postchemotheraphy changes 4- Imaging assessment of axillary lymph nodes. - Suspicious nodes - Extramodal involvement

**BRE175**

**Breast Diseases in Men: Is it Possible to Reliably Distinguish Benign from Malignant?**

*Education Exhibits*

*Location: BR Community, Learning Center*

**Participants**

- Christine U. Hyun MD (Presenter): Nothing to Disclose
- Susan Spieller MD : Nothing to Disclose
- Fatenah Ferr Sarlati MD : Nothing to Disclose
- Adina Floarea Achirloaie MD : Nothing to Disclose
- Pradeep Badhwar MD : Nothing to Disclose
- Nishant Mehta MD : Nothing to Disclose
- Alex Chung Yi MD : Nothing to Disclose

**TEACHING POINTS**

Typically, there is less familiarity with breast imaging in men due to overall fewer numbers of male breast studies, whether from true decreased prevalence of disease, lack of screening guidelines, or less males seeking care. The imaging features of benign and malignant breast disease in men can demonstrate significant overlap. Therefore, greater familiarity with imaging features may help to ensure proper management. Because the imaging features of benign and malignant disease can demonstrate significant overlap, biopsy and/or tissue sampling is not unwarranted for any clinically suspicious lesion. The purpose of this exhibit is to expose radiologists to a series of pathology-proven cases that highlight and confirm that benign and malignant breast diseases in men display overlapping features. A secondary purpose is to familiarize radiologists with breast diseases that are uncommon in men.

**TABLE OF CONTENTS/OUTLINE**

The cases will be presented in quiz format. The radiologist will be able to choose which diagnosis they think best fits the case. Key imaging features will be highlighted in the discussion of each case. The list of cases includes:

- Abscess
- Granulomatous mastitis/abscess
- Gynecomastia
- True cyst
- Vascular malformation
- Invasive ductal and lobular carcinoma
- Papillary carcinoma
- Mixed ductal and apocrine carcinoma

**BRE177**

**Breast Inflammatory Carcinoma: A Radiopathological Pictorial Review and Diagnostic Work-up**

*Education Exhibits*

*Location: BR Community, Learning Center*

*Certificate of Merit*

**Participants**

- Rosa M. Lorente-Ramos MD, PhD (Presenter): Nothing to Disclose
- Javier Azpeitia Arman MD : Nothing to Disclose
- Isabel Casado Farinas : Nothing to Disclose
- Teresa Rivera Garcia : Nothing to Disclose
- Miguel Angel Lara Alvarez : Nothing to Disclose
- Eva Cueva Perez : Nothing to Disclose

**TEACHING POINTS**

- To review clinical, and pathologic findings in inflammatory breast cancer.
- To illustrate imaging findings (mammogram, US, MR and CT) of cases from our series of inflammatory breast cancer, providing clinical images and pathologic correlation.
- To analyze the specific management of those lesions, including imaging and interventional procedures.
- To emphasize pitfalls, diagnostic difficulties and differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

We present:
- Clinical signs and symptoms.
- Pathology.
- Imaging findings Mammograms, US, MR, CT.
- Diagnostic work-up. - Interventional procedures. Tips and tricks.

**BRE178**

**Breast Sarcomas: Mammographic, Sonographic and MRI Features**

*Education Exhibits*

*Location: BR Community, Learning Center*

*Certificate of Merit*
Participants
Renato Augusto Eidy Kiota Matsumoto MD : Nothing to Disclose
Luciano F. Chala MD (Presenter): Nothing to Disclose
Bruna Maria Thompson MD : Nothing to Disclose
Barbara Helou Bresciani MD : Nothing to Disclose
Giselle Guedes Mello PhD : Nothing to Disclose
Su Jin Kim MD : Nothing to Disclose
Nestor Barros : Nothing to Disclose

TEACHING POINTS
- To know the different types of breast sarcomas
- To learn mammography, sonography and MRI appearances of breast sarcomas
- To identify the differences and the similarities in the presentation between sarcomas and malignant epithelial tumors in imaging methods

TABLE OF CONTENTS/OUTLINE
- Definition of mesenchymal tumors and sarcomas
- Frequency and epidemiology of breast sarcomas
- Case-based review illustrating imaging features of different types of breast sarcomas
- Differences and similarities in the presentation between sarcomas and malignant epithelial tumors in imaging methods
- It was not a fibroadenoma? I thought it was mastitis!!!!
- Presentation of some catastrophic cases of delayed diagnosis of breast sarcomas in very young women. Lessons to learn
- Conclusion

BRE181
Echogenic Breast Lesions: Be Worried or Not?

Education Exhibits
Location: BR Community, Learning Center

Participants
Flavia Beatriz Sarquis MD : Nothing to Disclose
Karina Pesce (Presenter): Nothing to Disclose
Bernardo Oscar Blejman MD : Nothing to Disclose
Fabiana Gisela Vega MD : Nothing to Disclose
Roxana Gerosa : Nothing to Disclose

TEACHING POINTS
- To review the differential diagnosis of echogenic breast lesions
- To show that physical examination and mammogram may help to elucidate the benign nature of lesions, and hence decrease the number of unnecessary biopsies
- To discuss the management of echogenic breast lesion based on imaging features

TABLE OF CONTENTS/OUTLINE
- Introduction
- Define the concept of echogenic lesion on ultrasound
- Review of ultrasound images of each of the clinical entities included
  - Benign lesions: hematoma, complex seroma, silicone granuloma, fat necrosis, lipoma, angiolipoma, sebaceous or epidermal inclusion cyst, abscess, pseudoangiomatous stromal hyperplasia, galactocele or lactating adenoma, ductal ectasia, papillary metaplasia, Malignant lesions: invasive ductal carcinoma, invasive lobular carcinoma, metastasis, lymphoma, angiosarcoma
- Differentiation of malignant vs. benign echogenic lesion on ultrasound
- Step-by-step to apply the BI-RADS classification
- Conclusion

BRE182
Favorable Prognosis Triple Negative Breast Cancers—They DO Exist

Education Exhibits
Location: BR Community, Learning Center

Participants
Kelly Ann Hastings MD (Presenter): Nothing to Disclose
Sheryl Gillikin Jordan MD : Nothing to Disclose

TEACHING POINTS
- Review the importance of immunohistochemistry (IHC) in breast cancer care algorithms focusing on triple negative breast cancer (TNBC)
- Four recognized subtypes of favorable prognosis TNBC namely medullary, adenoid cystic, secretory, and acinic cell carcinomas
- Our single institution experience with these subtypes, presenting pathology, patient presentation, patient followup, and tumor prognosis
- Understanding how the nuances of these tumor types' associated features and care algorithms help us as radiologist provide high quality patient care delivery - ie, the radiologist must be aware these cases are best handled as a distinct subgroup of otherwise poorer-prognosis TNBC prior to any discussion with the patient regarding her positive biopsy results

TABLE OF CONTENTS/OUTLINE
- Definition of the role of IHC in breast cancer care algorithms
- Definition of favorable prognosis triple negative breast cancer subtypes, including our institution's collated cases for each subtype
- Emphasis on the nuances of specific subtypes' associated features and oncologic care algorithms

BRE184
Giant Breast Masses: Differential Diagnosis with Multimodality and Histopathology Correlation

Education Exhibits
Location: BR Community, Learning Center

Participants
Elsa Maria Arribas MD : Nothing to Disclose
TEACHING POINTS

1. Giant (5 cm and larger) breast masses pose diagnostic challenges as their large size may not permit optimal imaging by mammography or ultrasound. Additional cross-sectional imaging modalities such as MRI and CT may help to fully image and further characterize these masses. 2. Clinical and imaging findings which may prompt the radiologist to suspect malignancy. 3. Treatment of these giant breast masses varies and may be complex, depending on the histopathology and size.

TABLE OF CONTENTS/OUTLINE


BRE186

Hashing out the PASH: Diagnostic Pearls & Pitfalls, Imaging Biomarkers, and Management of Pseudoangiomatous Stromal Hyperplasia (PASH)

Education Exhibits
Location: BR Community, Learning Center

Participants
Sirishma Kalli MD (Presenter): Nothing to Disclose
Michael Lanfranchi MD : Nothing to Disclose
Hoon Ji MD, PhD : Nothing to Disclose
Shital Saurin Makim MD : Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: 1. To review the spectrum of imaging findings of pseudoangiomatous stromal hyperplasia (PASH) at mammography, ultrasound, and MR imaging with pathologic correlation. 2. To propose an algorithm for the management of core breast biopsies revealing PASH, as the current literature regarding management is sparse.

TABLE OF CONTENTS/OUTLINE

1. Background discussion of PASH including types (diffuse and tumorous/nodular), clinical presentation, hormonal factors, and histologic findings. 2. Depiction of the various imaging findings of PASH at mammography, ultrasound, and MR imaging with diagnostic pearls and pitfalls. 3. Proposed algorithm regarding the management of PASH when diagnosed by core biopsy.

BRE189

Imaging Breast and Axillary Findings that Warn of Systemic Diseases

Education Exhibits
Location: BR Community, Learning Center

Participants
Karina Pesce : Nothing to Disclose
Flavia Beatriz Sarquis MD (Presenter): Nothing to Disclose
Bernardo Oscar Blejman MD : Nothing to Disclose
maria jose chico : Nothing to Disclose
Esperanza Casco Gomez : Nothing to Disclose
Graciela Fernandez Alonso : Nothing to Disclose
Chesi Donata : Nothing to Disclose

TEACHING POINTS

• To review systemic diseases that may affect the breast and axilla • To describe the imaging findings linked to systemic diseases. • To discuss the differential diagnosis • To emphasize pitfalls, diagnostic difficulties and differential diagnosis

TABLE OF CONTENTS/OUTLINE

• Introduction • Describe normal anatomy of breast and axilla. • Normal breast and axilla multimethod appearance • Possible differential diagnoses according to the anatomical structure that may be affected: skin, arterial and venous vessels, parenchyma, node lymph. • Clinical cases • Conclusion

BRE191

Internal Mammary Lymph Nodes in Breast Cancer

Education Exhibits
Location: BR Community, Learning Center

Selected for RadioGraphics

Participants
Ashley Robin Cahoon MD (Presenter): Nothing to Disclose
Benjamin David Smith MD : Nothing to Disclose
Wei Tse Yang MD : Researcher, Hologic, Inc

TEACHING POINTS

Describe the impact of internal mammary lymph node metastases on the staging, prognosis, and clinical management of breast
cancer patients. Recognize the appearance of internal mammary lymph nodes in multiple modalities. Discuss mimics and differential diagnoses of enlarged internal mammary chain nodes.

**TABLE OF CONTENTS/OUTLINE**

1. Role of internal mammary lymph node metastases in breast cancer staging.
2. Anatomy of the internal mammary lymph nodes.
3. Differential diagnosis of enlarged internal mammary lymph nodes.
4. Illustrative cases of internal mammary lymph node metastases in various imaging modalities including: ultrasound, CT, MRI, lymphoscintigraphy, and PET/CT.
5. Clinical evaluation and management, including sentinel lymph node biopsy of internal mammary nodes and radiation therapy.

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**BRE193**

**Male Breast Findings: The Unusual Suspects**

*Education Exhibits*

*Location: BR Community, Learning Center*

**Participants**

- **Victoria Mango MD (Presenter):** Nothing to Disclose
- **Richard S. Ha MD:** Nothing to Disclose
- **Lauren C. Friedlander MD:** Nothing to Disclose
- **Hanina Hibshoosh MD:** Nothing to Disclose
- **Ralph Thomas Wynn MD:** Nothing to Disclose

**TEACHING POINTS**

Male breast disease is uncommon and unusual cases create particular imaging and diagnostic challenges for the radiologist. We present 10 interesting male breast cases (5 benign and 5 malignant), teach associated radiologic findings, provide pathologic correlation and address appropriate management based on available literature. In this context we discuss techniques for imaging the male breast and review the differential diagnosis for benign and malignant male breast disease. Specific diagnoses taught include: invasive lobular carcinoma, mastitis with delayed malignancy diagnosis, axillary basaloïd metaplastic breast carcinoma with basal cell carcinoma of the nipple, chronic lymphocytic leukemia/small lymphocytic lymphoma, prostate cancer metastasis, hemangioma, epidermal inclusion cyst, gynecomastia in a transgender patient, fat necrosis and a pilomatrixoma.

**TABLE OF CONTENTS/OUTLINE**

- Introduction
- Imaging the male breast: Approach and techniques
- Benign and Malignant disease: differential diagnosis
- 10 interesting male breast cases with:
  - Clinical History
  - Imaging with radiologic findings
  - Pathologic findings (available for 8 of 10 cases)
  - Management based on current literature review
- Summary/Take Home teaching points

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**BRE194**

**Malignant Breast Lesions that May Mimic Benign Tumors: "A Diagnostic Challenge in Breast Radiology"**

*Education Exhibits*

*Location: BR Community, Learning Center*

**Participants**

- **Flavia Beatriz Sarquis MD (Presenter):** Nothing to Disclose
- **Karina Pesce:** Nothing to Disclose
- **Bernardo Oscar Bieglmair MD:** Nothing to Disclose
- **Lucia Isabel Beccar Varela MD:** Nothing to Disclose
- **Graciela Fernandez Alonso:** Nothing to Disclose

**TEACHING POINTS**

1-Describe and illustrate the spectrum of malignant breast lesion mimicking benign conditions 2-Exhibit signs and radiological features of these entities using cases clinical and histopathologic correlation. 3-Discuss limitations and difficulties that arise in image interpretation.

**TABLE OF CONTENTS/OUTLINE**

1-Introduction 2-Breast Imaging Techniques
   - Digital mammography
   - Ultrasonography
   - Color Doppler imaging
   - MR Imaging
   - Tomosynthesis
3- Malignant breast lesion that may mimic Benign conditions: Mucinous carcinoma, medullary carcinoma, triple negative breast cancer in BCRA 1, Squamous cell-type metaplastic breast carcinoma, metastatic, 4- Warning signs 5-Clinical cases 6- Conclusions

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**BRE195**

**Mammographic Finding of Eosinophilic Fasciitis**

*Education Exhibits*

*Location: BR Community, Learning Center*

**Participants**

- **Nara Pacheco Pereira MD (Presenter):** Nothing to Disclose
- **Reine Fahed MD:** Nothing to Disclose
- **Almir Bitencourt MD:** Nothing to Disclose
- **Nagi Fouad Khouri MD:** Nothing to Disclose

**TEACHING POINTS**

- To review the characteristics and describe the complex-symptoms of that rare disease: eosinophilic fasciitis. - The purpose of
this study is to report a rare case of eosinophilic fasciitis, which the findings on mammography have not been described in the literature. The purpose of our presentation is to illustrate the mammographic progression during a ten year follow up of that rare condition.

TABLE OF CONTENTS/OUTLINE
- Review eosinophilic fasciitis' (EF) complex symptoms. - Review the etiology and pathogenesis of the disease. - Illustrate a case report: 67-year-old patient with a history of breast cancer, treated by lumpectomy and radiation therapy, who developed diffuse fasciitis with eosinophilia. - Illustrate the mammographic progression during a ten year follow up of that rare condition, which shows extensive coarse calcifications throughout the left breast moderately to markedly increasing, with many of them noted to be subcutaneous and dermal, and some of the calcifications breaking through the skin. - Summary: Our case illustrates a remarkable chronological association of the incipience of EF following lumpectomy and radiation therapy for carcinoma of the breast. The manifestations of EF on mammographic findings have not been described in the literature.
Participants

Karina Pesce (Presenter): Nothing to Disclose
Flavia Beatriz Sarquis MD: Nothing to Disclose
Carlos Mariano Lamattina MD: Nothing to Disclose
Bernardo Oscar Blejman MD: Nothing to Disclose
Silvia Giusti: Nothing to Disclose

TEACHING POINTS

• To acknowledge the different types of gynecomastia, and the multimodality radiological appearance.
• To describe the etiological base of the disease.
• To Discuss the utility of the different image techniques on the study of the gynecomastia, with special approach of three-dimensional tomosynthesis.

TABLE OF CONTENTS/OUTLINE

1 Introduction
2- Etiology: A) Physiologic: a) neonatal b) puberty b) aging B) Pathologic: a) decreased production/action of androgens b) Increased estrogen production c) systemic illness d) drugs e) idiopathic.
3 - Clinical classification of different types of gynecomastia (schematic drawing and pictures of clinical cases)
4- Mammographic breast images, ultrasounds, and three-dimensional tomosynthesis of the three phases of gynecomastia; examples with different cases
5-Clinical cases
6- Differential diagnosis.
7- Conclusions

BRE199
Multimodality Imaging Appearance of Noncalcified Ductal Carcinoma in Situ

Education Exhibits
Location: BR Community, Learning Center

Participants

Juliana Rosenblat MD (Presenter): Nothing to Disclose
Suzanne McElligott MD: Nothing to Disclose
Monica Majmundar Sheth MD: Nothing to Disclose

TEACHING POINTS

1. For diagnosis of noncalcified ductal carcinoma in situ (DCIS), the finding of pseudomicrocysts on ultrasound and utilization of color flow and Doppler are important in helping a radiologist to determine when to biopsy. 2. Noncalcified DCIS should be included in the differential of suspicious enhancing masses or nonmass enhancement in patients where DCIS is not seen mammographically. Additionally, MRI is a useful adjunct in evaluating extent of disease and determining surgical management.

TABLE OF CONTENTS/OUTLINE

-Introduction -Purpose -Discuss multimodality imaging features of noncalcified DCIS -Imaging Findings -Mammography
-Distortion -Mass / focal asymmetry -Occult -Ultrasound -Mass -Irregular shape -Microlobulated margins -Complex echotextures -Pseudomicrocystic- clustered microcysts -MRI - Nonmass enhancement -Mass -Focus -Kinetics -Role of MRI in determining extent of disease and surgical planning -Conclusion -It is important for the radiologist to be aware of the various imaging features of noncalcified DCIS in order to optimize technique and guide patient management.

BRE201
Not Your Average Man: Biopsy or Not These Male Breast Lesions?

Education Exhibits
Location: BR Community, Learning Center

Participants

Sadia Choudhery MD (Presenter): Nothing to Disclose
Soume Daulat Foshee MD: Nothing to Disclose
Pramod Kumar Gupta MD: Nothing to Disclose

TEACHING POINTS

The aim of this presentation is to: 1) Briefly discuss the anatomic and imaging appearance of the male breast and its differences from the female breast. 2) Test the viewer's knowledge of classic appearance of male breast lesions that should not be biopsied and lesions that should be biopsied through a series of cases. 3) Utilize these cases to teach mammographic and sonographic characteristics of male breast lesions that render them benign, equivocal, or malignant.

TABLE OF CONTENTS/OUTLINE

Anatomy of the male breast and differences between male and female breasts. Mammographic and sonographic appearances of the normal male breast. Series of cases of benign and malignant male breast lesions asking the viewer if they would biopsy or not biopsy in each situation. Cases will include: Dendritic and nodular gynecomastia, pseudogynecomastia, hematoma, fibroadenoma, myofibroblastoma, subareolar abscess, invasive ductal carcinoma, angiolipoma, sebaceous cyst, primary papillary carcinoma, breast schwannoma, and intramammary lymph nodes Relevant clinical history and followup findings will be provided. Through these cases, the viewer will learn differential diagnoses of various male breast lesions and learn strategies to distinguish benign from malignant and equivocal lesions.

BRE202
Papillary Lesions: From Duct to Diagnosis

Education Exhibits
Location: BR Community, Learning Center

Participants

Aditi Dhakar Modi MD (Presenter): Nothing to Disclose
Paul Friedman DO: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is to: 1) Highlight the clinical significance and common presentations of papillary lesions. 2) Address the spectrum and pathophysiology of papillary lesions ranging from benign papillomas to papillary cancer. 3) Demonstrate the appearances of papillary lesions on various modalities ranging from ductograms to MRI.

TABLE OF CONTENTS/OUTLINE
1) Describe the clinical presentation of papillary lesions and the role of radiological workup. 2) Elaborate on the pathological distinction between papillary lesions and the prognostic implications. 3) Discuss the advantages and disadvantages of the available imaging options. 4) Present the characteristic appearances of papillary lesions on various modalities including ductography, mammography, ultrasound and MRI. 5) Provide examples of papillary lesion mimics such as ductal carcinoma in situ and duct ectasia.

BRE203
Phyllodes Tumor of the Breast: Imaging Update with a Focus on Histopathologic Correlation of Core Biopsy and Surgical Pathology

Education Exhibits
Location: BR Community, Learning Center

Certificate of Merit

Participants
- Erica Leigh Martin-Macintosh MD (Presenter): Nothing to Disclose
- Robert T. Fazzio MD, PhD : Nothing to Disclose
- Katrina Nesta Glazebrook MBChB : Nothing to Disclose
- Katie Noella Jones MD : Nothing to Disclose
- Edwin Onkendi : Nothing to Disclose
- Rafael E. Jimenez MD, PhD : Nothing to Disclose
- Tina Hieken : Nothing to Disclose

TEACHING POINTS
The purpose of this educational exhibit is to review the imaging features of 50 independent cases of Phyllodes tumor (PT) with clinical presentation, core biopsy, surgical, and pathologic correlation. Major teaching points include:

- PT are rare fibroepithelial neoplasms of the breast.
- Aside from interval growth, PT are often difficult to differentiate from a fibroadenoma using conventional breast imaging techniques and histologic core needle biopsy.
- Accurate characterization and diagnosis of PT during breast imaging evaluation is essential for surgical planning purposes given the potential for malignance and recurrence.

TABLE OF CONTENTS/OUTLINE
- Review the demographics and clinical presentation of PT.
- Illustrate cases of PT with clinical and histopathology correlation.
- Demonstrate multimodality imaging features of PT, with a focus on the readily available breast imaging techniques including mammography, ultrasound, and MR.
- Compare/contrast imaging features of PT with potential mimickers.
- Report outcomes data of core needle biopsy correlation with surgical pathology.

BRE204
Phyllodes Tumors of the Breast: Tips in Radiologic Diagnosis

Education Exhibits
Location: BR Community, Learning Center

Participants
- Hye-Won Kim MD (Presenter): Nothing to Disclose

TEACHING POINTS
1. To review characteristics of phyllodes tumors
2. To differentiate phyllodes tumors from fibroadenomas on clinical and radiological features
3. To explain the suggestive findings of malignant phyllodes tumor on diagnostic images

TABLE OF CONTENTS/OUTLINE
1. What is phyllodes tumor?
2. Differentiation of phyllodes tumors from fibroadenomas on MG, US and MRI
3. Characteristic imaging finding of phyllodes tumors according to histologic grade
4. How can we predict malignant phyllodes tumors on diagnostic imaging?
5. Sample case

BRE205
Pregnancy-associated Breast Cancer: Imaging Findings and What Should Radiologists Know

Education Exhibits
Location: BR Community, Learning Center
TEACHING POINTS

1. To understand the physiologic change of the breast during pregnancy and lactation.
2. To overview the clinical presentations, pathologic and radiologic findings of pregnancy-associated breast cancer.
3. To demonstrate the management guidelines of the breast disease during pregnancy and lactation.

TABLE OF CONTENTS/OUTLINE

A. Definition of pregnancy-associated breast cancer
B. Physiologic changes of breast during pregnancy and lactation
C. Clinical manifestation
D. Diagnostic approach
E. Imaging findings of pregnancy-associated breast cancer
   1. Mammography
   2. US
   3. MRI
   4. Other imaging modalities
F. Management of pregnancy-associated breast cancer

BRE206
Primary Lymphoma of the Breast: Multimodality Features with Pathologic Correlation and Management Review

Education Exhibits
Location: BR Community, Learning Center

Participants

Monica Liwen Huang MD (Presenter): Nothing to Disclose
Flavia Posleman Monetto: Nothing to Disclose
Elsa Maria Arribas MD: Nothing to Disclose
Gaiane M. Rauch MD, PhD: Nothing to Disclose
Savitri Krishnamurthy MD: Nothing to Disclose
Beatriz E. Adrada MD: Nothing to Disclose

TEACHING POINTS

1) The classification system of lymphoma and the diagnostic criteria for primary lymphoma of the breast.
2) Imaging features of primary breast lymphoma on mammography, sonography, and MRI (with PET/CT correlation) and features which prompt the radiologists to include this disease entity in their differential diagnosis.
3) Biopsy techniques utilized to obtain the necessary tissue material for the diagnosis of lymphoma of the breast, with review of cytology, flow cytometry, and histopathology findings, as well as receptor studies.
4) Management and prognosis of primary lymphoma of the breast are complex.

TABLE OF CONTENTS/OUTLINE

1) Classification of lymphoma
2) Diagnostic criteria for primary lymphoma of the breast.
3) Patient demographics and clinical presentation.
4) Mammographic, sonographic, and MRI features, with PET/CT correlation.
5) Biopsy techniques necessary for diagnosis of lymphoma in the breast.
6) Cytology, flow cytometry, and histopathology findings with receptor analysis.
7) Management and prognosis of primary breast lymphoma.
The purpose of this exhibit is: 1. To review the MMG, US and MRI findings of sclerosing adenosis (SA) and cancer in sclerosing adenosis (CASA) 2. To reveal the pathological findings of above lesions 3. To discuss the relationship between the image and the pathology

TABLE OF CONTENTS/OUTLINE

Content Organization: 1. Image of SA 2. Image of CASA 3. Histological findings of above lesions 4. Difference of the image between SA and CASA 5. Histological background of image difference Summary: The major teaching points of this exhibit are: 1. Distortion is more commonly found in CASA than SA. 2. Distortion is basically reflected by radial sclerosing lesion of stroma. 3. Distortion is often found on MMG than US or MRI. 4. Fast type dynamic pattern in contrast enhanced MRI is more frequently found in CASA than SA.

The Breast Biopsy Shows Predominately Fat, Now What? Managing Radiology Pathology Concordance

Education Exhibits
Location: BR Community, Learning Center

Participants
Amanda Jeanne Beer MD (Presenter): Nothing to Disclose
Cherie Paquette MD : Nothing to Disclose
Kristen Atkins MD : Nothing to Disclose
Heather Renee Peppard MD : Consultant, Siemens AG Research Grant, Hologic, Inc
Carrie Margaret Rochman MD : Nothing to Disclose
Jennifer A. Harvey MD : Researcher, Hologic, Inc Researcher, VuCOMP, Inc Researcher, Volpara Solutions, Ltd Shareholder, Volpara Solutions, Ltd Shareholder, Hologic, Inc
Brandi Tamara Nicholson MD : Stockholder, Hologic, Inc

TEACHING POINTS

The purpose of this exhibit is:
1. Show how to best determine concordance after biopsy demonstrates predominately benign fatty tissue.
2. Provide tools to improve communication between Radiologists and Pathologists to prevent radiology pathology discordance in breast lesions undergoing biopsy.
3. Discuss lesions that have a classic radiologic appearance but overlapping pathologic findings such as lipoma, angiolipoma, and hamartoma.
4. Review recommendations for management, specifically on to excise or accept as benign concordant, after radiology pathology concordance is determined.

TABLE OF CONTENTS/OUTLINE

Present cases of breast lesions which can have predominately fat on histology Discordant breast biopsy showing fat Lipoma Angiolipoma Fat necrosis versus invasive carcinoma Hamartoma versus fibroadenoma Review imaging and pathology findings in a case-based format with discussion of significant mimickers Discuss how to best determine concordance with focus on the following: Communication between radiology and pathology Confidence in accuracy of biopsy Histology interpretation by pathologist Image review with pathology results by radiologist Summarize recommendations for improved teamwork between Radiologist and Pathologist

The Great Mimicker: Multimodality Case Series of Lymphoma in the Breast

Education Exhibits
Location: BR Community, Learning Center

Participants
Ilana Kafer MD (Presenter): Nothing to Disclose
Patrick Kobes DO : Nothing to Disclose
Monica Majmundar Sheth MD : Nothing to Disclose
Suzanne McElligott MD : Nothing to Disclose

TEACHING POINTS

1. Lymphoma in the breast can have multiple imaging presentations and is important to include in differential for single or multiple unilateral and bilateral masses, skin thickening and parenchymal edema, bilateral axillary adenopathy
2. Post treatment imaging-PET CT and/or dedicated breast imaging can evaluate response to therapy and guide future management
3. Review the difference between primary and secondary breast lymphoma

TABLE OF CONTENTS/OUTLINE

1. Introduction to Lymphoma II. Imaging features a. Mammography b. Sonography c. MRI d. PET/CT III. Differential IV. How
can imaging guide management (diagnosis and follow-up after treatment) V. Conclusion: Review of primary and secondary lymphoma of the breast showing findings on mammography, ultrasound, breast MRI, and PET CT. Cases will summarize the key imaging findings that lead to a diagnosis of lymphoma and demonstrate imaging follow-up after treatment.

**BRE212**

**The Hormonal Breast: A Comprehensive Anatomical and Imaging Review**

*Education Exhibits*

*Location: BR Community, Learning Center*

**Participants**

- Nina Woldenberg MD (Presenter) : Nothing to Disclose
- Melissa Marie Joines MD : Nothing to Disclose

**TEACHING POINTS**

1. Understand how hormonal manipulation affects the prepubertal to post-menopausal breast with anatomical and imaging correlation. 2. Understand the physiology and imaging features of breast conditions and neoplasms associated with endogenous or exogenous hormones. 3. Hormonal influences on the male breast with case examples.

**TABLE OF CONTENTS/OUTLINE**

Comprehensive anatomical and imaging review of the hormonal breast including: 1. Normal breast development/Tanner stages. 2. Hormonal influences on the breast during menses, pregnancy, and lactation. 3. Hormonal changes during perimenopause and menopause. 4. Hormonal replacement therapy. 5. Breast conditions associated with hormones including breast pain, cysts, fibroadenomas, and malignancies, as well as pregnancy associated cancers and benign masses. 6. Understanding endogenous/exogenous hormonal influences on the male breast.

**BRE213**

**The Male Breast: Masses, Malignancies and More**

*Education Exhibits*

*Location: BR Community, Learning Center*

*Certificate of Merit*

**Participants**

- Monique Marie Tyminski DO (Presenter) : Nothing to Disclose
- Rebecca Hultman DO : Nothing to Disclose
- Jade Watkins MD : Nothing to Disclose
- Thomas Stockl MD : Nothing to Disclose
- Sue A. MacMaster MD : Nothing to Disclose

**TEACHING POINTS**

1. Understand male breast anatomy and correlate with examples of male breast pathology seen on breast imaging. 2. Demonstrate the common imaging presentations of multiple benign and malignant diseases of the male breast. 3. Examples will be presented with clinical history, imaging findings on mammography, ultrasound, CT and MRI with pathology correlation images. 4. Help narrow the differential diagnosis and understanding of both common and uncommon male breast lesions.

**TABLE OF CONTENTS/OUTLINE**

Anatomy of the Male Breast

Benign Male Breast Pathology:
- Gynecomastia and its presentations including nodular, dendritic and diffuse gynecomastia including a case of exogenous estrogen use in a transgender patient
- Spindle cell neoplasm
- Minimally complicated cyst
- Lipoma
- Sclerosing lipoma
- Angiolipoma
- Fibrosis
- Intramammary lymph node
- Hematoma
- Abscess

Male Breast Cancer:
- Invasive ductal carcinoma
- Intraductal carcinoma
- Papillary carcinoma
- Inflammatory carcinoma
- Lymphoma

**BRE214**

**The Pathology Showed What? Confounders in Breast Radiologic Pathology Correlation: Fibrous and Spindle Lesions**

*Education Exhibits*

*Location: BR Community, Learning Center*

**Participants**

- Amanda Jeanne Beer MD (Presenter) : Nothing to Disclose
- Cherie Paquette MD : Nothing to Disclose
- Kristen Atkins MD : Nothing to Disclose
- Carine Margaret Rochman MD : Nothing to Disclose
- Heather Renee Peppard MD : Consultant, Siemens AG Research Grant, Hologic, Inc
- Jennifer A. Harvey MD : Researcher, Hologic, Inc Researcher, VuCOMP, Inc Researcher, Volpara Solutions, Ltd Shareholder, Volpara Solutions, Ltd Shareholder, Hologic, Inc
- Brandi Tamara Nicholson MD : Stockholder, Hologic, Inc

**TEACHING POINTS**

The purpose of this exhibit is:

1. Discuss why fibrous and spindle cell lesions have overlapping pathology.
2. Provide tools to improve communication between Radiologists and Pathologists to best diagnose breast masses.
3. Review management for fibrous and spindle cell lesions.

**TABLE OF CONTENTS/OUTLINE**
Present cases of fibrous and spindle breast lesions undergoing image guided biopsy

1. Misdiagnosed sclerosed fibroadenoma as malignancy
2. Sarcomatoid carcinoma
3. Pseudoangiomatous stromal hyperplasia (PASH)
4. Lymphocytic mastopathy
5. Myoepithelial proliferation

Review imaging and pathology findings in a case-based format with discussion of significant mimickers

Discuss how to best determine concordance following biopsy with focus on the following:

1. Communication between radiology and pathology
2. Confidence in accuracy of biopsy
3. Histology interpretation by pathologist
4. Image review with pathology results by radiologist

Summarize recommendations for improved teamwork between Radiologist and Pathologist as well as management of the breast lesions

**BRE215**

**The Sternum—A New Review Area in the Imaging of Breast Carcinoma**

*Education Exhibits*

*Location: BR Community, Learning Center*

**Participants**

Lucy Jane Wilding MBBS, FRCR (Presenter): Nothing to Disclose

Ying Chen MBBS: Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is to illustrate the appearances of metastatic disease to the sternum in breast carcinoma. Increasingly we are finding bony disease involving the sternum following invasive breast carcinoma, often as a solitary site of secondary disease. We will demonstrate the range of appearances of lytic and sclerotic bony metastases on Computed Tomography. Cases will also include metastases detected on dynamic breast Magnetic Resonance Imaging. Nuclear medicine examples will include uptake on bone scan as well as subtle uptake on PET scan, occult on other forms of imaging. Histological correlation is provided in cases of isolated disease where core biopsy or fine needle aspiration cytology was obtained. The importance of reviewing this possibly overlooked area on routine staging and surveillance imaging is emphasized.

**TABLE OF CONTENTS/OUTLINE**

- The incidence and pathophysiology of sternal metastatic disease in breast carcinoma
- Appearance of sternal metastases on ultrasound, CT, MRI, NM bone scan and PET imaging
- Histological correlation following image guided sampling
- The importance of the sternum as a review area

**BRE216**

**Unusual Suspects: Spectrum of Extramammary Malignant Neoplasms in the Breast with Radiologic-Pathologic Correlation**

*Education Exhibits*

*Location: BR Community, Learning Center*

Certificate of Merit

**Participants**

Sirishma Kalli MD (Presenter): Nothing to Disclose

Michael Lanfranchi MD: Nothing to Disclose

Andrew Alexander MD: Nothing to Disclose

Shital Saurin Makim MD: Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is: 1. To discuss the spectrum of extramammary malignant lesions that can localize to the breast including lymphoma, melanoma, ovarian carcinoma, neuroendocrine tumors, and sarcomas, as the currently literature regarding this topic is sparse. 2. To depict imaging appearances of a variety extramammary breast neoplasms on multiple imaging modalities including mammography, ultrasound, MR, and PET/CT. 3. To correlate radiologic imaging of extramammary breast neoplasms with pathologic diagnoses.

**TABLE OF CONTENTS/OUTLINE**

- Background information including incidence of extramammary malignant neoplasms that can localize to the breast
- A review of specific types of extramammary malignant neoplasms that may be identified by breast imaging including their clinical features
- Present case-based, multimodality depiction of a variety of extramammary malignant neoplasms including melanoma, lymphoma, gastric adenocarcinoma, small cell carcinoma, angiosarcoma, and other rare entities
- Correlation of each case with pathologic diagnoses

**BRE217**

**When All Else Fails Examine The Patient: Clinical Correlates Of Breast Imaging**

*Education Exhibits*

*Location: BR Community, Learning Center*

**Participants**

Quinn Colin Meisinger MD: Nothing to Disclose

Gregory Sean Bernstein MD: Nothing to Disclose

Jade De Guzman MD: Nothing to Disclose
TEACHING POINTS

Many radiologists are attracted to breast imaging because it maintains contact with patients. However, some radiologists who are not involved in breast imaging routinely may be apprehensive about clinically evaluating patients. In breast imaging, it is often necessary to visually examine the patient, and to perform breast clinical exams. To provide clinical photograph correlates to common and some unusual patient clinical presentations; Suggest an algorithm to correlate clinical findings to breast imaging diagnosis; Specifically discuss the management and differential considerations of the inflamed breast; Suggest appropriate referral for patients with negative imaging and persistent clinical findings.

TABLE OF CONTENTS/OUTLINE

Introduction; Clinical appearance and imaging correlates of: Malignancy, infection, nipple discharge, breast reconstruction, radiation changes, post procedural changes, male breast cancer, Paget's disease, locally advanced breast cancer and more; Conclusion

BRE218

When Malignancy in the Breast is not Breast Cancer

Education Exhibits

Location: BR Community, Learning Center

Participants

Kirsten Stafford MBCh, MRCP (Presenter): Nothing to Disclose
Roma Patel MBBS, FRCR : Nothing to Disclose
Tamara Suares MBBS : Nothing to Disclose
Dylan Rame Tsukagoshi MBBS : Nothing to Disclose
Brian Joseph Holloway MBCh : Nothing to Disclose
Anmol A. Malhotra MBBS : Nothing to Disclose

TEACHING POINTS

The incidence of metastases to the breast is low, but has been reported and may be the first sign of malignancy. With increased screening across the world, more patients may present with cancer diagnosed on breast imaging as the primary modality. Furthermore, patients living with a non breast primary malignancy may present with palpable lumps and metasases should be considered. The aim of this exhibit is to raise awareness of the types of malignancy that most commonly metastasize to the breast and to highlight features that may distinguish between them.

TABLE OF CONTENTS/OUTLINE

When masses present in the breast, there are sometimes imaging characteristics which are atypical for breast cancer, yet still suggest malignancy. We present a review of different types of metastases with imaging and histopathological correlation. We have examples of metastases from various modalities: ultrasound, mammography, CT and MRI. Our cases of metastases to the breast include: 1. Melanoma 2. Lymphoma 3. Neuroendocrine tumours 4. Paraganglioma

BRE220

Are Irregular Hypoechoic Breast Masses on Ultrasound Always Malignancies?

Education Exhibits

Location: BR Community, Learning Center

Certificate of Merit

Participants

Yoe Ree Kim MD (Presenter): Nothing to Disclose
Hye-Won Kim MD : Nothing to Disclose

TEACHING POINTS

Irregular hypoechoic masses in breast do not always indicate malignancies. These lesions were assessed as BI-RADS Category 4a-to-4c suspicious malignancy on ultrasonography, resulting in US-guide biopsy. 1. There were many kinds of benign or borderline breast diseases representing irregular hypoechoic masses that can mimic carcinoma on ultrasonography. 2. Careful US examination, history taking, and biopsy could help to differentiate them from malignancies.

TABLE OF CONTENTS/OUTLINE

Benign or borderline breast lesions into 4 groups - Iatrogenic or trauma-related breast lesions Foreign body reaction Fat necrosis Fibrotic scar - Proliferative disease - Benign breast tumors - Inflammation Abscess Idiopathic granulomatous lobular mastitis Diabetic mastopathy Sclerosing adenosis Apocrine metaplasia Fibrocystic change Intraductal papilloma Fibroadenoma

BRE222

Breast Elastography: How We Do It

Education Exhibits

Location: BR Community, Learning Center

Certificate of Merit

Participants

Christina Gkali MD (Presenter): Nothing to Disclose
Athanasios N. Chalazonitis MD, MPH : Nothing to Disclose
Zoi Antoniou BMedSc : Nothing to Disclose
Andromachi Zourla : Nothing to Disclose
Eleni Feida : Nothing to Disclose
TEACHING POINTS

1. To review the technique of both Strain Elastography (SE) and Acoustic Radiation Force Impulse Imaging (ARFI).
2. To suggest an appropriate breast SE and ARFI imaging examination protocol.
3. To demonstrate the elastographic imaging findings in benign and malignant breast lesions.
4. To review the potential elastographic pitfalls.
5. To suggest an appropriate reviewing method.

TABLE OF CONTENTS/OUTLINE

Both benign and malignant breast lesions were examined with SE and ARFI imaging in more than 50 consenting patients and can be displayed in details as a pictorial essay. All cases were paired with cytological or/and histological confirmation. Both SE and ARFI imaging were performed in benign and malignant breast lesions in order to depict the hardness of the examined lesion. SE provides qualitative assessment of the tissue hardness. Strain ratio consist a quantification of this qualitative type of elastography. ARFI imaging is divided into two types: a) Virtual Touch Tissue Imaging (VTI) which provides the relative stiffness in qualitative way in the selected region of interest on a gray scale image and b) Virtual Touch Tissue Quantification (VTQ) which expresses the shear wave speed in solid materials as numeric values and describes quantitatively the hardness of tissue.

BRE223

Breast Ultrasound BI-RADS 5th Edition Lexicon: What's New and How Should We Use It?

Education Exhibits
Location: BR Community, Learning Center

Participants
Emily Lorraine Sedgwick MD (Presenter): Nothing to Disclose
Sarah Louise Moorhead MD : Nothing to Disclose
Tamara Ortiz-Perez MD : Nothing to Disclose
Lilian O. Ebuoma MD : Nothing to Disclose

TEACHING POINTS

Teaching Points: Provide a pictorial review of the ultrasound lexicon in the BI-RADS 5th Edition, with emphasis on the changes in the lexicon, to promote appropriate use of the lexicon.

TABLE OF CONTENTS/OUTLINE

Studies have shown that focused teaching about the BI-RADS lexicon leads to improved appropriate use of the lexicon. Ultrasound images demonstrating the lexicon characteristics will be displayed with the corresponding BI-RADS descriptors. Images depicting the new BI-RADS descriptors (e.g. tissue composition, complex cystic and solid echo pattern) will be shown. A quiz will be provided following the instructive slides to reinforce the appropriate use of the BI-RADS lexicon.

Quiz

BRE224

Cavernous Hemangioma of the Breast: Percutaneous Biopsy is not Always Necessary

Education Exhibits
Location: BR Community, Learning Center

Participants
Erika Magdalena Meisen MD (Presenter): Nothing to Disclose
Maria Florencia Andraca : Nothing to Disclose
Laura Soledad Muscillo MD : Nothing to Disclose
Maria Emilia Diaz : Nothing to Disclose
Florence Pia Sojo : Nothing to Disclose
Eduardo Pablo Eyheremendy MD : Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: The objective of this paper is to describe the clinical and imaging features of cavernous hemangiomas, emphasizing those that allow it to differentiate themselves from angiosarcoma and other breast lesions. The major teaching points of this exhibit are: 1 - Nodules of solid appearance, usually hypo or hyperechoic and slightly heterogeneous. 2 - Classified as cavernous and capillary depending on the size of the vessels. Mixed are more common than pure capillaries. 3 - Usually are extraparenchymal (subcutaneous tissue) while angiosarcomas usually are intraparenchymal. 4 - Unlike angiosarcoma, hemangioma show no flow on color doppler study. The flow inside the vascular structures is too slow to be demonstrated. 5-In mammograms, appears as a circumscribed, round, oval or lobulated, well-defined and high density lesion.

TABLE OF CONTENTS/OUTLINE

Cavernous hemangiomas are benign vascular tumors, usually located in the subcutaneous tissue. Classically, the diagnosis of cavernous hemangioma in adults was percutaneous biopsy, since it could be mistaken for a low-grade angiosarcoma (malignant lesion). However, there are imaging features of cavernous hemangiomas that allow us to differentiate them from angiosarcomas, avoiding unnecessary biopsies.

BRE225

Childhood Hemangiomas in the Breast

Education Exhibits
Location: BR Community, Learning Center

Participants
Maria Florencia Andraca (Presenter): Nothing to Disclose
The aim of this paper is to describe the clinical and imaging characteristics of childhood hemangiomas in the breast. The major teaching points of this exhibit are: 1. Solid nodules with benign clinical features. 2. Ultrasonography they may be echogenic or slightly heterogeneous. 3. They have positive doppler flow in color doppler study, which is the fundamental pillar of this diagnostic entity.

**TABLE OF CONTENTS/OUTLINE**

The childhood capillary hemangiomas are benign vascular tumors that appear in the first months of life and are characterized by an initial proliferative phase and a later phase of regression. They are unusual lesions that may be located in both the breast parenchyma and the subcutaneous tissues surrounding the gland. The most important feature is their tendency to regression. Lesions appear in the first weeks of life, grow for a few months and from the first year of life initiate a regression process leading to the total disappearance of the lesion in 95% of cases. There are ultrasound signs that force us to think about this entity, both in 2D and color doppler study, which correlate with histopathological findings. Treatment is expectant in the first place, unlike breast hemangiomas in adults, in which excision is recommended to avoid being confused with an underlying low-grade angiosarcoma, which invades the subcutaneous tissue.

**BRE226**

**Common Errors in Breast Ultrasound**

**Education Exhibits**

Location: BR Community, Learning Center

**Participants**

Romuald Ferre (Presenter): Nothing to Disclose
Shaza Alsharif MD: Nothing to Disclose
Melanie Theriault MD: Nothing to Disclose
Valerie Blouin MD: Nothing to Disclose
Martine Pare RT: Nothing to Disclose
Benoit Delphin Mesurolle MD: Nothing to Disclose

**TEACHING POINTS**

The goals of the exhibits are: 1. To present and discuss the common errors encountered in breast US 2. Provide tips to limit the errors

**TABLE OF CONTENTS/OUTLINE**

Four scenarios that seem relevant in daily practice will be exposed: 1. Misinterpretation of "benign" appearing lesions (cancers displaying benign features: oval shape, circumscribed margins, hyperechoic echotexture) 2. Inadequate correlations between US / mammogram and US / physical exam 3. Value of a negative breast US 4. Underuse of available US settings particularly in interventional procedures 5. Misleading elastography (technique and results) US is an essential tool for breast imagers. However, challenging situations can lead to misdiagnoses. Through various examples, practical tips and evidence-based algorithms will be proposed in this exhibit for better management of such situations in daily practise.

**BRE227**

**Lessons to Learn in Breast Ultrasound: A Case Based Review. Acceptable and Unacceptable Mistakes**

**Education Exhibits**

Location: BR Community, Learning Center

**Participants**

Irai Santana Oliveira MD (Presenter): Nothing to Disclose
Flavio Spinola Castro MD: Nothing to Disclose
Barbara Helou Bresciani MD: Nothing to Disclose
Luciano F. Chala MD: Nothing to Disclose
Vera Christina Camargo de Siqueira Ferreira MD: Nothing to Disclose
Nestor Barros: Nothing to Disclose

**TEACHING POINTS**

• To acknowledge the importance of ultrasound in breast imaging daily practice: may be problem solving, may outrule malignity, may detect subtle suspicious features • To understand ultrasound is an operator-depandant method: optimal scanning technique and accurate use of available resources is key for an appropriate examination and correct results • To accurately correlate ultrasound with other methods (mammography, MRI, CT): importance of positioning, anatomic landmarks and particular features of the lesion • To learn which mistakes are acceptable and how to avoid the unacceptable ones

**TABLE OF CONTENTS/OUTLINE**

• Breast ultrasound: background and importance in lesion characterization and assessment • Ultrasound technique: equipment, parameters and resources • Ultrasound technique: illustrative cases • Multimodality correlation: what must be regarded for an accurate correlation • Multimodality correlation: illustrative cases • Acceptable and unacceptable mistakes: a case-based review • Conclusion

**BRE228**

**Non-mass Lesion on Breast Ultrasound: Appearance and Significance Radiologists Should Know**

**Education Exhibits**

Location: BR Community, Learning Center
Certificate of Merit

Participants
Youichi Machida MD, PhD (Presenter): Nothing to Disclose
Mitsuhiro Tozaki MD, PhD : Nothing to Disclose
Akiko Shimauchi MD : Nothing to Disclose
Tamiko Yoshida : Nothing to Disclose
Yoshidae Kanemaki : Nothing to Disclose

TEACHING POINTS
1. It is important to recognize "Ultrasound non-mass lesions (U-NML)" on breast ultrasound (US), which will become essential with increase in use of automated breast ultrasound (ABUS) imaging. 2. To detect and count suspicious features of U-NML helps interpreters assess possibility of malignancy.

TABLE OF CONTENTS/OUTLINE
Breast US is reported to detect incremental cancers that are negative on mammography, especially in women with dense breasts. ABUS enables radiologists to evaluate the breast comprehensively using three-dimensional sectional views, in a similar way to MRI. With a rising number of ABUS exams, it will become increasingly important to appreciate US lesions that were observed as non-mass enhancements on MRI. Radiologists will be able to appreciate and evaluate "U-NML" properly after viewing this exhibit containing following topics; 1. U-NML in comparison with mammographic and MRI findings, as well as pathology results: what kind of lesions can appear as non-mass? 2. Categorization of U-NML based on scores of suspicious features.

BRE229
Retro-areolar Lesions in Breast Ultrasound: Pearls and Pitfalls
Education Exhibits
Location: BR Community, Learning Center
Selected for RadioGraphics

Participants
Romuald Ferre (Presenter): Nothing to Disclose
Martine Pare RT : Nothing to Disclose
Lisa Smith : Nothing to Disclose
Shaza Alsharif MD : Nothing to Disclose
Melanie Thenault MD : Nothing to Disclose
Ann Elizabeth Aldis MD : Nothing to Disclose
Benoit Delphin Mesurolle MD : Nothing to Disclose
Pierre-Alain Goumot : Nothing to Disclose

TEACHING POINTS
The goals of the exhibit are: 1. To present and discuss the contributing factors in missed retro-areolar cancers on ultrasound 2. To describe technical challenges, and propose management tips 3. To review the spectrum of retro-areolar lesions

TABLE OF CONTENTS/OUTLINE
1. Technical challenges of retro-areolar lesions: due to lesion position, lesion size 2. Management tips for challenging lesions: frequency, Doppler, elastography 3. Radio-pathologic correlation examples with management recommendations 4. False negatives: how to identify and prevent them US is an essential tool of the breast imager yet the technique remains challenging and imperfect to explore retro-areolar lesions. Challenges include technical considerations related to scanning adequately. Through various examples using Doppler, elastography, this exhibit will offer practical tips to the radiologists as well as propose evidence-based algorithms for the diagnosis of retro-areolar lesions.

BRE230
Right at the Surface: Skin and Superficial Lesions of the Breast
Education Exhibits
Location: BR Community, Learning Center

Participants
Megan Jenkins Kalambo MD (Presenter): Nothing to Disclose
Savitri Krishnamurthy MD : Nothing to Disclose
Sarah DeSnyder MD : Nothing to Disclose
Madeleine Duvic MD : Nothing to Disclose
Victor G. Pretto MD, PhD : Nothing to Disclose
Gary J. Whitman MD : Nothing to Disclose

TEACHING POINTS
Accurate classification and description of skin and superficial lesions of the breast will aid the radiologist in distinguishing benign from suspicious imaging findings that warrant biopsy. In this presentation, we will provide a systematic approach to the evaluation of skin and superficial lesions of the breast on mammography and ultrasound and discuss distinctive imaging features of superficial breast lesions and indications for biopsy.

TABLE OF CONTENTS/OUTLINE
We will present a pictorial essay of our experience with superficial breast lesions at our institution, including management of challenging cases. Knowledge of the imaging features of superficial breast and skin lesions helps to guide appropriate management that includes annual mammography for benign lesions or biopsy for suspicious lesions. 1) Techniques that aid in identifying skin/superficial lesions. 2) Imaging features that aid in distinguishing benign superficial lesions from lesions that warrant biopsy. 3) Appropriate differential diagnoses for benign and malignant superficial lesions Top Differentials: Benign: epidermal inclusion cyst, nevus, hemangioma. Iatrogenic: scar, keloid Malignancy: breast cancer with direct skin involvement, angiosarcoma, metastases Hereditary: neurofibromatosis, steatocystoma multiplex
BRE231

Role of Contrast Enhanced Ultrasound and Shear Wave Elastography for Assessment of Treatment Response to Neoadjuvant Chemotherapy in Breast Cancer – Preliminary Results

Education Exhibits
Location: BR Community, Learning Center

Participants
Brenna Ann Talkin Chalmers MD (Presenter): Nothing to Disclose
Linda Hovanessian-Larsen MD: Nothing to Disclose
Bhushan Desai MBBS, MS: Nothing to Disclose
Darryl Hwang PhD: Nothing to Disclose
Sanamth Delapena: Nothing to Disclose
Sandy Chia-En Lee MD: Nothing to Disclose
Edward G. Grant MD: Research Grant, Bracco Group Research Grant, General Electric Company Medical Advisory Board, Nuance Communications, Inc

TEACHING POINTS
1. To understand the basics of contrast enhanced ultrasound (CEUS) and Shear Wave Elastography (SWE). 2. To investigate the role of CEUS and SWE as a potential response assessment biomarker to neoadjuvant chemotherapy (NAC) in breast cancer by evaluating changes in tumor size, perfusion characteristics, and tissue stiffness before (baseline) and 2-3 weeks post-NAC initiation. 3. To assess the agreement between CEUS and SWE based classification rule and pathologically determined treatment response. 4. To determine the agreement between different imaging modalities (including conventional US, MRI, SWE). 5. To illustrate pictorial cases where CEUS and SWE are useful for therapy monitoring of breast cancer patients on NAC.

TABLE OF CONTENTS/OUTLINE
I. Background and Significance II. Literature review III. Limitations of conventional imaging modalities IV. Clinical utility of CEUS and SWE V. Technical note: Imaging data acquisition methodology (qualitative and quantitative) VI. Evaluating treatment response using different imaging modalities VII. Clinical case examples of studies done at our institution

BRE232

Scary Images: Lipofilling Appearances during Breast Cancer Follow-up Ultrasound

Education Exhibits
Location: BR Community, Learning Center

Participants
Daniel Claudio Mysler MD (Presenter): Nothing to Disclose
Andres Kohan MD: Fellowship funded, Koninklijke Philips NV
Mora Amat: Nothing to Disclose
Fernando Farache: Nothing to Disclose
Veronica Fabiano: Nothing to Disclose
Ricardo D. Garcia-Monaco MD, PhD: Research Consultant, Siemens AG Research Consultant, BTG International Ltd
Federico Colo: Nothing to Disclose

TEACHING POINTS
To review ultrasound imaging findings secondary to lipofilling To understand the impact this technique has on the adequate handling of patients with history of breast cancer To provide a decision tree upon ultrasound findings during the breast oncological control in patients that had a lipofilling treatment

TABLE OF CONTENTS/OUTLINE
- **Procedure:** description of the lipofilling technique
- **Clinical Findings:** during physical examination
- **Pathophysiology:** histopathologic findings, cascade of fat necrosis
- **Ultrasound Findings:** review the different changes that happen in the breast and their visualization in ultrasound.
- **Tips and practical tricks:** which associated ultrasound findings are suspicious for recurrent breast cancer and which ones discard it
- **Radiologic decision-tree**

BRE233

The Breast Imager’s Approach to Non-mammary Masses in the Axilla and Chest Wall during Ultrasound: Scanning Technique, Clues to Origin, and Further Management

Education Exhibits
Location: BR Community, Learning Center

Selected for RadioGraphics

Participants
Matthew Cole Oliff MD (Presenter): Nothing to Disclose
Catherine Streete Giess MD: Nothing to Disclose
Sughra Raza MD: Consultant, Seno Medical Instruments, Inc
Robyn L. Birdwell MD: Nothing to Disclose

TEACHING POINTS
1. To review the anatomy of the chest wall and axilla and to describe optimal ultrasound scanning techniques. 2. To present examples of non-mammary masses encountered during breast and axillary ultrasound with mammographic, CT, and/or MRI correlation. 3. To outline imaging clues to the origin of non-mammary masses and to describe management strategies.

TABLE OF CONTENTS/OUTLINE
1. Review the anatomy of the axilla and chest wall and review the differential diagnosis of lesions in these regions. 2. Demonstrate optimal ultrasound scanning techniques of the axilla to enable the breast imager to properly localize a lesion within the sometimes disorienting region of the axilla. 3. Present cases of ultrasound evident non-mammary masses with mammographic, CT, and/or MRI correlation. 4. Describe clues and pitfalls in the diagnosis of non-mammary masses of the axilla and chest wall. 5. Review management strategies if a mass is thought to be non-mammary in origin.

**BRE234**

**The "Other" Second-Look Ultrasound: Tips and Tricks for the Sonographic Work-up of Architectural Distortions Detected on Tomosynthesis**

*Education Exhibits*

*Location: BR Community, Learning Center*

- Certificate of Merit
- Selected for RadioGraphics

**Participants**

- Mailan Melissa Cao MD (Presenter): Nothing to Disclose
- Fan Yang MD, PhD: Nothing to Disclose
- Heather I. Frimmer MD: Nothing to Disclose

**TEACHING POINTS**

This exhibit will teach participants: - subtle signs of architectural distortion on ultrasound, - troubleshooting techniques in hard-to-find lesions, - benefits and limitations of advanced ultrasound modes such as harmonics, spectral compound imaging, and other automated image optimization tools in the characterization of architectural distortion, - optimal techniques for ultrasound-guided biopsy of architectural distortion.

**TABLE OF CONTENTS/OUTLINE**

1. Indications for ultrasound in the work-up of architectural distortion detected with tomosynthesis
2. Sonographic imaging findings of architectural distortion with tomosynthesis correlation
3. Troubleshooting Techniques: using the parenchymal pattern seen on tomosynthesis to localize the lesion repositioning the patient imaging behind the nipple using advanced ultrasound modes such as harmonics, spectral compound imaging, and power Doppler
4. Techniques for successful ultrasound-guided biopsy of architectural distortion

**BRE236**

**Tumor Phylloides: The Great Ghost**

*Education Exhibits*

*Location: BR Community, Learning Center*

**Participants**

- Maria Florencia Andraca (Presenter): Nothing to Disclose
- Erika Magdalena Meisen MD: Nothing to Disclose
- Laura Soledad Muscillo MD: Nothing to Disclose
- Maria Emilia Diaz: Nothing to Disclose
- Florencia Pia Sojo: Nothing to Disclose
- Eduardo Pablo Eyheremendy MD: Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is: 1- Describe the clinical and imaging characteristics of tumors phylloides, emphasizing those that allow differentiation of fibroadenoma, the main differential diagnosis. 2- Correlate these findings with histopathological diagnosis. The major teaching points of this exhibit are: 1 - Solid nodules with benign clinical features, which usually appear in women aged 40-50 years, with rapid growth. 2 - On mammograms, appear as a well-defined lesion, round, oval or lobulated, circumscribed and with soft tissue density. 3 - Ultrasonography may be heterogeneous with anechoic areas inside. 4 - They can show positive doppler flow in color doppler study.

**TABLE OF CONTENTS/OUTLINE**

The phylloides tumors represent a heterogeneous group of biphasic neoplasms composed of stromal and epithelial components, which may be benign, borderline or malignant. They are unusual tumors constituting from 0.3 to 0.9% of all mammary tumors. The average age of onset is around 40-50 years old. There are ultrasound signs that force us to think about this entity, both in 2D and color doppler study, which correlate with histopathological findings. Definitive diagnosis is histopathological, and full resection with free margins is the main treatment of these lesions.

**EDE001-b**

**Breast Case of the Day**

*Education Exhibits*

*Location: NA*

**Participants**

- Co-Moderator
  - Susan O. Holley MD, PhD Research Consultant, Seno Medical Instruments, Inc
- Co-Moderator
  - Michelle V. Lee MD Nothing to Disclose
  - Evguenia Jane Karimova MD: Nothing to Disclose
  - Matthew S. Clower MD: Nothing to Disclose
  - Rachel Uttech Loomans MD: Nothing to Disclose
  - Hillary Linwen Shaw MD: Nothing to Disclose

**TEACHING POINTS**
1) Identify, characterize, and analyze abnormal findings on multimodality breast imaging studies. 2) Develop differential diagnostic considerations based on the clinical information and imaging findings. 3) Recommend appropriate management for the patients based on imaging findings.

EDE100

Image Interpretation Exhibit in Digital Format

Education Exhibits

Participants

Jeffrey C. Weinreb MD : Nothing to Disclose

TEACHING POINTS

This is the companion electronic exhibit to the Image Interpretation Session, scheduled for Sunday, November 30, 4:00 - 5:45 pm, in Arie Crown Theater. Several of the case histories to be discussed in the Sunday session will be on display electronically beginning Sunday at 8:00 am. After the session concludes, the accompanying discussion for each case will be revealed. The exhibit will remain on display for self-study until 12:30 pm, Friday, December 5.

The learning objectives for this presentation are: 1) Identify key abnormal findings on radiologic studies that are critical to making a specific diagnosis. 2) Construct a logical list of differential diagnoses based on the radiologic findings, focusing on the most probable differential diagnoses. 3) Determine which, if any, additional radiologic studies or procedures are needed in order to make a specific final diagnosis. 4) Choose the most likely diagnosis based on the clinical and the radiologic information.

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


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

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.
**SPSP01B**

**Primera Parte/Part 1**

Moderator: Pablo Riera Ros MD, PhD : Medical Advisory Board, Koninklijke Philips NV Medical Advisory Board, KLAS Enterprises LLC Medical Advisory Committee, Oakstone Publishing Departmental Research Grant, Siemens AG Departmental Research Grant, Koninklijke Philips NV Departmental Research Grant, Sectra AB Departmental Research Grant, Toshiba Corporation

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**SPSP01C**

**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. Anaplastic astrocytomas produce metalloproteases and thus VEGF and PDGF can stimulate angiogenesis resulting in high perfusion with gadolium and ASL. Lastly, 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

**SPSP01D**

**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 actales 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 disease. 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.

**SPSP01E**

**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 breast lesion on MRI 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.

**SPSP01**

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

**SPSP01G**

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.

**SPSP01H**

Segunda Parte/Part II

Moderator: Miguel E. Stoopen MD: Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**ABSTRACT**

N/a

**URL**

www.webcir.org

**SPSP01I**

Musculoesqueletico: Imágenes Avanzadas del Cartílago Articular y "Chemichal Shift" de Médula Osea/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.

**SPSP01J**

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

Luis Antonio Sosa MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**
LEARNING OBJECTIVES

View learning objectives under main course title.

**SPSP01K**

**Próstata: Resonancia Magnética de 3T y PET/CT con Colina/Prostate: 3T MRI and Choline PET/CT**

Daniela Stoisa MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

**Handout:** Daniela Stoisa

http://media.rsna.org/media/abstract/2014/14002966/cap chicago 2014.ppt

**SPSP01M**

**Clausura/Closing Remarks**

Dante R. Casale Menier MD (Presenter): Nothing to Disclose, Pablo Riera Ros MD, PhD (Presenter): Medical Advisory Board, Koninklijke Philips NV Medical Advisory Board, KLAS Enterprises LLC Medical Advisory Committee, Oakstone Publishing Departmental Research Grant, Siemens AG Departmental Research Grant, Koninklijke Philips NV Departmental Research Grant, Sectra AB Departmental Research Grant, Toshiba Corporation, Miguel E. Stoopen MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

**SPOI11**

**Oncodiagnosis Panel: Breast Cancer**

**Special Courses**

AMMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 10:45 AM - 12:15 PM Location: E353C

**Sub-Events**

**SPOI11A**

**Innovations in Breast Cancer Diagnosis and Targeting for Therapy**

Ellen Bachman Mendelson MD (Presenter): Research support, Siemens AG Speakers Bureau, Siemens AG Medical Advisory Board, Quantason, LLC Consultant, Quantason, LLC

LEARNING OBJECTIVES

1) Learn how to sequence multimodality imaging and interventions to provide specific diagnoses and map disease extent as well assess responses to breast cancer therapies.

ABSTRACT

At the conclusion of this presentation, which will provide an update on state-of-the art breast imaging, attendees will learn how to sequence multimodality imaging and interventions to provide specific diagnoses and map disease extent as well assess responses to breast cancer therapies.

**SPOI11B**

**Changing Paradigms of Radiation Therapy in Breast Cancer, Maximizing Tumor Control and Minimizing Toxicity**

Jean Lundberg Wright MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the principles of radiation therapy, including external and brachytherapy and various treatment fractionation and dose schedules. 2) Learn to apply specific imaging modalities and techniques for radiation therapy planning to maximize target coverage. 3) New techniques to reduce dose to normal tissue and novel radiation therapy modalities will be reviewed.

**SPOI11C**

**New Paradigms of Breast Cancer Surgery**

Kelly K. Hunt MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Following this program, participants should have an understanding of the important controversial aspects of coordinated local treatment of breast cancer. 2) Participants will learn different approaches to nodal staging and management of the axilla in patients with positive lymph nodes. 3) They will obtain a better understanding of the pros and cons of neoadjuvant and adjuvant systemic therapies based on breast cancer subtypes.

**SSA01**

**ISP: Breast Imaging (Ultrasound Screening)**

**Scientific Papers**

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**Sun, Nov 30 10:45 AM - 12:15 PM  Location: Arie Crown Theater**

**Participants**

**Moderator**

Wendie A. Berg MD, PhD : Research Grant, Gamma Medica, Inc Research Grant, General Electric Company Equipment support, Gamma Medica, Inc Equipment support, General Electric Company

**Moderator**

Regina J. Hooley MD : Nothing to Disclose

**Sub-Events**

**SSA01-01**

**Breast Imaging Keynote Speaker: State of the Art—Ultrasound for Breast Cancer Screening**

Regina J. Hooley MD (Presenter): Nothing to Disclose

**SSA01-03**

**The Connecticut Experiment Continues: Ultrasound in the Screening of Women with Dense Breasts Years 3 and 4**

Jean M. Weigert MD (Presenter): Stockholder, Tractus Company Limited

**PURPOSE**

To determine if the addition of screening breast ultrasound in women with mammographically normal but dense breasts in the 3rd and 4th year since the legislation was enacted has continued to improve breast cancer detection while demonstrating an improvement in PPV.

**METHOD AND MATERIALS**

The study utilized a retrospective chart review. Data collected included: (1) total number of screening mammograms; (2) total number of dense breast screening ultrasounds; (3) screening ultrasound Breast Imaging Reporting Data System (BI-RADS) code results; (4) biopsy results; and (5) demographic data on women with malignant biopsies. Data was obtained from included sites throughout 2012 and 2013.

**RESULTS**

Data from 2 Connecticut radiology practices with 5 sites was collected. A total of 32230 screening mammograms and 4128 dense breast ultrasounds were performed in year 3 and 27937 screening mammograms and 3330 dense breast ultrasounds in year 4. In year 3, of the screening ultrasounds 148 were BI-RADS 4 or 5, and 13 were found to have a cancer on biopsy. In year 4, there were 52 BI-RADS 4 or 5 ultrasounds and 10 cancers. The rate of detection is 3.1/1000 in year 3 and 3.0/1000 in year 4. The positive predictive value increased from 8.1% in year 3 to 16.1% in year 4. Of the women eligible for the screening ultrasound, 32% and 30% requested the test respectively in years 3 and 4.

**CONCLUSION**

Based on the data collected from these sites, screening breast ultrasound in women with dense breast parenchyma continues to detect mammographically occult malignancy in years 3 and 4 at the same rate as year 1 and 2. The rate of detection remains stable at 3.0/1000. However, the PPV increased in year 4 indicating that the selection of lesions biopsied was more accurate with fewer false positives. Of concern, the number of eligible women who elect to have the additional test remains low at about 30% which is due to several factors including education and cost.

**CLINICAL RELEVANCE/APPLICATION**

Adding screening breast ultrasound in patients with mammographically dense breasts continues to diagnose a significant number of additional cancers in the 3rd and 4th year since the legislation was enacted and the PPV has also improved.

**SSA01-04**

**Impact of Breast Density Notification Law in the Detection of Breast Cancer: Initial 15 Months Experience**

Islamiat O. Ego-Osuala MD (Presenter): Nothing to Disclose, Kristin Elias MD : Nothing to Disclose, Sara Daniel Shaylor MD : Nothing to Disclose, Mariessa Lauren Albert MD, MSc : Nothing to Disclose, Hildegard B. Toth MD : Nothing to Disclose, Linda Moy MD : Nothing to Disclose

**PURPOSE**
To determine the utilization and role of adjunct ultrasound (US) screening examination with the implementation of the breast density notification law.

**METHOD AND MATERIALS**

IRB approved retrospective review of women who underwent a hand held high resolution whole breast US exam performed by one of 11 experienced breast US technologists from Jan 1, 2013 to March 31, 2014. Screening mammogram and US exams were performed at a large academic center and two satellite private practices and evaluated by 1 of 16 breast imaging radiologists. The findings of the screening mammograms were known by the sonographer before the US exam was performed. Repeat scanning for lesions identified by the technologists was performed by the radiologists. The follow up rate, biopsy rates and added cancer detection rates were determined.

**RESULTS**

A total of 42,341 screening mammograms were performed in 36,523 women. Breast density was predominantly fatty in 3980 (9.4%), scattered fibroglandular tissue in 17,106 (40.4%), heterogeneously dense in 17,910 (42.3%) and extremely dense in 3345 (7.9%). Of 3044 women who underwent 3167 screening US exam, 2253 (74%) of women had dense breasts and 1857 (61%) had average risk for breast cancer. Screening US exam was performed within 1 month of the screening mammogram in 80.5% of the cases and 19.0% between 4-6 months from the mammogram. Of 3,167 US exams, 2614/3167 (82.5%) US exams were assessed as BIRADS 1 or 2, 276 (8.7%) as BIRADS 3, 277 (8.7%) as BIRADS 4 or 5. 18 biopsies were cancelled because the lesion was no longer seen or reassessed as benign. Biopsy was performed in 259 lesions, yielding 249 (96.1%) benign results, 5 high-risk lesions and 5 malignancies. Of 249 benign lesions, 109 (43.8%) were complex cyst and 59 (23.7%) were fibrocystic change. Of 10 lesions that underwent surgical excision, 6 were malignancies, 3 IDCs and 3 DCIS, yielding a PPV of 2.32%. 4 of 6 cancers were less than 1cm. 4 of 6 cancers were detected in women with abnormal mammographic finding. Screening US led to an additional cancer yield of 2/ 3167 (0.06%).

**CONCLUSION**

Supplemental whole breast US detects mammographically occult cancers, although our rate is much lower than previous studies.

**CLINICAL RELEVANCE/APPLICATION**

The low PPV of screening US in our study where most women had dense breast tissue and were average risk suggests further studies are necessary to identify the women who may benefit from the exam.

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**SSA01-05 Whole Breast US after Screening Breast Tomosynthesis: Initial Experience**

Vera Lucia Nunes Aguillar MD (Presenter): Nothing to Disclose, Vera Christina Camargo de Siqueira Ferreira MD : Nothing to Disclose, Erica Endo MD : Nothing to Disclose, Carla Basso Dequi MD : Nothing to Disclose, Daniela Gregolin Giannotti MD : Nothing to Disclose, Giovanni Guido Cerri MD, PhD : Nothing to Disclose

**PURPOSE**

to determine performance of whole breast ultrasonography (US) in women who underwent additional breast US during the first year of implementation of breast tomosynthesis (digital mammography - DM - plus tomosynthesis (BT), in a screening population

**METHOD AND MATERIALS**

Prospective study, including 1034 consecutive women, age 35-85 year-old, who underwent screening tomosynthesis for the first time: 2 views DM + 2 views BT of each breast, with sequential reading and consensus arbitration and, subsequently, had physician performed handheld whole breast US, from september/2011 through august/2012.

**RESULTS**

Twenty - six cases were classified as BI-RADS category 4 or 5 by screening BT and 24 were submitted to biopsy with 12 cancers found (4 DCIS and 8 invasive). In subsequent screening US, 09 lesions were classified as BI-RADS category 4, all submitted to FNA of biopsy and one cancer was found: lobular invasive carcinoma, HGI, NH 1, 6 mm, LS negative. Of 13 cancers detected in this screening population, with BT and additional US, 12 could be seen by tomosynthesis (4 DCIS and 8 invasive), while only 7 were detected by US (all invasive). Cancer detection rate was 1.16% (12/1034) with breast tomosynthesis and increased to 1.26% (13/1034), with additional US. Adding US to BT increase the number of biopsies from 26 to 35. PPV3 for US only lesion detection was 1,1 (1/9) compared to 50% for lesions detected by tomosynthesis

**CONCLUSION**

Adding physician-performed handheld US to breast tomosynthesis had a little impact in cancer detection rate and a low overall PPV. Further clinical studies are needed with a large number of women, especially with dense breasts.

**CLINICAL RELEVANCE/APPLICATION**

Screening breast ultrasound

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**SSA01-06 Digital Breast Tomosynthesis (DBT) and Breast Ultrasound (US): Additional Roles in Dense Breasts with Category 0 at Conventional Digital Mammography (DM)**
PURPOSE
To compare the diagnostic performance of DBT and US for the dense breasts with category 0 at conventional DM.

METHOD AND MATERIALS
From December 2012 to March 2013, DBT, breast US and DM were performed in 202 patients. Among them, 156 patients were dense breasts (ACR pattern 3 and 4) and 108 lesions of 108 patients were categorized as BI-RADS 0 (asymmetry, 84; calcifications, 6; asymmetry with calcifications, 18). BI-RADS final assessment for DBT and US were recorded. BI-RADS category 1-3 was considered benign, and BI-RADS category 4 and 5 were considered malignant. Sixty-two lesions underwent biopsy or surgical excision and others had at least 1 year of follow-up data.

RESULTS
Among 108 lesions, 17 (15.7%) were malignant and 91 (84.3%) were benign. Final assessments of US were categorized as follows: category 1 in 5, category 2 in 6, category 3 in 38, category 4a in 34, category 4b in 12, category 4c in 1 and category 5 in 12. For DBT, final assessments were categorized as follows: category 1 in 34, category 2 in 16, category 3 in 24, category 4a in 13, category 4b in 4, category 4c in 3, category 5 in 14. The sensitivity and negative predictive value were 100% for both US and DBT. For US, specificity and positive predictive value were 53.9 and 28.8%. For DBT, specificity and positive predictive value were 81.3 and 50%. Diagnostic accuracy of US and DBT were 61.1 and 84.3%. Benign biopsy rate of DBT (50%, 17/34) was lower than that of US (71.2%, 42/59).

CONCLUSION
For dense breasts, DBT showed better diagnostic performance than breast US. DBT may reduce the benign biopsy rate and short-term follow-up.

CLINICAL RELEVANCE/APPLICATION
DBT is a beneficial method for dense breasts on DM, with reducing unnecessary breast biopsy and short-term follow-up.

Comparison of Breast Digital Tomosynthesis and Full-field Digital Mammography: Ultrasonography Detected Breast Cancer

KYUNG JIN NAM MD (Presenter): Nothing to Disclose, Boo-Kyung Han MD, PhD: Nothing to Disclose, Eun Sook Ko MD: Nothing to Disclose, Ji Soo Choi MD, PhD: Nothing to Disclose

PURPOSE
To compare the diagnostic performance of digital breast tomosynthesis (DBT) with that of conventional full-field digital mammography (FFDM) in a population of screening US-detected breast cancers.

METHOD AND MATERIALS
From January 2013 to June 2013, 865 women underwent both conventional FFDM and DBT imaging. Among them, 84 patients were classified as having screening US-detected cancers, which were initially detected by screening US in asymptomatic patients with negatively interpreted mammography. The cases with retrospectively seen, overt mammographic findings or incomplete datasets were excluded (n = 43). In the rest 41 women with US-detected mammographically occult cancers (hereafter, UDMOCs), three radiologists independently described the lesion type and location of the most actionable findings in both FFDM and DBT with 4-week interval, without knowledge of US findings. The lesion type was divided into: negative, mass, asymmetry, focal asymmetry, calcifications only, single view mass and mass with calcifications. The visibility score from 0 to 2 was given to each case.

RESULTS
Diagnostic performance when sum of visibility scores of three radiologists was equal to or more than score 4 was significantly different between DBT and FFDM (53.6% vs. 26.8%, P=0.013). Among 41 cases, all three readers detected cancers in 11 cases with DBT and 1 case with FFDM and no reader detected cancers in 6 cases with DBT and 16 cases with FFDM. We found significant difference of diagnostic performance between DBT and FFDM in aspect of the individual visibility in two of three radiologists (63.4% vs. 31.7% for reader 1, p=0.005; 43.9% vs. 9.7% for reader 3, p =0.001). The dominant lesion type was “mass” on DBT (50%) and “focal asymmetry” on FFDM (57.1%).

CONCLUSION
This study has demonstrated improved diagnostic performance of DBT compared to FFDM in patients with UDMOCs and increased accuracy for mass characterization of DBT compared to FFDM.

CLINICAL RELEVANCE/APPLICATION
When DBT is added to FFDM, cancer detection and mass characterization could be improved in the interpretation of mammographic abnormalities in women with mammographically occult breast cancer.
**SSA01-08**

**Analysis of Missed Breast Cancers on Prior Screening US of Women Subsequently Diagnosed with Breast Cancers**

Sung Eun Song MD (Presenter): Nothing to Disclose, Nariya Cho MD: Nothing to Disclose, A Jung Chu MD: Nothing to Disclose, Sung Ui Shin MD: Nothing to Disclose, Ann Yi MD, PhD: Nothing to Disclose, Su Hyun Lee MD: Nothing to Disclose, Won Hwa Kim MD, PhD: Nothing to Disclose, Min Sun Bae MD, PhD: Nothing to Disclose, Woo Kyung Moon: Nothing to Disclose

**PURPOSE**

To retrospectively investigate the presumptive reasons for a missed diagnosis on prior screening ultrasonography (US) examinations in women subsequently diagnosed with breast cancers.

**METHOD AND MATERIALS**

Between 2003 and 2011, 230 pairs of US examinations including prior images with negative or benign findings and subsequent images with developed cancers (mean interval, 11.2 months; range, 2-24 months) were found. Mean size of detected cancers was 2.3 cm (range, 0.1 - 8.2 cm) for invasive cancers (n=182) and 2.4 cm (range, 0.3 - 7cm) for DCIS (n=48). Mammographic density, background echotexture, lesion visibility, features on prior US, and reasons for missed diagnoses as well as their actionability were classified by two experienced radiologists in consensus. Differences between visible versus non-visible cases and actionable versus underthreshold findings were compared.

**RESULTS**

Of the 230 prior US images, 32% (74 of 230) had visible findings (mean size on US, 0.8cm; range, 0.2-2.5 cm) correlated with subsequent cancers and 68% (156 of 230) did not. No differences were found in mammographic density (P=0.966) or background echotexture between visible and non-visible cases (P=0.229). Of the 74 visible findings, reasons for missed diagnoses were misinterpretation (41%, 30/74), benign appearance (30%, 22/74), small lesion size < 5mm (9%, 7/74), multiple distracting lesions (8%, 6/74), stability > 24 months (7%, 5/74), or missed core biopsy (5%, 4/74). Fifty-three percent (39/74) of them were classifying as actionable and 47% (35/74) as underthreshold. Actionable findings showed more irregular shape (P <0.001), non-circumscribed margin (P=0.004), non-parallel orientation (P =0.046), and larger lesion size (P =0.049) than underthreshold findings.

**CONCLUSION**

Breast cancer findings on prior screening US are mainly missed due to misinterpretation (41%), benign appearance (30%), small size < 5mm (9%), or multiple distracting lesions (8%).

**CLINICAL RELEVANCE/APPLICATION**

To avoid missing early cancers on screening breast US, close attention should be paid to subtle suspicious findings as well as separate assessment of multiple findings.

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**SSA01-09**

**BI-RADS Differences in Lesion Assessment between Handheld Physician-Performated Whole Breast Ultrasound (HHUS) and Supine Automated Ultrasound (AUS)**


**PURPOSE**

To study equivalence in lesion detection & assessment between HHUS and whole breast AUS, independently interpreted.

**METHOD AND MATERIALS**

From 4/2012 to 2/2014, 505 pts. referred for breast US exams at 2 sites participated in this IRB-approved, HIPAA-compliant prospective study. Physicians performed HHUS with a 18-6 MHz linear transducer using ACRIN 6666 documentation & assigning BI-RADS per lesion of 2 to 6, 1 (normal), or 0 (not seen) when HHUS and AUS were compared. For AUS, a sonographer positioned a wide 14-5MHz transducer for AP, lateral, and medial views. Transverse, coronal, and sagittal views were reviewed at a workstation by a 2nd breast imager blinded to HHUS. AUS and HHUS exams were integrated with clinical, mammography & MRI data. Where AUS and HHUS BI-RADS were different, clinical significance was determined and explanation sought.

**RESULTS**

Age range: 19-92y. 505 pts. had 745 lesions. 87/505(17 %) had different HHUS and AUS lesion BI-RADS. Mismatches were HHUS 0 (not seen) or 1 (negative) and AUS 4 (suspicious) in 29/87(33%); BI-RADS 2 on HHUS and 4 on AUS in 16/87(18%); and 4 on HHUS with 0,1, or 2 on AUS in 26/87(30%). No BI-RADS mismatch resulted in cancer diagnosis. All lesions biopsied were benign. For BI-RADS HHUS 0/1 and AUS 4, many 4's had hypoechoic shadowing artifacts seen on one AUS view, often the lateral. Where HHUS was BI-RADS 2 and AUS 4, oval masses <8mm had indistinct margins on the coronal and transverse views. Most HHUS lesions not seen on AUS were found retrospectively on transverse but not coronal view.

**CONCLUSION**

HHUS and AUS lesion BI-RADS assessments differed in 18%, but no cancers were miscast as benign. For AUS...
success in breast imaging workflow, interpreters may benefit from knowing the AUS appearance of artifacts as well as lesions studied with HHUS.

**CLINICAL RELEVANCE/APPLICATION**

With concern for masking of cancers by dense breast tissue on mammography, a supine automated breast US scanner has been approved by the FDA for supplemental screening, only one of many indications for breast ultrasound. With experience in the similarities and differences between small FOV HHUS and AUS, automated scanners can be useful for diagnostic applications such as detection and follow-up of multiple benign-appearing masses.
PURPOSE
Amino acid transport is upregulated in breast carcinoma. Anti-1-amino-3-[18F]fluorocyclobutane-1-carboxylic acid (anti-3-[18F]FACBC) is a synthetic amino acid analog positron emission tomography (PET) radiotracer which is transported primarily via system ASCT2 and LAT1 amino acid transporters. The purpose of this exploratory study is to characterize anti-3-[18F] FACBC uptake in benign and malignant breast lesions.

METHOD AND MATERIALS
Four women with histologic confirmation of breast carcinoma or about to undergo biopsy for suspected breast carcinoma not currently undergoing therapy underwent 45 minute dynamic anti-3-[18F]FACBC PET-CT. Standardized uptake values (SUVs) within malignant and benign breast lesions as well as the contra-lateral normal breast were recorded at 5-8mins, 17-21mins, 29-32mins and 41-44mins time frames. Findings were validated by histologic and imaging correlation. T-tests were used to examine the significance of difference in the mean SUVmax of benign to malignant lesions as well as to normal breast tissue.

RESULTS
Average age ±SD was 64.25 ± 11.2 years. Average dose ±SD of anti-3-[18F] FACBC injected was 9.8mci ±0.3. There were 7 breast lesions characterized in 4 patients; 3 benign and 4 malignant (Figure 1A and B). Malignant lesions had significantly higher SUVmax compared to benign lesions and normal contra-lateral breast tissue at all time points (Figure 1C). There was no significant difference in the mean SUVmax of benign breast lesions and normal contra-lateral breast at any time point (Figure 1). 

CONCLUSION
Anti-3-[18F] FACBC shows promise in delineating malignant from benign breast lesions and normal breast tissue. Our result may guide the design of larger studies examining its utility in breast cancer detection, staging and restaging.

CLINICAL RELEVANCE/APPLICATION
Anti-3-[18F] FACBC characterization of amino acid transport upregulation may be useful for the diagnosis of breast cancer and to differentiate malignant from benign lesions.

SSA12-04 Diagnostic Value of Diffusion-weighted Imaging in a Simultaneous 18F-FDG PET/MRI Protocol for Whole-body Staging of Female Patients with Pelvic Malignancies

PURPOSE
To evaluate the diagnostic benefit of diffusion-weighted imaging (DWI) in a simultaneous 18F-FDG PET/MRI protocol for whole-body staging of patients with primary or recurrent malignancies of the female pelvis.

METHOD AND MATERIALS
67 patients with primary or a suspected recurrence of a pelvic malignancy were included in our study. All patients underwent whole-body 18F-FDG PET/MRI (Biograph mMR, Siemens) including DWI. Two radiologists separately evaluated the 18F-FDG PET/MRI datasets without DWI followed by a second reading including DWI. After assessment of (1) overall lesion detection, all lesions considered as malignant were evaluated concerning (2) lesion conspicuity (4-point ordinal scale) and (3) diagnostic confidence (3-point ordinal scale). In a second session, the lesion-to-background contrast and diagnostic confidence for PET and DWI was assessed qualitatively. Wilcoxon signed-rank test was applied to assess statistical significance.

RESULTS
A total of 136 primary and recurrent tumor lesions were detected in 58 of the 67 patients. 18F-FDG PET/MRI including DWI revealed an insignificantly minimal higher lesion conspicuity (PET/MRI + DWI: 3.85 ± 0.38; PET/MRI - DWI: 3.88 ± 0.37) and diagnostic confidence (PET/MRI: 2.71 ± 0.57 DWI: 2.77 ± 0.50) in comparison to PET/MRI without DWI. Furthermore, the lesion-to-background contrast revealed significantly higher values for PET (3.82 ± 0.43) in comparison to DWI (3.57 ± 0.80) with a significantly higher diagnostic confidence (PET: 2.70 ± 0.58; DWI: 2.51 ± 0.68) for malignancy (p < 0.01).

CONCLUSION
DWI in PET / MRI does not provide a diagnostic benefit for whole-body staging of female patients with pelvic malignancies. Regarding the advantages of PET in comparison to DWI in the delineation and characterization of tumor lesions, DWI should be questioned as an integral part of PET / MRI protocols for whole-body tumor staging.

CLINICAL RELEVANCE/APPLICATION
The omission of DWI in whole-body tumor staging of pelvic malignancies may lead to a significant reduction of
Pharmacodynamic Imaging of Estrogen Receptor Guides Dosing of Fulvestrant

Pedram Heidari MD (Presenter): Nothing to Disclose, Francis Deng BA: Nothing to Disclose, Shadi A. Esfahani MD, MPH: Nothing to Disclose, Alicia Leece: Nothing to Disclose, Umar Mahmood MD, PhD: Research Grant, Sabik Medical Inc

PURPOSE

Fulvestrant, an estrogen receptor degrader, is now widely used in management of breast cancer (BrCa). Currently, there are no methods to optimize treatment dosing of fulvestrant. This study assesses the utility of pharmacodynamic imaging using 16Α-[18F]-fluoroestradiol (18F-FES) in dose optimization of fulvestrant in a preclinical model of ER+ BrCa.

METHOD AND MATERIALS

MCF7 cells (ER+) were incubated with different doses of fulvestrant for 24 h. Retention of 18F-FES was measured and compared to ER protein expression (ELISA) and ESR1 mRNA transcription (qPCR). MCF7 tumors were grown in ovariectomized nude mice. The mice were randomly assigned to vehicle, low- (0.05mg), medium- (0.45mg) or high-dose (5mg) treatment groups (n=5-7). Two days after fulvestrant treatment, PET/CT was performed using 18F-FES and 18F-FDG. ER expression was assayed by immunohistochemistry (IHC), ELISA, and qPCR on xenografts. Tumor proliferation was assessed using Ki-67 IHC.

RESULTS

In vitro, fulvestrant was equipotent at reducing 18F-FES uptake as ER protein expression, despite stimulating mRNA transcription severalfold. In xenografts, ER expression significantly decreased with fulvestrant treatment in a dose-dependent manner both in ELISA of tumor lysates and IHC staining, despite similar mRNA expression. No difference in Ki-67 staining was observed among the treatment groups. We observed a significant dose-dependent reduction of 18F-FES PET SUVmean with fulvestrant treatment, but no significant difference among the treatment groups in 18F-FDG PET parameters.

CONCLUSION

We demonstrated that 18F-FES uptake mirrors the dose-dependent changes in functional ER expression with fulvestrant treatment, which precedes the changes in tumor metabolism and proliferation. Pharmacodynamic imaging of estrogen receptor may be useful for tracking early efficacy of ER degradation and guiding ER-targeted therapy dosing in BrCa patients.

CLINICAL RELEVANCE/APPLICATION

precise anti-ER dosing in individual patients using pharmacodynamic imaging of ER may improve therapy response

18F-Fluoroethylcholine PET/CT in Endometrial and Cervical Tumors: First Experience and Comparison with 18F-FDG PET/CT and DW-MRI

Tara Diane Barwick MBChB (Presenter): Nothing to Disclose, Nishat Bharwani MBBS, FRCR: Nothing to Disclose, Sameer Khan MBBS: Nothing to Disclose, Marc Eric Miquel PhD: Nothing to Disclose, Andrea Grace Rockall MRCP, FRCR: Nothing to Disclose

PURPOSE

1. Prospective evaluation of 18F-fluoroethylcholine (FEC) PET/CT in the detection of cervical and endometrial tumors 2. Degree of correlation with 18F-FDG PET/CT and whole tumor ADCmean (mean apparent diffusion co-efficient) on diffusion weighted (DW-) MRI

METHOD AND MATERIALS

Sub-group analysis of patients prospectively recruited to the multi-centre MAPPING study (Eudra CT:2011-001290-78). Preliminary findings of 15 patients with surgically staged endometrial (n=6,FIGO stage 2-4B) and cervical cancer (n=9,FIGO stage 1B1-2B). The endometrial tumors were 5 endometrioid adenocarcinomas (grades 1 and 2) and 1 clear cell carcinoma. The cervical tumors were 4 squamous cell carcinomas (SCC), 3 adenosquamous tumors, 1 adenocarcinoma and 1 undifferentiated tumor. Each patient underwent DW-MRI, FDG and FEC PET/CT. The PET/CT studies were performed on consecutive days. The time interval between DW-MRI and first PET/CT was 0-17 days. 4 cervical cancer cases (all SCC) were excluded as the primary tumor was excised at cone biopsy leaving 11 for analysis. The correlation between tumor grade, FDG SUVmax, FEC SUVmax and ADCmean of the primary tumor were determined.

RESULTS

There were no adverse effects documented following the FEC administration. The primary tumor was visualized in 10/11 cases on FEC PET/CT and on all FDG PET/CT and DW-MRI studies. Mean SUVmax FEC (7.2±3.8) was significantly lower than mean SUVmax FDG (16.6±10.7;p=0.005) but there was a positive correlation between values (r=0.78). There was no correlation between ADCmean and FEC or FDG SUVmax (r=-0.35 and -0.24 respectively). When comparing high (G3) with low grade (G1+2) tumors there was a significant difference in whole tumor ADCmean (p=0.004) but no significant difference demonstrated in FEC or FDG SUVmax (p=0.25 & 0.28 respectively).

CONCLUSION

FDG PET/CT has been disappointing in staging early endometrial and cervical tumors. We have evaluated 18F-FEC, an alternative tracer which is effective in prostate cancer staging. Preliminary results show imaging of endometrial and cervical cancers with 18F-FEC is feasible. There is positive correlation with FDG uptake but in general tumor FEC SUVmax is lower than FDG SUVmax.
Preliminary results suggest that imaging of primary endometrial and cervical cancers with 18F-fluoroethylcholine PET/CT is feasible. Further evaluation is now required to assess staging accuracy.

**A Novel PET Probe for Imaging HER3 Receptor Status**

**Eric Wehrenberg-Klee MD (Presenter): Nothing to Disclose, Nafize Selcan Turker PhD: Nothing to Disclose, Pedram Heidari MD: Nothing to Disclose, Umar Mahmood MD, PhD: Research Grant, Sabik Medical Inc, Bryan Chang: Nothing to Disclose**

**PURPOSE**

HER3 is a surface receptor tyrosine kinase that plays an important role in pro-oncogenic signaling pathways. The receptor is expressed at low-copy number, which is potentially limiting for PET probe development. We developed an antibody-based PET probe specific for HER3, characterized if in vitro, and successfully image HER3 expressing xenografts. We demonstrate that the ability to image this low-expression surface protein is time-dependent, and is related to internalization of receptor-probe complex.

**METHOD AND MATERIALS**

64Cu-DOTA-HER3 F(ab')2 was prepared from whole HER3 monoclonal antibody with F(ab')2 fragmentation and chelator conjugation, and its affinity for HER3 assessed using radio-labeled binding studies. HER3 surface-expression on multiple cell lines was confirmed using fluorescent-activated cell sorting (FACS). Probe internalization kinetics were determined by conducting cell uptake studies at both 4°C and 37°C. Results of cell uptake studies were correlated with geometric mean FITC signal obtained from FACS. In vivo PET-CT imaging with 64Cu-DOTA-HER3 F(ab')2 was conducted using mouse xenografts of MDA-MB 468 and HCC 70 tumors (n=3 for both groups).

**RESULTS**

The HER3 PET probe demonstrates a HER3 Kd of 6.8 nM. FACS confirmed HER3 expression of approximately 200 receptors per cell across multiple lines. Cell uptake studies demonstrate counts/minute/cell of 0.28, 0.45, 0.82 for MCF-7, HCC-70, and MDA-MB-468 cells, respectively after 1 hour. Time course studies demonstrate linear increase of HER3 probe uptake over time at 37°C but not at 4°C that correlates with findings on FACS. In vivo imaging with the HER3 PET Probe of MDA-MB-468 and HCC70 tumor xenografts demonstrate SUVs of 0.35 and 0.95, with TBRs of 6.0 and 11.4 respectively.

**CONCLUSION**

We have developed a HER3 specific PET probe, and demonstrate successful in vivo imaging of HER3 expressing xenografts. We demonstrate that imaging of a low-expression surface protein is possible, and is dependent upon internalization of the receptor-probe complex. These findings have relevance for the development of PET probes for imaging of low-expression receptors of clinical interest.

**CLINICAL RELEVANCE/APPLICATION**

The developed HER3 PET probe has utility for measuring HER3 expression levels on cancers, which is thought to be a primary mediator of resistance to HER2 inhibition.
PET/MR imaging of treated breast cancer is feasible and provides diagnostic image quality in the assessment of possible local recurrent disease as well as metastases. PET/MR did not under-stage any patient when compared to PET/CT and provided the correct diagnosis for all 11 discordant cases (95% binomial upper confidence limit 0.24)

**CLINICAL RELEVANCE/APPLICATION**

PET/MR might represent an innovative and valid tool for accurate follow up of breast cancer patients.

**Multimodal Magnetic Resonance and Near Infrared-Fluorescent Imaging of Intraperitoneal Ovarian Cancer Using a Dual-Mode, Dual-Gadolinium Liposomal Contrast Agent**

Murali Ravoori: Nothing to Disclose, Sheela Singh: Nothing to Disclose, Rohan Bhavane PhD: Nothing to Disclose, Bahman Anvari PhD: Nothing to Disclose, Ananth Annapragada PhD: Stockholder, Marval Pharma Ltd Stockholder, Alzea Biosciences LLC Stockholder, Sensulin LLC Stockholder, Abbott Laboratories Stockholder, Johnson & Johnson, Vikas Kundra MD, PhD (Presenter): License agreement, Introgen Therapeutics Inc, James Bankson PhD: Nothing to Disclose

**PURPOSE**

To assess whether a dual-mode, dual-Gadolinium (DM-Dual Gd) liposomal contrast agent can be used to visualize intraperitoneal ovarian tumors by multimodal magnetic resonance (MR) and near infra-red (NIR) imaging.

**METHOD AND MATERIALS**

DM-Dual Gd was manufactured based on the Dual Gd format for MR, with gadolinium molecules on the surface and within the lumen of the liposome to increase relaxivity, and the NIR agent indocyanine green (ICG) within the lumen. Phosphorus (P) and Gd content were measured by ICP-AES. Female nude mice bearing intraperitoneal Hey A8 human ovarian cancer tumors were injected IV with or without DM-Dual Gd (n=6). Two days later, the animals were imaged by T1-weighted MR. Afterwards, NIR imaging of open abdomen and excised tumors/organs was performed. Signal to noise ratio (SNR) was used to compare tumor enhancement by MR and radiant efficiency to compare tumor signal by NIR imaging. For robustness, experiments were repeated using a second human ovarian cancer (OVCAR-3) model.

**RESULTS**

Gd content was 60.34 mM and P content was 29.44 mM resulting in a Gd/P ratio of 2.05 per particle. On T1-weighted MR images, intraperitoneal ovarian tumors (HeyA8 or OVCAR3) enhanced compared to control tumors two days after DM-dual Gd injection (SNR, p<.05). As seen in the laparotomy and excised tumors views, HeyA8 or OVCAR3 tumors from animals injected with DM-dual Gd had increased fluorescence compared to control tumors (p<.05).

**CONCLUSION**

DM-Dual Gd can be used to visualize intraperitoneal ovarian tumors by MR and NIR imaging in pre-clinical intraperitoneal ovarian cancer mouse models.

**CLINICAL RELEVANCE/APPLICATION**

Nearly 75% of patients with ovarian cancer present with intraperitoneal disease; and, the degree of cytoreduction at surgery is one of the most important factors for prognosis. Current imaging is limited in detecting peritoneal disease and surgery relies on the naked eye to identify nodules for resection. The current findings suggest clinical potential for using a single injection of a single nanoparticle (DM-Dual Gd) to localize tumor by MR for pre-surgical planning and by NIR at the time of surgery for resection.
PURPOSE

To evaluate the diagnostic performance of lesion-to-fat elasticity ratio (Eratio) according to the location of the reference area in shear-wave elastography (SWE) for the diagnosis of breast cancers.

METHOD AND MATERIALS

A total of 257 breast masses in 250 women who underwent SWE before core biopsy or surgery from February 2013 to August 2013 were retrospectively analyzed. For each mass, multiple quantitative Eratios were measured with a fixed region of interest (ROI) for the mass along with multiple ROIs for the surrounding normal fat in different locations. Logistic regression analysis with random effect was used to determine that Eratio was independently associated with breast cancers considering the location of ROI for the fat (depth, laterality, the actual or vertical distance from lesion, and the actual or vertical distance from the ROI of lesion). Quantitative mean (Emean) and maximum (Emax) elasticity values of the reference fat were divided into 4 groups according to their 25th percentile, median, and 75th percentile. Diagnostic performance of each group was evaluated using the area under the ROC curve (AUC).

RESULTS

At logistic regression analysis, Eratio showed a significant difference between benign and malignant lesions (P<0.0001), irrespective of the location of ROI for the fat (depth, laterality, the actual or vertical distance from the lesion, and the actual or vertical distance from the ROI of lesion). The 25th percentile, median, and 75th percentile of elasticity values of fat were 11.5 kPa, 16.9 kPa, and 25.3 kPa for Emean and 16.3 kPa, 24.7 kPa, and 35.7 kPa for Emax, respectively. The AUC of each group (<25th percentile, 25th percentile~median, median~75th percentile, and ≥75th percentile) was 0.973, 0.982, 0.967, and 0.954 for Emean and 0.977, 0.967, 0.966, and 0.957 for Emax, respectively. There was no significant difference in AUC among different 4 groups.

CONCLUSION

Eratio was independently associated with breast cancers when considering the location of the reference area. Eratio showed good diagnostic performance which was not influenced by the difference in elasticity value of reference fat.

CLINICAL RELEVANCE/APPLICATION

Eratio in SWE can be expected to reduce the effect of precompression. Eratio was useful for the diagnosis of breast cancers with good performance independent of the location of reference area.

BRS238

Tumor Stiffness on Sonoelastography and the Risk of Recurrence in Early Breast Cancer Patients (Station #2)

Ann Yi MD, PhD (Presenter): Nothing to Disclose, Woo Kyung Moon: Nothing to Disclose

PURPOSE

To evaluate whether the breast cancer stiffness according to the immunohistochemistric (IHC) subtypes is associated with the risk of recurrence in early breast cancer patients.

METHOD AND MATERIALS

Between January, 2006 and December, 2009, 164 consecutive women (mean age 50.5 years; range 27 - 78 years) who underwent ultrasound (US), sonoelastography and surgery for clinically T1-2 (mean US size 2.1 mm; range 5 - 40 mm), N0 breast cancers. Prospectively recorded elasticity scores of tumor (EST) were correlated with histopathology including IHC subtypes (luminal [ER+ and/or PR+], HER2 [ER- and PR-, HER2+], triple negative [ER-, PR-, and HER2-]) using Fisher’s exact test. Cox proportional hazards model was used to calculate adjusted hazard ratio (HR) of EST for recurrence after controlling for clinico-pathologic variables including age, menopausal status, tumor size, tumor histology, nuclear grade, nodal status, lymphovascular invasion status, resection margin status, surgery type, and adjuvant treatment. Recurrence-free survival (RFS) outcomes estimated by Kaplan-Meier curve were compared between low EST (scores 1, 2, and 3) and high EST (scores 4 and 5) groups using log-rank test.

RESULTS

Among 164 patients, 116 (70.7%) had luminal, 14 (8.5%) had HER2, and 34 (20.7%) had triple negative tumors. The mean value of ESTs were significantly different between IHC subtypes (4.22±0.94 in luminal, 3.71±0.99 in HER2, 3.82±0.99 in triple negative; P = .036), whereas recurrence rates were not (2.6% [3/116] in luminal, 14.3% [2/14] in HER2, 5.9% [2/32] in triple negative; P = .108). At multivariate cox analysis, high EST was independently associated with worse RFS outcome (HR, 1.63; P = .032) in luminal subtype, whereas were not in HER2 (HR, 1.36; P = .696) and triple negative (HR, 0.75; P = .677) subtypes. 77 patients with luminal high EST tumors had 1.5 times (log rank, 1.51; P = .022) worse RFS outcome than 39 patients with luminal low EST tumors.

CONCLUSION

High elasticity score of luminal breast cancer might be a risk factor of recurrence in clinically T1-2, N0 breast cancer patients.
Do Women with an Abnormal Sonographic Axillary Lymph Node and no Breast Malignancy Need a Biopsy? (Station #3)

Yoav Amitai MD (Presenter): Nothing to Disclose, Tehillah Menes MD: Nothing to Disclose, Orit Golan MD, PhD: Nothing to Disclose

PURPOSE

Abnormal axillary lymph nodes on ultrasound are not a rare finding. We examined clinical and imaging characteristics, in order to define patients who may safely be followed.

METHOD AND MATERIALS

Clinical, imaging and pathology data were collected for 167 consecutive patients who underwent sonographic guided needle biopsy of an abnormal lymph node between 2008 and 2013. Malignancy rates were examined for different clinical settings: palpable axillary mass; history of breast cancer; findings suggestive of a systemic disease; and those with a breast finding of low suspicion or an incidental abnormal axillary lymph node. Patients with known breast cancer and those with a highly suspicious breast mass were excluded.

RESULTS

Thirteen patients (8%) were found to have a malignant result (10-carcinoma; 2-lymphoma; 1-malignant spindle cell tumor). Malignancy increased with age (Mean age in those with benign pathology was 54 vs. 69 in malignancy, P<0.001). Malignancy rates varied with clinical setting; Axillary mass (8, 26%); history of breast cancer (2, 11%); systemic disease (0%) and breast finding of low suspicion or incidental abnormal lymph node on screening (1, 1%). Malignancy was associated with lymph node size and cortical thickness. Low rates of malignancy were found when the cortex was<6mm (1, 0.8%). The most important imaging finding associated with malignancy was the lack of a preserved hilum, in which case almost a third (11, 31%) of the biopsies were malignant.

CONCLUSION

Only 1 of 85 women with a breast finding of low suspicion or an incidental abnormal axillary lymph node, was found to have malignancy. In this case the lymph node had no hilum. In women without breast cancer or a highly suspicious breast mass, more stringent criteria should be used when evaluating an abnormal axillary lymph node on sonography, as the malignancy rates are very low (1%).

CLINICAL RELEVANCE/APPLICATION

In women being evaluated for breast findings, such as a low suspicion breast mass, and in those undergoing screening studies, the finding of an abnormal axillary lymph node does not usually require a needle biopsy as long as the lymph node has a preserved hilum and cortical thickness is under 6mm.
were benign. 80/99 (81%) of cases were assigned a BI-RADS 2, 3, or 4A final assessment by at least one reader. If the lower BI-RADS score was used and these lesions were not biopsied, the PPV would have increased to 37.5% and one case of DCIS would have been downgraded to BI-RADS 3.

CONCLUSION
Retrospective blinded review showed many BI-RADS 4 lesions detected on SBUS have benign features and biopsy could probably have been avoided. Most cancers detected on SBUS have suspicious US features and are correctly identified by radiologists. Solid masses detected on SBUS require careful evaluation and may benefit from double reading in order to improve specificity.

CLINICAL RELEVANCE/APPLICATION
Screening breast US is being more widely performed in the United States. Strategies are needed to improve overall diagnostic performance and decrease false positive biopsies.

BRE169

Tilting the Atlas: A Discussion of the Changes between the 4th and 5th Editions of BI-RADS (Station #5)

Sadia Choudhery MD (Presenter): Nothing to Disclose, Stephen Jacob Seiler MD: Nothing to Disclose

TEACHING POINTS
1) Provide an overview of the changes recently implemented in the 5th edition of the Breast Imaging-Reporting and Data System (BI-RADS). 2) Present a variety of cases to highlight the changes in the reporting of mammography, breast ultrasound, and magnetic resonance imaging.

TABLE OF CONTENTS/OUTLINE
1) Mammography: • Removal of percentages from breast composition • A lobular mass is now oval • Isodensity re-termed equal density • Developing asymmetry added • Calcifications are benign or suspicious, without "intermediate" or "high" probability of malignancy • Eggshell calcifications encompassed by rim calcifications • Clustered calcifications re-termed grouped 2) Ultrasound: • Inclusion of tissue composition • A lobular mass is now oval • Re-categorization of margins to circumscribed and not circumscribed • Description of breast elasticity 3) MRI: • Non-mass-like enhancement re-termed non-mass enhancement (NME) • A lobular mass is now oval • Mass margins reclassified into circumscribed and not circumscribed • Internal enhancement of a mass no longer includes enhancing septations and central enhancement • Ductal enhancement now incorporated into linear distribution of NME • Internal enhancement of NME no longer includes reticular/dendritic and stippled/punctate but clustered ring has been added 4) Uncoupling of assessment and management recommendation.

BRE109

Pre-Operative Image Guided Breast Lesion Localization - A Pictorial Review of Technique (Station #6)

Katrina Fern Lambert MD (Presenter): Nothing to Disclose, Lucy Boyd Spalluto MD: Nothing to Disclose, Erin Wyatt Kinney MD: Nothing to Disclose

TEACHING POINTS
To review indications and technique for image guided pre-operative breast lesion localization, including mammographic and sonographic guidance techniques and both standard wire localization and radioactive seed placement.

TABLE OF CONTENTS/OUTLINE
I. Review indications for wire localization
II. Illustrate technique for mammographic and sonographic guidance for wire localization with detailed photographs and diagrams to include:
1. Documenting patient history and confirming appropriate indication for procedure
2. Obtaining informed consent
3. Tray set up and needle/wire demonstration
4. Positioning patient appropriately and pre-procedural imaging
5. Needle/wire placement
6. Post-procedural imaging
7. Discussion of necessary information to relay to surgeon
III. Illustrate technique for mammographic and sonographic guided radioactive seed placement with detailed photographs and diagrams to include:
1. Documenting patient history and confirming appropriate indication for procedure
2. Obtaining informed consent
3. Tray set up and radioactive seed deployment device demonstration
4. Positioning patient appropriately and pre-procedural imaging
5. Seed placement
6. Post-procedural imaging
7. Discussion of necessary information to relay to surgeon
8. Discussion of management of radioactive material

**BRE107**

Mastering the Challenges of MRI-guided Breast Interventions; MRI-guided Biopsy and Beyond (Station #7)

Lumarie Santiago MD (Presenter): Nothing to Disclose, Mohammad Eghtedari MD, PhD: Nothing to Disclose, H. Carisa Le-Petross MD: Nothing to Disclose

**TEACHING POINTS**

1. Review of various types MRI guided breast interventions and their indications
2. Review the technical aspects and step by step planning of MRI guided breast biopsy
3. Describe alternate techniques for challenging MRI guided interventions and how to anticipate their utilization
4. Understanding alternate techniques that may help the radiologist troubleshoot difficult cases and prevent false negative biopsies or potential surgical biopsies

**TABLE OF CONTENTS/OUTLINE**

We will present a pictorial essay of our experience performing MRI guided breast interventions over the last 10 years, including management of challenging cases
1. Variable appearance of the target lesion between the diagnostic and the intervention breast MRI
2. Planning schematics generated for MRI guided interventions with and without CAD
3. When MRI guided needle localization and bracketed needle localization are indicated
4. When MRI guided marker clip placement is indicated
5. Alternate techniques addressing challenging interventions due to lesion location, presence of breast implants, multiplicity and bilateralities of lesions
6. Determination of sampling adequacy and false negatives
7. How to address clip deployment failures or migration

**BRE110**

Radioactive Seed Localization: Why to Start a Program, the Pros and Cons of RSL vs. Wire Localization of Non Palpable Breast Lesions, How To Start a Program and How To Perform Radioactive Seed Localizations under Mammographic and Ultrasound Guidance (Station #8)

Laurie R. Margolies MD (Presenter): Consultant, FUJIFILM Holdings Corporation Consultant, Konica Minolta Group, Janet R. Szabo MD: Consultant, Siemens AG Consultant, FUJIFILM Holdings Corporation Consultant, Konica Minolta Group, Emily B. Sonnenblick MD: Nothing to Disclose, Elisa Port MD: Nothing to Disclose, Jacob Kamen PhD: Nothing to Disclose

**TEACHING POINTS**

1. Radioactive seed localizations are a relatively new way of localizing imaging detected breast abnormalities requiring surgical excision. They are often more convenient for the patient as well as physicians as the surgeon and radiologists schedules are uncoupled. Radioactive seed localizations also uncouple the surgeon's and radiologists pathway and multiple studies have shown a decrease in positive margin rate with seed localizations. The localization procedure is easy for the radiologist to learn. At the conclusion of this presentation the viewer will be familiar with the concept of radioactive seed localization and its pros and cons.

**TABLE OF CONTENTS/OUTLINE**

A. Why to consider setting up a radioactive seed localization program
B. Ins and outs of beginning a radioactive seed localization program: regulatory requirements
C. Mammographic localization
D. Ultrasound localization
E. What can go wrong, how to prevent and what to do if there is loss of a seed or transection of a seed.

**BRE159**

Blind Spots and Pitfalls in Breast Imaging (Station #9)

Rebecca Rakow-Penner MD, PhD: Nothing to Disclose, Jade De Guzman MD (Presenter): Nothing to Disclose, Youn Jeong Kim MD: Nothing to Disclose, Ifeanyi C. Onyeacholem MD: Nothing to Disclose, Haydee Ojeda-Fournier MD: Nothing to Disclose

**TEACHING POINTS**

1. Differentiate perceptual versus cognitive errors in radiology
2. Review blind spots and pitfalls for screening and diagnostic exams on mammography, US and MRI with imaging correlation
3. Provide an algorithmic approach/checklist for reading screening and diagnostic mammograms, breast US and breast MRI
4. Test your knowledge with imaging case review in multiple choice format

**TABLE OF CONTENTS/OUTLINE**

Many radiologists, specifically those without breast imaging fellowship training, are apprehensive about reading breast imaging exams due to medical legal notoriety. That being said, most breast imaging exams in the United States are still interpreted by radiologists without dedicated breast imaging training. This educational exhibit will review specific "blind spots" and common pitfalls on routine breast imaging. It will also provide a checklist for reading mammograms, breast US and breast MRI and provide an opportunity for self-assessment.

1. Introduction
2. Errors in detection v. errors in interpretation
   a) limited detection secondary to technical factors
   b) patient factors
   c) human factor
3. Blind spots by a) mammogram
4. US and c) dynamic contrast enhanced breast MRI
5. Algorithmic approach to prevent missed cancer
6. Interactive multiple-choice case review
Lesion Stiffness Measured by Shear-wave Elastography: Preoperative Predictor of the Histologic Underestimation of US-guided Core Needle Breast Biopsy (Station #1)

Ah Young Park MD : Nothing to Disclose, Ji Hyun Youk MD : Nothing to Disclose, Eun Ju Son MD, PhD : Nothing to Disclose, Hye Mi Gweon MD : Nothing to Disclose, Jeong-Ah Kim MD, PhD : Nothing to Disclose, Dahye Lee (Presenter): Nothing to Disclose

PURPOSE

To determine whether lesion stiffness measured by shear-wave elastography (SWE) could be used to predict the histologic underestimation of ultrasound (US)-guided 14-gauge core needle biopsy (CNB) for breast masses.

METHOD AND MATERIALS

This retrospective study enrolled a total of 99 breast masses including 40 high-risk lesions and 59 DCIS which were diagnosed at US-guided CNB and excised surgically. SWE was performed for all breast masses to measure quantitative elasticity values. To identify the preoperative factors associated with the histologic underestimation, patient age, symptom, lesion size, B-mode US findings, and quantitative SWE parameters were compared between the upgrade group and the non-upgrade group and estimated the predictive power for underestimation of each variable using univariate and multivariate logistic regression.

RESULTS

The overall underestimation rate was 28.3% (28/99) and the underestimation rate of high-risk lesion (ADH, phyllodes tumor and other atypia) and DCIS was 25.0% (57.1%, 16.7%, and 20.0%) and 30.5%, respectively. Lesion size was larger (16.0 vs 10.0 mm, p=.016) and BI-RADS category was higher (p=.030) in the upgrade group than in non-upgraded group. The medians of all elasticity values of the upgrade group were significantly higher than those of the non-upgrade group (p<.0001): mean (Emean), 133.1 vs 57.4 kPa; maximum, 151.1 vs 66.6 kPa, minimum, 103.1 vs 43.6 kPa; the lesion-to-fat ratio, 7.8 vs 4.6. In subgroup analysis, high-risk lesions which were upgraded to malignancy showed higher Emean than the non-upgrade lesions (ADH, p=.077; phyllodes tumors, p=.028; other atypia, p=.030) and as did DCIS upgraded to invasive cancer (p<.0001). In multivariate analysis, Emean was an independent predictor for underestimation of malignancy (odds ratio, 1.022; p<.0001).

CONCLUSION

Breast lesion stiffness quantitatively measured by SWE could be helpful to predict the underestimation of malignancy in US-guided CNB.

CLINICAL RELEVANCE/APPLICATION

For patients with high-risk lesions or DCIS after CNB which are sufficiently stiff on SWE, a one-step operation could be considered when surgical excision is performed.
RESULTS

Mean patient age was 54.1 years (range 35-85). Lesions consisted of 7 masses, 12 focal asymmetries (FAD), and 41 calcifications. Fifteen (25%) of 60 lesions upgraded from initial BIRADS 3 assessment were malignant (1.47% of total; 15/1017 BIRADS 3 examinations). Breast imaging specialists interpreted 21 of 60 upgraded lesions, with 3 (14.3%) malignancies, compared to general radiologists who interpreted 39 of 60 upgrades, with 12 (30.8%) malignancies (p=0.160). Twelve (26.7%) of 45 benign upgraded lesions were masses or FADs, and 7 (46.7%) of 15 upgraded malignant lesions were masses or FADS (p=0.149). Six of 7 malignant upgraded masses/FADs had negative US at time of initial BIRADS 3 assignment. At initial assessment, prospective reports described features appropriate for BIRADS 3 classification in only 30/60 (50%). Mammographic development or change was reported in 18/60 (30%), increased prominence in 20/60 (33.3%) and stability in 1/60 (1.7%); change was not reported in 17/60 (28.3%), and 4/60 (6.7%) had no prior studies.

CONCLUSION

Most mammographic lesions upgraded from probably benign to suspicious had shown change or increased conspicuity at the time of initial BIRADS 3 assessment. Non breast imaging specialists had a higher malignancy rate among upgraded lesions compared to specialists. Masses and focal asymmetries represented a higher proportion of malignant than benign upgrades, and usually had no US correlate.

CLINICAL RELEVANCE/APPLICATION

Malignant masses and focal asymmetries mis-characterized as probably benign usually had no US correlate. Careful utilization of BIRADS terminology will improve appropriate characterization.

BRS243

Positive Predictive Value of Biopsy of Palpable Masses on the Mastectomy Side in Reconstructed and Non-reconstructed Breasts (Station #3)

Sandra Brennan MBCh, Msc (Presenter): Nothing to Disclose, Donna Danielle D’Alessio MD : Nothing to Disclose, Jennifer Brisman Kaplan MD : Nothing to Disclose, Marcia Edelweiss MD : Nothing to Disclose, Alexandra Heerdt : Nothing to Disclose, Elizabeth A. Morris MD : Nothing to Disclose

PURPOSE

To determine the positive predictive value (PPV) of biopsy of palpable masses on the mastectomy (MX) side and to determine if there are patient or imaging features predictive of cancer.

METHOD AND MATERIALS

Following IRB approval, we performed a HIPPA-compliant retrospective review of 3,286 breast ultrasounds (US) performed from June 2008 to January 2013 to identify patients with MX presenting with palpable masses on the MX side. We included reconstructed and non-reconstructed breasts and both prophylactic and therapeutic MX. Medical records and imaging studies were reviewed. Statistical analysis was performed with Fisher’s exact test. 95% confidence intervals (CI) were calculated.

RESULTS

69 patients with MX had targeted US of palpable masses. Age 25-82, mean 52 years. 43/69 (62%) underwent biopsy. 26/69 (38%) had follow-up and no biopsy; range of follow-up was 4-71, mean 21 months. 53/69 patients had a mass on US. 16/69 had no mass and the palpable was related to the implant in 7, clip/suture in 4, rib 1 and 4 had no finding on US. 5/12 (42%) had received prior radiation and 6/12 (50%) hormonal therapy. Recurrences ranged from 0.6 to 4.5 cm maximum diameter, mean 1.6cm. Neither patient age (p=1.0), hormonal (p=0.14) or radiation therapy (p=0.7) had a statistically significant association with finding cancer on biopsy. Lesion shape (irregular versus oval/round) was very statistically significant (p=0.003) as was non-parallel orientation on US (P=0.01). Circumscribed versus non-circumscribed margins was not quite statistically significant (p=0.08). Lesion size and presence of shadowing were not statistically significant (p=1.0). No cancers were found on follow-up.

CONCLUSION

The PPV of biopsy of palpable masses on the MX side in our study was 28% (95% CI; 17-43). Neither patient age, prior history of radiation or hormonal therapy had a statistically significant association with positive biopsy. All recurrences were on the original cancer side not the prophylactic MX side. An irregular shape and anti-parallel orientation on US were significantly associated with cancer.

CLINICAL RELEVANCE/APPLICATION

The PPV of biopsy of palpable masses on the MX side is high at 28% with irregular shape and anti-parallel orientation on US significantly associated with cancer.

BRS244

Outcomes of Probably Benign Lesions Detected on Screening Ultrasound in Women with Average and High Risk: Are We Recommending Unnecessary Follow Up Exams? (Station #4)

Kristin Elias MD : Nothing to Disclose, Islamiat O. Ego-Osuala MD (Presenter): Nothing to Disclose, Sara Daniel Shaylor MD : Nothing to Disclose, Marissa Lauren Albert MD, MSc : Nothing to Disclose, Hildegard B. Toth MD : Nothing to Disclose, Linda Moy MD : Nothing to Disclose

PURPOSE

BRS243
The purpose of this study is to evaluate the prevalence and rate of malignancy of BI-RADS category 3 lesions detected on screening ultrasound in average and high risk patients.

**METHOD AND MATERIALS**

IRB approved retrospective review of consecutive technologist performed, hand-held screening ultrasound from 1/11 to 12/12 was performed. Patient characteristics, outcome, mammography results, and follow up of all BI-RADS 3 cases were recorded and evaluated.

**RESULTS**

116/1937 screening US (6%) performed over a consecutive two year period were interpreted as BI-RADS category 3 with a total of 201 probably benign lesions. 53% of women had no known risk factors for breast cancer. 50% of the women were premenopausal and 78% had mammographically dense breasts. Mammography was performed within 1 month in 84.5% of the cases. 108/116 (93%) US exams with 190 probably benign lesions had mean follow up of 15.7 months, range 5-36 months. On follow up, 141/190 (74.2%) lesions were downgraded to benign due to decrease in size, more definitive benign features, or stability over two years. 43/190 (22.6%) lesions remained stable and probably benign. Biopsy was performed of 6 (3.2%) lesions that demonstrated interval growth or suspicious change. One biopsy was performed due to patient preference. All 7 biopsies were benign with results including cysts, fibrocystic change, or fibroadenoma. Two subsequent malignancies were detected in the contralateral breast on follow up within one year. The index lesions assessed as probably benign remained stable. Of the 108 cases with follow up no BI-RADS 3 lesions were found to be malignant.

**CONCLUSION**

In this study where 53% of women were average risk no subsequent cancers were detected in lesions assessed as probably benign on screening ultrasound.

**CLINICAL RELEVANCE/APPLICATION**

It is possible that with careful assessment some lesions may be interpreted as benign rather than probably benign in order to decrease unnecessary follow up exams without missing a malignancy, especially in an average risk population.

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**BRE157**

**You will see it When you Know it: Clustered Ring Enhancement, a New Breast MRI BI-RADS Descriptor for Internal Enhancement Pattern of Non-mass Enhancement (Station #5)**

Youichi Machida MD, PhD (Presenter): Nothing to Disclose, Mitsuhiro Tozaki MD, PhD: Nothing to Disclose, Akiko Shimauchi MD: Nothing to Disclose, Tamiko Yoshida: Nothing to Disclose, Yoshihide Kanemaki: Nothing to Disclose

**TEACHING POINTS**

1. Clustered ring enhancement (CRE) becomes more distinct on delayed phase of dynamic contrast MRI following either a heterogeneous or clumped internal enhancement pattern on early phase. 3. When a non-mass enhancement (NME) bears both CRE internal pattern and segmental distribution, the lesion is highly predictive of malignancy. 4. While focal and regional distributions are descriptors of intermediate suspicion, NMEs with such distributions are indicative of malignancy when CRE is observed, especially in combination with clumped internal pattern.

**TABLE OF CONTENTS/OUTLINE**

CRE has reported to be high predictive of malignancy. Although this descriptor will be more widely used after the revision of BI-RADS, employing it without knowledge of its definition or characteristics can lead to misinterpretation and undesirable outcomes. Radiologists engaged in breast imaging will be able to promote a better understanding of CRE through the following contents; 1. Reviewing the definition of CRE: how can we detect it? 2. Corresponding pathological findings and assumed pathophysiology 3. Examples of CRE: assessment in combination with distributions

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**BRE208**

**Rare Breast Lesions: Correlation with Radiologic Imaging, Pathology, and Clinical Management (Station #6)**


**TEACHING POINTS**

The purpose of this exhibit is to illustrate the varying rare entities occurring in the breast and to give a pictorial multimodality essay of these entities. Additionally, pathologic correlation and clinical management will be discussed.

**TABLE OF CONTENTS/OUTLINE**

There are multiple uncommon lesions of the breast that are encountered after biopsy. Characteristics of these rare entities will be discussed in a multimodality approach along with pathologic correlation and clinical management. Cases that will be included are entities such as sarcoid, lymphoma, angiosarcoma, phyllodes tumor, pseudoangiomatous stromal hyperplasia, granular cell tumor, tubular adenoma, granulomatous inflammation, diabetic mastopathy, lipoma, and metastases.
A New Era in Axillary Management in Early Breast Cancer: The Gold Star is Ultrasound (Station #7)

Karina Pesce: Nothing to Disclose, Flavia Beatriz Sarquis MD (Presenter): Nothing to Disclose, Bernardo Oscar Blejman MD: Nothing to Disclose, Carlos Mariano Lamattina MD: Nothing to Disclose, Fabiana Gisela Vega MD: Nothing to Disclose

TEACHING POINTS

To analyze the history evolution of the management of the axilla in early breast cancer To discuss the diagnostic value of pre-surgery axillary ultrasound for nodal staging in patients with early breast cancer To define a sonographically normal anatomy and normal appearing axillary lymph node To describe the spectrum of sonographic findings in axillary pathologic lymphadenopathy To discuss false positive and negative value of axillary us.

TABLE OF CONTENTS/OUTLINE

1-Introduction 2-History evolution of the management of the axilla in early breast cancer 3-Ultrasound anatomy of the axilla and normal sonographic appearance of a lymph node 4-Differentiation of malignant vs. benign axillary nodes with imaging and pathological correlation will be illustrated 5-Limits, false positive and negatives of the axillary ultrasound 6-Role of the detection of axillary nodes in the staging of early breast cancer will be discussed 7- Conclusion

Three Heads Are Better than One: Unique and Complementary Strengths of Mammography, Ultrasound and MRI in Achieving Optimal Evaluation of Breast Lesions (Station #8)

Morlie Ling Wang MD, MPH (Presenter): Nothing to Disclose, Marleine Tremblay MD, MSc: Nothing to Disclose, Raffat Tahira Ahmad MD: Nothing to Disclose, Hiroyuki Abe MD: Consultant, Seno Medical Instruments, Inc

TEACHING POINTS


TABLE OF CONTENTS/OUTLINE

1. The imaging lexicon and highlights from the 2013 5th Edition of the ACR BI-RADS Atlas are central to the proficient practice of breast imaging. 2. Each modality provides unique and complementary information and has potential pitfalls.

How I Do It: The Diagnostic Breast Evaluation (Station #9)

Rebecca Rakow-Penner MD, PhD (Presenter): Nothing to Disclose, Jade De Guzman MD: Nothing to Disclose, Ifeanyi C. Onyeacholem MD: Nothing to Disclose, Haydee Ojeda-Fournier MD: Nothing to Disclose

TEACHING POINTS

After reviewing this exhibit the learner will 1. Review an algorithmic approach for callbacks from screening evaluation and for patients presenting with clinical symptoms; 2. Understand the rationale for specific imaging protocols for callbacks; 3. Present special considerations for unique situations including post-surgical, pregnant and nursing patient; 4. Discuss common pitfalls in the diagnostic workup; 5. Have an opportunity for self assessment with imaging case review in multiple choice format.

TABLE OF CONTENTS/OUTLINE

The approach to the diagnostic exam in breast imaging continues to be a source of much confusion due to lack of standardization and differences in approach that may be present even in an individual practice. The methodology and rationale for performing certain mammographic views in various situations and when and where to perform breast US is not well understood, especially in light of recent controversies. This educational exhibit will contain: Introduction; Rational and motivation for standardizing protocols; Algorithmic approach for clinical symptoms; Algorithmic approach for callback from screening mammogram; Special considerations including protocols for the post surgical breast, nursing or pregnant patient, others; Outline common pitfalls in the diagnostic evaluation; Conclusion; Test yourself
Sub-Events

RC115A  Current Controversies
Daniel B. Kopans MD (Presenter): Research Grant, General Electric Company Royalties, Cook Group Incorporated Consultant, Siemens AG

LEARNING OBJECTIVES
1) The data that support mammography screening beginning at the age of 40. 2) The history of efforts to reduce access to screening mammography and the scientific errors in those efforts. 3) The details of the poor quality mammography and the allocation errors that compromised the Canadian National Breast Screening Study. 4) Errors in analysis from a major review that incorrectly suggested that screening leads to massive overdiagnosis of breast cancer.

ABSTRACT
Mammography screening is one of the major medical advances of the last half century. Prior to the onset of screening in the U.S., the death rate from breast cancer had been unchanged since 1940. Screening began in the mid 1980’s and soon after, in 1990, the death rate began to fall. Each year there are now more than 30% fewer women who die from breast cancer each year than would have had screening not been available. Therapy has improved, but therapy saves lives when cancers are treated earlieir. Nevertheless, controversy continues to be raised about the efficac of screening. For more than 30 years, specious arguments have been made in an effort to limit access to screening. These will be described, and shown to be based on faulty methodology.

RC115B  Supplemental Screening Beyond Mammography
Carol H. Lee MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) To learn when supplemental screening beyond mammography may be useful. 2) To understand the strengths and weaknesses of various supplemental screening modalities. 3) To identify which modality is most appropriate in which clinical setting.

RC115C  Current Economic Challenges
Geraldine B. McGinty MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) To review the current economic issues in breast imaging. 2) Understand the recent cuts to breast interventional procedures.

MR Imaging-guided Breast Biopsy (Hands-on Workshop)
Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 2:00 PM - 3:30 PM  Location: E260

Participants
Peter R. Eby MD (Presenter): Nothing to Disclose
Beatriz E. Adrada MD (Presenter): Nothing to Disclose
Sandra Brennan MBCh, MSc (Presenter): Nothing to Disclose
Selin Carkaci MD (Presenter): Consultant, Hologic, Inc
Chloe Muy-Chou Chhor MD (Presenter): Nothing to Disclose
Mark Joseph Dryden MD (Presenter): Nothing to Disclose
Sujata Vijay Ghate MD (Presenter): Nothing to Disclose
Jiyon Lee MD (Presenter): Nothing to Disclose
Vilert Alon Loving MD (Presenter): Nothing to Disclose
Michelle Denise McDonough MD (Presenter): Nothing to Disclose
Virginia M. Molleran MD (Presenter): Nothing to Disclose
William R. Poller MD (Presenter): Consultant, Devicor Medical Products, Inc
Thomas L. Pope MD (Presenter): Nothing to Disclose
Habib Rahbar MD (Presenter): Nothing to Disclose
Simone Schrading MD (Presenter): Nothing to Disclose
Roberta Marie Strigel MD, MS (Presenter): Speaker, Bracco Group
Lilian Wang MD (Presenter): Nothing to Disclose
LEARNING OBJECTIVES

1) Establish criteria for MR-guided breast biopsy patient selection. 2) Cultivate a working understanding of MR-guided biopsy and needle localization instrumentation and implementation. 3) Understand basic MR-guided biopsy and needle localization parameters and requirements for appropriate coil, needle and approach selection. 4) Consider patient management before, during and after MR-guided breast biopsy. 5) Explore benefits and limitations of availability of MR-guided biopsy/needle localization in your practice. 6) Practice the MR-guided biopsy procedure on phantoms with multiple needle and coil combinations.

ABSTRACT

This course is intended to provide both basic didactic instruction and hands-on experience in the application of MR-guided breast biopsy and needle localization. Because of the established role of breast MRI in the evaluation of breast cancer through screening and staging, there is a proven need for MR-guided biopsy and needle localization of the abnormalities that can only be identified at MRI. This course will be devoted to the understanding and identification of: 1) appropriate patient selection 2) optimal positioning for biopsy 3) target selection and confirmation 4) various biopsy technologies and techniques 5) potential problems and pitfalls and 6) practice audits. Participants will spend 30 minutes in didactic instruction followed by 60 minutes practicing MR-guided biopsy with phantoms placed in various combinations of full size state-of-the-art breast MRI coils, biopsy localization equipment and needles.

Active Handout


PS12

Sunday Afternoon Plenary Session

Plenary Sessions

AMA PRA Category 1 Credits ™: 1.75
ARRT Category A+ Credits: 1.50
Sun, Nov 30 4:00 PM - 5:45 PM  Location: Arie Crown Theater

Participants

Presiding
N. Reed Dunnick MD  Nothing to Disclose  President, Radiological Society of North America

Sub-Events

PS12A

Report of the RSNA Research and Education Foundation

James P. Borgstede MD (Presenter):  Nothing to Disclose  Chairman, Board of Trustees, RSNA Research and Education Foundation

Abstract

The RandE Foundation - A Transformative Force in Radiology The theme of the 2014 RSNA Scientific Assembly and Annual Meeting is "A Century of Transforming Medicine." For 30 years of that century, the RandE Foundation has played a significant role in advancing the RSNA mission to promote excellence in patient care and health care delivery through education, research and technologic innovation. In celebration of 100 years, the Foundation is launching Inspire-Innovate-Invest, The Campaign for Funding Radiology's Future. This bold campaign seeks to raise $17.5 million to fund grants in radiologic research and education, bridging the gaps in funding for promising investigators and educators. The need is great and the time is now, if the Foundation reaches its campaign goal of $17.5 million, it will keep pace with the growing demand and help ensure that critical discoveries by radiologic investigators come to fruition. This year, the Foundation will fund 95 grants totaling $3.7 million. This means the RandE is funding 25% of our ever increasing number of excellent grant applications. While pleased with these achievements, imagine what the R and E Foundation could fund with additional support from all of us as radiology colleagues? And please recall that we are all the beneficiaries of this research. Of these individuals, who will start their academic research career with an RandE grant, and what will grow from this initial funding? What advances will emanate from their research? And, how can radiologists support these investigators and educators as they pursue their chosen career paths in an effort to make the specialty even stronger? During the meeting week, please take time to visit the RandE Foundation Booth, located on Level 3 of Lakeside Center to learn more about how you can be a part of the campaign and support the RandE Foundation and the future of our specialty.

PS12B

Image Interpretation Session


LEARNING OBJECTIVES

1) Identify key abnormal findings on radiologic studies that are critical to making a specific diagnosis. 2) Construct a logical list of differential diagnoses based on the radiologic findings, focusing on the most probable
differential diagnoses. 3) Determine which, if any, additional radiologic studies or procedures are needed in order to make a specific final diagnosis. 4) Choose the most likely diagnosis based on the clinical and the radiologic information.

RC252
US-guided Interventional Breast Procedures (Hands-on Workshop)
Refresher/Informatics

US BR US BR
AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Mon, Dec 1 8:30 AM - 10:00 AM Location: E264

Participants
Gary J. Whitman MD (Presenter): Nothing to Disclose
Annamarie Wilhelm MD (Presenter): Research Grant, Merck & Co, Inc
Richard Merrell Chesbrough MD (Presenter): Consultant, C. R. Bard, Inc Consultant, Radnet, Inc
Michael N. Linver MD (Presenter): Nothing to Disclose
Paula Beth Gordon MD (Presenter): Stockholder, OncoGenex Pharmaceuticals, Inc Scientific Advisory Board, Hologic, Inc Consultant, Seno Medical Instruments, Inc
Stamatia V. Distounis MD (Presenter): Investigator, FUJIFILM Holdings Corporation Investigator, Seno Medical Instruments, Inc
Anna Irene Holbrook MD (Presenter): Nothing to Disclose
Alice S. Rim MD (Presenter): Nothing to Disclose
Alda Felicita Cossi MD (Presenter): Nothing to Disclose
Eren D. Yeh MD (Presenter): Nothing to Disclose
Gary W. Swenson MD (Presenter): Nothing to Disclose
Catherine Welch Piccoli MD (Presenter): Stockholder, VuCOMP, Inc Consultant, Real Time Tomography, LLC Stockholder, Real Time Tomography, LLC
Time Tomography, LLC
Michael Patrick McNamara MD (Presenter): Stockholder, Apple Inc Stockholder, General Electric Company
Selin Carkaci MD (Presenter): Consultant, Hologic, Inc
Jean M. Seely MD (Presenter): Nothing to Disclose
Phan Tuong Huynh MD (Presenter): Research Grant, Siemens AG Consultant, Siemens AG
H. Carisa Le-Petross MD (Presenter): Nothing to Disclose
Basak Erguvan Dogan MD (Presenter): Nothing to Disclose
Jay Alan Baker MD (Presenter): Research Consultant, Siemens AG
Tanya W. Stephens MD (Presenter): Nothing to Disclose
Jiyon Lee MD (Presenter): Nothing to Disclose
Alexis Virginia Nees MD (Presenter): Nothing to Disclose
William R. Poller MD (Presenter): Consultant, Devicor Medical Products, Inc

LEARNING OBJECTIVES
1) Describe the equipment needed for ultrasound guided interventional breast procedures. 2) Review the basic principles of ultrasound guidance and performance of minimally invasive breast procedures. 3) Practice hands-on technique for ultrasound guided interventional procedures.

ABSTRACT
This course is intended to familiarize the participant with equipment and techniques in the application of US guided breast biopsy and needle localization. Participants will have both basic didactic instruction and hands-on opportunity to practice biopsy techniques on tissue models with sonographic guidance. The course will focus on the understanding and identification of: 1) optimal positioning for biopsy 2) imaging of adequate sampling confirmation 3) various biopsy technologies and techniques 4) potential problems and pitfalls

VSBR21
Breast Series: MR Imaging
Series Courses

MR BR
AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 4.00
Mon, Dec 1 8:30 AM - 12:00 PM Location: Arie Crown Theater

Participants
Moderator
Constance D. Lehman MD, PhD : Consultant, Bayer AG Consultant, General Electric Company Research Grant, General Electric Company
Moderator
Christopher E. Comstock MD : Nothing to Disclose

Sub-Events
VSBR21-01 MR Image Acquisition

Mitchell Dennis Schnall MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) To describe the technical elements needed to perform high-quality breast MRI. 2) To describe and illustrate the pulse sequences needed for high-quality breast MRI. 3) To describe and illustrate the importance of simultaneously achieving high in-plane spatial resolution, thin slices, adequate temporal resolution, adequate signal-to-noise ratios, and full coverage of both breasts in breast MRI. 4) To show examples of high-quality and sub-standard breast MRI exams.

**VSBR21-02**

**Diffusion Kurtosis Imaging for Breast Lesions: Preliminary Results**

Hiromi Ono MD (Presenter): Nothing to Disclose, Satoshi Goshima MD, PhD: Nothing to Disclose, Yukino Goto MD: Nothing to Disclose, Nobuyuki Kawai MD: Nothing to Disclose, Yukichi Tanahashi MD: Nothing to Disclose, Yoshifumi Noda MD: Nothing to Disclose, Hiroshi Kondo MD: Nothing to Disclose, Masayuki Kanematsu MD: Nothing to Disclose

**PURPOSE**

To determine the diagnostic performance of diffusion kurtosis imaging (DKI) of the breast lesions for the detection of malignant breast tumors.

**METHOD AND MATERIALS**

IRB approval and written informed consent was obtained. During a 10-months period, we prospectively evaluated 51 patients (mean age, 52.0 years; range, 13-86 years) with 58 breast lesions including 21 benign lesions and 37 malignant tumors. DKI was performed with a single-shot echo-planar sequence with multiple b values (0, 100, 500, 1000, 1500, and 2000 sec/mm²). We computed the mean kurtosis (MK) and apparent diffusion coefficient (ADC) (10⁻³ mm²/s) over regions of interest encompassing the entire tumor using diffusion kurtosis model programed by MATLAB software (Mathworks, Natick, Mass). The diagnostic performance of MK and ADC value for the detection of malignant breast tumors were compared.

**RESULTS**

MR image acquisition and analysis were successful in all our study patients. MK was significantly higher in malignant tumors (1.13 ± 0.28) than in benign lesions (0.74 ± 0.22) (P < 0.001). Mean ADC value was significantly lower in malignant tumors (1.17 ± 0.35) than in benign lesions (1.72 ± 0.41) (P < 0.001). For the detection of malignant tumors, there was no significant difference in AUC between MK and ADC value, whereas ADC value (71.4%) had a greater sensitivity than MK (62.2%) (P = 0.007) and MK (100%) had a greater specificity than ADC value (86.5%) (P = 0.04).

**CONCLUSION**

DKI was feasible in breast MRI. Our study findings suggest that a combination of MK and ADC may provide the additional value for the detection of malignant breast tumors.

**CLINICAL RELEVANCE/APPLICATION**

When MRI is performed to evaluate the breast lesions, diffusion kurtosis imaging may improve the diagnostic confidence of lesion characterization in addition to conventional diffusion imaging analysis in breast MR imaging.

**VSBR21-03**

**Intravoxel Incoherent Motion MR Imaging at 3.0T in Breast: Quantitative Analysis for Characterizing Breast Lesions**

Naier LIN MS (Presenter): Nothing to Disclose, Jia Hua: Nothing to Disclose

**PURPOSE**

To compare mono-exponential model DWI and intravoxel incoherent motion (IVIM) DWI in characterizing different subtype and different grade of breast lesions.

**METHOD AND MATERIALS**

51 malignant and 47 benign breast lesions in 93 patients were performed with mono-exponential DWI (b = 0,600s/mm²) and bi-exponential analysis DWI (b = 0,50,100,200,500,800 s/mm²) at 3.0T MRI. Apparent diffusion coefficient (ADC), as well as IVIM-based parameters: true diffusion coefficient (D), perfusion fraction (f), and pseudo-diffusion coefficient (D*) were compared among different subtype and different grade lesions. Receiver operating characteristic (ROC) was used for lesion discrimination.

**RESULTS**

All the data were fitted well (R²>0.90). In the lesions except cyst, D value was significant lower than ADC (p<0.05). ADC, D and D* in malignant tumors were significantly smaller than those of benign ones (P = 0.000 for ADC and D ,0.002 for D*, respectively), f value was higher than that of benign lesions (P=0.000). D value showed increasing order as the following: Invasive ductal carcinoma (IDC)< ductal carcinoma in situ (DCIS)<Intraductal papilloma (IDP)< Fibroadenoma (FA)< breast cyst. ROC demonstrated D had the best performance in identification of malignancy from benign lesion (AUC= 0.945) and discriminating DCIS from IDC (AUC= 0.791) than that of ADC, f and D*. Furthermore, a direct inverse correlation had been observed between D value and histological IDC grade, while no other paremeters showed difference among varied grade of IDC (P>0.05).

**CONCLUSION**

IVIM-DWI provides quantitative measurement of cellularity and vascularity properties within breast lesions and VSBR21-02

VSBR21-03
IVIM-DWI provides quantitative measurement of cellularity and vascularity properties within breast lesions and showed better diagnostic ability in discrimination malignancy and tumor grading than ADC. Therefore, IVIM are expected to enhance the role of MRI in diagnosis, monitoring, and treatment screening of breast cancer.

**CLINICAL RELEVANCE/APPLICATION**

IVIM provides noninvasive sensitivity to lesions microenvironment properties and has the potential to improve the specificity of breast MRI without contrast agent, thus it is recommended as part of the MR exam for screening high-risk women.

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**VSB21-04 Enhancement Parameters on Dynamic Contrast-enhanced Breast MRI: Do They Correlate with Prognostic Factors and Subtypes of Breast Cancers?**

**Ji Youn Kim MD : Nothing to Disclose, Sung-Hun Kim MD : Nothing to Disclose, Soung Moon Yang (Presenter): Nothing to Disclose**

**PURPOSE**

To correlate the enhancement parameters of dynamic contrast-enhanced magnetic resonance imaging (MRI) with prognostic factors and immunohistochemical subtypes of breast cancer.

**METHOD AND MATERIALS**

A total of 81 breast carcinomas were included in our study. We obtained the following enhancement parameters: 1) background parenchymal enhancement (BPE) and BPE coefficients (BEC) from bilateral breasts, 2) the number of vessels per breast as a representation of whole-breast vascularity. In 50 patients, 3) semiquantitative parameters of tumors (the initial enhancement percentage, the peak enhancement percentage, the time to peak enhancement, the signal enhancement ratio) and 4) perfusion parameters (Ktrans, kep, ve and iAUC) from tumors and ipsilateral breasts. Correlations among parameters and prognostic factors, including tumor size, axillary node status, nuclear grade, histologic grade, estrogen receptor (ER) expression, progesterone receptor (PR) expression, Ki-67, human epidermal growth factor receptor 2 (HER-2) expression, epidermal growth factor receptor (EGFR) expression, bcl-2, CK5/6 and subtypes categorized as luminal, triple negative and HER-2 were analyzed.

**RESULTS**

BPE was significantly correlated with EGFR expression (p=0.040). BEC was significantly higher in tumors larger than 2 cm than in tumors smaller than 2 cm (p=0.001). The vessel numbers in ipsilateral breasts were higher in tumors larger than 2 cm than in tumors smaller than 2 cm (p=0.034), with higher nuclear grades (grade 3) than with lower nuclear grades (grade 1,2) (p=0.001) and with PR-negative rather than with PR-positive (p=0.010) results. The mean Ktrans was higher in Ki-67-positive tumors than Ki-67 negative tumors (p=0.002). The mean kep was higher in Ki-67-positive tumors than in Ki-67-negative tumors (p=0.005) and in CK5/6-positive tumors than in CK5/6-negative tumors (p=0.015). The mean Ktrans was lower in the ipsilateral breast parenchyma with HER-2-positive tumors compared to HER-2-negative tumors (p=0.012).

**CONCLUSION**

The BPE, BEC and ipsilateral whole-breast vascularity, higher Ktrans and kep of breast cancer and lower Ktrans and iAUC of ipsilateral breast parenchyma may serve as additional predictors of poor prognosis of breast cancer.

**CLINICAL RELEVANCE/APPLICATION**

Enhancement parameters on breast MRI can predict the prognosis and subtypes of breast cancer and is recommended for the preoperative evaluation of breast cancer patients.

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**VSB21-05 7T Breast MR Imaging for Preoperative Characterization of Breast Cancer Using One-stop-Shop Dynamic Contrast Enhancement, Diffusion-weighted Imaging, and Phosphorus MR Spectroscopy**

**Alexander Martijn Theodorus Schmitz MD (Presenter): Nothing to Disclose, Wouter B. Veldhuis MD, PhD : Nothing to Disclose, Marian Menke-Pluijmers : Nothing to Disclose, Wybe van der Kemp : Nothing to Disclose, Tijl A. van der Velden : Nothing to Disclose, Marc C.J.M. Kock MD : Nothing to Disclose, Pieter Westenend : Nothing to Disclose, Dennis W. J. Klomp : Nothing to Disclose, Kenneth G.A. Gilhuijs PhD : Nothing to Disclose**

**PURPOSE**

Detection of breast cancer at earlier stages has raised concern of overtreatment in subgroups of patients, while treatment failure still occurs in other. Continuing need exists for prognostic models tailored to individual patients at time of diagnosis. Preoperative core biopsy results in discordant assessment of tumor grade in up to 40% compared to postoperative assessment. Imaging features may potentially close this gap, as they provide full overview of the tumor. Aim of this study is to assess the potential of biomarkers at 7T functional Breast MRI to characterize the proliferative nature of breast tumors in-vivo.

**METHOD AND MATERIALS**

A one-stop-shop protocol was developed at 7T MRI (Philips) including high temporal (HT; 5 s; 2,8mm³ isotropic) and high spatial (HS; 90 s; 0,7mm³-1,0mm³ isotropic) dynamic contrast-enhanced (DCE) magnetic resonance (MR) imaging, diffusion-weighted imaging (DWI), and phosphorus spectroscopy (31P-MRS) to analyze tumor metabolism. Sixteen women (age 53-70 years) with histologically proven invasive breast
carcinoma on biopsy were scanned prior to surgery. DCE characteristics were assessed according to BI-RADS. ADC-values were calculated and hypointense tumor areas scored. Localized 31P-MR spectra were assessed and scored (1-5) based on degree of tumor proliferation using a newly developed lexicon. Tumor characteristics on pathology were assessed from the resection specimen and correlated to the MRI features. Explorative analyses were performed using box plots, Pearson Chi-Square and Krusal Wallis tests.

RESULTS
In 16 patients, 18 malignant lesions were detected on HS DCE-MRI. The mean largest tumor diameter was 22mm (range 8-58). Time to enhancement on HT DCE-MRI ranged from 12s to 29s. Shortest interval was observed in a rim-enhancing triple-negative tumor. First observations showed correlations between the 31P-MRS score and mitotic cell index (N=11; p=0,02) as well as a trend between ADC and modified Bloom-Richardson tumor grade (N=11; p=0,097).

CONCLUSION
A one-stop-shop imaging protocol for breast MRI at 7T was developed to explore prognostic and predictive tumor biomarkers in-vivo. First explorations indicate feasibility to visualize tumor grade in-vivo.

CLINICAL RELEVANCE/APPLICATION
Imaging of breast cancer biomarkers in-vivo using a one-stop-shop 7T Breast MR imaging protocol allows stratification of tumor proliferation, an important predictive marker used in therapy selection.

VSBR21-06

DWI
Savannah Corrina Partridge PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Understand the physical basis of diffusion imaging and methods used to acquire diffusion-weighted data. 2) Understand the clinical applications of diffusion-weighted imaging for cancer diagnosis and assessment of response to therapy. 3) Be familiar with the challenges of breast diffusion imaging and technical considerations for protocol optimization. 4) Future directions.

VSBR21-07

Diagnostic Performance of Diffusion-Weighted Imaging (DWI) versus Targeted Ultrasound (tUS) in the Characterization of Suspicious Enhancing Lesions at Breast Magnetic Resonance Imaging (BMRI)
Rubina Noemi Cavallin : Nothing to Disclose, Marta Maria Panzeri : Nothing to Disclose, Giulia Cristel MD (Presenter): Nothing to Disclose, Claudio Losio MD : Nothing to Disclose, Mariagrazia Rodighiero MD : Nothing to Disclose

PURPOSE
Percutaneous biopsy is mandatory for all suspicious BMRI-detected lesions (BI-RADS 4 of the Breast Imaging Reporting and Data System), but the malignancy rate is variable (from 2 to 95%) and BMRI-guided biopsy is an expensive procedure, frequently resulting in benign histopathology. Our purpose was to investigate whether DWI and tUS could help in this setting by reducing the number of cases assigned as BI-RADS 4.

METHOD AND MATERIALS
From January 2008 to December 2012, 1757 patients underwent BMRI (1.5T) including T2-weighted sequences, DWI (b-values: 0-900s/mm2) and dynamic study. A BI-RADS score was assigned according to conventional morpho-dynamic criteria. For each suspicious enhancement (BI-RADS 4), the Apparent Diffusion Coefficient (ADC) value was quantified and an ultrasonographic correlate was searched. When both DWI and tUS downgraded the suspicious enhancement to BI-RADS 3 (probably benign), a short term follow-up was recommended. If at least one of the two methods (DWI and/or tUS) confirmed the suspicion, the lesion remained BI-RADS 4 and a biopsy was done using MRI or US-guidance. Histopathological results and radiological follow up data (minimum 6 months) were recorded and considered the gold standard. Diagnostic performance indicators of MRI+DWI and tUS were compared using Chi-square test.

RESULTS
BMRI detected 152 BI-RADS 4 lesions in 120 patients: 52% (90/152) of them were proven to be breast cancers. Eighty percent (121/152) of the lesions were also DWI visible. The sensitivity, specificity, positive and negative predictive value of DWI in the characterization of these lesions were 98%, 87%, 93 and 96%, respectively. An ultrasonographic correlate was found in 66% of MRI lesions: the sensitivity, specificity, positive and negative predictive value of tUS were inferior to those of DWI (p<0,05) (77%, 82%, 86% and 74%, respectively). Twenty-eight percent (43/152) of the suspicious lesions were downstaged to BI-RADS 3 by means of both DWI and tUS: 7% of these revealed to be malignant during subsequent follow-up (2 DCIS and 1 tubular breast cancer).

CONCLUSION
The combination of Quantitative DWI and tUS showed a high accuracy in the characterization of BMRI-detected suspicious lesions, resulting in a reduction of false positives.

CLINICAL RELEVANCE/APPLICATION
The use of DWI and tUS could theoretically reduce the need of unnecessary preoperative breast biopsies in case of BI-RADS 4 enhancing lesions.

**VSBR21-08**

### 3.0 Tesla Breast MRI: Analysis of Apparent Diffusion Coefficient with a Small Intratumoral ROI Improves Diagnostic Performance and Tumor Characterization

**Otso Arponen** (Presenter): Nothing to Disclose, **Amro Masarwah MD**: Nothing to Disclose, **Mikko Tapani Taina**: Nothing to Disclose, **Suvi Hanne Katriona Rautiainen MD**: Nothing to Disclose, **Mervi Kononen MSC**: Nothing to Disclose, **Reijo Sironen**: Nothing to Disclose, **Masah Sudah**: Nothing to Disclose, **Anna Sutela**: Nothing to Disclose, **Juhana Hakumaki**: Nothing to Disclose, **Ritva Liisa Vanninen MD**: Nothing to Disclose

**PURPOSE**

We compared measurements of apparent diffusion coefficient (ADC) within the whole breast tumor vs. a small intratumoral region of interest (ROI) to differentiate malignant from benign tumors and assessed whether the ADC parameters represent surrogate markers for tumor prognostic characteristics.

**METHOD AND MATERIALS**

Approval of the institutional ethics board and institutional approval were obtained. The study protocol included 3.0T structural breast MRI and diffusion weighted imaging (DWI). Patients were selected according to the recommendations of EUSOMA and the local guidelines. Forty-nine patients (mean age, 59±12 years; range, 36-82 years) and 49 lesions (17 benign, 32 malignant) were included to this prospective study. Two observers measured the ADC values (mean, standard deviation, kurtosis and skewness) from a) the whole lesion (WL-ROI), avoiding cystic, hemorrhagic and necrotic regions b) six small intratumoral ROIs (SI-ROIs) with lowest-appearing values on ADC map. WL-ROI and SI-ROI with second-lowermost mean value were used for statistical analysis. Data on estrogen and progesterone receptors, HER2-overexpression, tumor grade, Ki-67, vascular and lymph duct invasion and metastasis to axillary lymph nodes were collected.

**RESULTS**

Using SI-ROI ADC mean values, reproducibility of the measurements proved to be excellent (κ=0.75; Intra-Class Correlation Coefficient, 0.904). In receiver operating characteristic curve analysis, area under the curve was 0.891 for observer 1 and 0.881 for observer 2. Using cut-off value of 0.602×10-3 mm2/s, sensitivity of 82.4%, specificity of 87.5% and overall accuracy (OA) of 85.7% were reached for diagnosing malignant lesions. ADC measurements from SI-ROIs proved to be more accurate than WL-ROIs (OA=67.3%, P<0.05). SI-ROI ADC values inversely correlated to the presence of axillary metastases (P=0.008), and to vascular invasion (P=0.003). There was no independent correlation between ADC values and tumor grade, estrogen, progesterone, HER2 or Ki-67 expression.

**CONCLUSION**

Measuring ADC values from a small intratumoral ROI is clinically more accurate than using the whole tumor ROI in assessment of breast tumors in 3.0T MRI and may help in tumor characterization.

**CLINICAL RELEVANCE/APPLICATION**

When evaluating breast tumor MRIs, ADC measurements should be targeted to most suspicious subregion instead of the whole tumor.

**VSBR21-09**

### Measurement of ADC Values in Malignant Breast Lesions and their Relation to Classical and Molecular Prognostic Factors and Oncotype Dx

**Manuela Durando** (Presenter): Nothing to Disclose, **Dilip Giri**: Nothing to Disclose, **Merlin Gnanasigamani**: Nothing to Disclose, **Joseph Owen Deasy PhD**: Nothing to Disclose, **Elizabeth A. Morris MD**: Nothing to Disclose, **Sunitha Thakur PhD, MS**: Nothing to Disclose

**PURPOSE**

To measure apparent diffusion coefficient (ADC) values in malignant lesions and evaluate their relationship with classical and molecular prognostic factors and Oncotype Dx scores.

**METHOD AND MATERIALS**

This HIPAA compliant retrospective study consisted 212 consecutive patients with known cancers who underwent 3.0T MRI with DWI (b=0 and 600 s/mm2) between Jan' 2011 and Jan' 2013. Lesions < 0.8 cm, lesions undergoing neoadjuvant chemotherapy or suboptimal DW images were excluded. ADC was analyzed on 148 malignant lesions in 135 patients. A region of interest was drawn within each lesion on DW images, avoiding any cystic/necrotic portion. Patient characteristics, classical histological prognostic factors (histologic type, grade, size, and lymph node (LN) status), molecular factors (ER, PR, and HER2) and genetic factors (BRCA, Oncotype DX scores) were reviewed and recorded. The relationships between ADC values and patient characteristics and prognostic factors were analyzed. Statistical analysis was performed using Student’s t-test and ANOVA (statistical significance was established at p= 0.05). ADC values are measured in units of 10-3 mm2/s.

**RESULTS**

The mean ADC value of the 148 malignant lesions was 1.00±0.170. The ADC values in lesions were not
influenced by the BPE or breast density (respectively \( p=0.550 \) and \( p=0.967 \)). The mean ADC values were significantly lower for the invasive ductal carcinoma ( \( p=0.015 \) ), mass enhancement ( \( p=0.001 \) ), BRCA positive lesions ( \( p=0.032 \) ) compared to DCIS, invasive lobular carcinoma, non mass enhancement and BRCA negative lesions. The mean ADC values tended to be lower in premenopause women, high grade, LN positive, triple-negative lesions (though not statistically significant). No statistical significant difference was observed in the ADC values among the different subgroups in size (<2cm, 2-5cm, >5cm), and molecular prognostic factors (ER positive, HER positive, TN). According to Oncotype Dx score (available for 27/41 ER positive tumors with negative LN) ADC values were higher in low risk (0.106±0.207) than in intermediate risk tumors (0.957±0.105), even if not statically significant different ( \( p=0.100 \) ).

**CONCLUSION**

Our study shows that ADC may be a potential clinical adjunct in the evaluation of prognostic factors mostly in relation to the malignant lesion aggressiveness.

**CLINICAL RELEVANCE/APPLICATION**

ADC may be a potential clinical adjunct in the evaluation of breast cancer prognostic factors.

**VSB21-10**

Preoperative MRI Features and Patterns of Recurrence according to Breast Cancer Subtype in Women Treated with Breast Conserving Therapy

Min Sun Bae MD, PhD (Presenter): Nothing to Disclose, Woo Kyung Moon: Nothing to Disclose, Nariya Cho MD: Nothing to Disclose, Su Hyun Lee MD: Nothing to Disclose, Won Hwa Kim MD, PhD: Nothing to Disclose, Sung Eun Song MD: Nothing to Disclose, A Jung Chu MD: Nothing to Disclose, Sung Ui Shin MD: Nothing to Disclose

**PURPOSE**

To determine whether preoperative MRI findings differ according to breast cancer subtype and to examine the relationship between the pattern of recurrence and breast cancer subtype in women treated with breast conserving therapy (BCT).

**METHOD AND MATERIALS**

A total of 102 primary breast cancer patients (mean age, 45 years; range, 22-78 years) treated with BCT who had preoperative breast MRI and locoregional recurrence after BCT between September 2003 and December 2012 were included in the study. Patients who underwent neoadjuvant chemotherapy or surgical excision prior to MRI were excluded. Two breast imaging radiologists blinded to the clinicopathologic data assessed fibroglandular tissue (FGT) and background parenchymal enhancement (BPE) on MRI using BI-RADS criteria. Presence of multifocal/multicentric disease and lymph node involvement were evaluated. The pattern of recurrence and detection method were examined. Breast cancer subtypes were defined as luminal (ER+ and PR+), HER2+ (ER-, PR-, and HER2+), and triple-negative (TN; ER-, PR-, and HER2-). MRI and clinical features were compared between the breast cancer subtypes.

**RESULTS**

The 102 cases were classified as 56 (55%) luminal, 17 (17%) HER2+, and 29 (28%) TN subtype. Women with dense breasts were more likely to have luminal subtype compared to HER2+ or TN subtypes (95% vs (71%, 79%), \( p = 0.013 \)). Multifocal/multicentric disease was more frequently detected by MRI in HER2+ subtype, compared to luminal or TN subtypes (59% vs (20%, 21%), \( p = 0.002 \)). Ipsilateral breast cancer recurrence was more frequently observed in HER2+ subtype, compared to luminal or TN subtypes (88% vs (50%, 62%), \( p = 0.018 \)). Compared to luminal subtype, HER2+ and TN subtypes were more likely to be associated with clinically detected recurrence (11% vs (41%, 41%), \( p = 0.002 \)). There were no significant differences in BPE and lymph node involvement between subtypes.

**CONCLUSION**

Preoperative breast MRI is more likely to detect multifocal/multicentric disease in HER2+ breast cancer and FGT on MRI is more likely to be associated with luminal breast cancer. Patients with HER2+ and TN breast cancers more frequently have clinically detected recurrence.

**CLINICAL RELEVANCE/APPLICATION**

The use of preoperative breast MRI and the postoperative imaging follow-up strategy could be tailored according to breast cancer subtype in women treated with BCT.

**VSB21-11**

Diffusion-weighted Imaging Study of the Influence of Size and Position of the Region of Interest on the Apparent Diffusion Coefficient Values of Breast Lesions and on Discriminating Benign from Malignant

Mirjam Wielema: Nothing to Disclose, Monique D. Dorrius MD, PhD (Presenter): Nothing to Disclose, Hildebrand Dijkstra MSC: Nothing to Disclose, Paul E. Sijens: Nothing to Disclose, Matthijs Oudkerk MD, PhD: Nothing to Disclose

**PURPOSE**
To determine the influence of the size and position of the ROI in Diffusion Weighted Images (DWI) of breast lesions on the Apparent Diffusion Coefficient (ADC) values and on discriminating benign from malignant lesions.

METHOD AND MATERIALS

Sixty-four patients with 72 breast lesions (52 malignant and 20 benign) underwent breast DWI. ADCs were calculated for b-value pairs: 0-1000, 0-800, 0-500, 0-200 and 0-50 s/mm². In each lesion 4 oval regions of interest (ROI) were drawn, ROI1-ROI4. ROI1 encompassed as much of the lesion as possible, while avoiding surrounding tissue, ROI2 (0.5 cm²) was located in the middle of the lesion and ROI3 (0.5 cm²) and ROI4 (1.0 cm²) were selections within the lesion yielding the lowest ADC value. ROI3 and ROI4 were compared to determine the influence of the size of the ROI. ROC analysis was used to quantify the diagnostic accuracy of the ROI methods with the different b-value pairs. Statistical significance was determined with an independent sample t-test for malignant lesions and Mann-Whitney U test for all and benign lesions.

RESULTS

Lower b-value pairs generally showed higher ADC values in the lesions. Benign and malignant lesions significantly differ for almost every b-value pair (p<0.001). There was a significant difference between ROI3 and ROI4 for malignant lesions (p=0.005) with a higher accuracy for ROI3 (0.943 versus 0.932), probably due to reduced partial volume effect. The ADC outcomes of b-values 0-1000 and 0-800 s/mm² met a higher specificity than the lower b-value pairs, that is, up to 70-75% for ROI1 and ROI3 when choosing a sensitivity and negative predictive value of 100%. The AUC was highest for ROI3 using b values 0-1000 and 0-800s/mm² (0.965 and 0.964, respectively).

CONCLUSION

The size and the position of the ROI influenced the ADC values of benign and malignant breast lesions in DWI. ROI3, a small volume selected for the lowest ADC within the lesion, had the highest accuracy in differentiating benign from malignant lesions, with b-value pairs 0-1000 and 0-800 s/mm².

CLINICAL RELEVANCE/APPLICATION

Different ROI methods influence the ADC in breast DWI, therefore a ROI (0.5 cm²) positioning at the lowest ADC value within the lesion with b-value 0-1000 or 0-800s/mm² is recommended.

VSBR21-12

Prediction of Breast Cancer Phenotypes Using Multiparametric MRI of the Breast with Dynamic Contrast Enhancement and Diffusion Weighted Imaging at 3T

Riham H. El Khouli MD, PhD (Presenter): Nothing to Disclose , Katarzyna J. Macura MD, PhD : Nothing to Disclose , Ihab R. Kamel MD, PhD : Nothing to Disclose , David A. Bluemke MD, PhD : Research support, Siemens AG , Michael Anthony Jacobs PhD : Nothing to Disclose

PURPOSE

To assess the value of multiparametric breast MRI (including morphology, DCE MRI and DWI with Apparent Diffusion Coefficient (ADC) mapping) at 3T in distinguishing among DCIS, Luminal A and B, HER2 positive, and Triple Negative breast cancer phenotypes

METHOD AND MATERIALS

Our institutional review board approved the study. We included 219 patients with 234 lesions patients who underwent bilateral breast MRI at 3T (mean age 53±11.5 year). Both high temporal (15 sec) DCE and high spatial resolution (0.5 mm² voxel size) MRI were acquired along with DWI with ADC mapping. Regions of interest were drawn on the ADC maps of breast lesions and normal appearing glandular tissue (GT). Morphologic features, DCE-MRI results (kinetic curve type), GT and lesion absolute and normalized ADC values were included in multivariate models for prediction of breast cancer histological subtypes. Area under ROC curve analysis was performed

RESULTS

Of 234 breast cancer lesions, 12% of were DCIS, 47% Luminal A, 22.2% Luminal B, 4.3% HER2 positive, and 14.5% triple negative. Lesion morphology (combining type of lesion with margin/distribution), Kinetic curve type, time to peak enhancement, and both absolute and normalized ADC values were univariate predictors of breast cancer phenotypes with an AUC 0.61-0.79. Combining lesion volume, morphology, kinetic curve type, internal enhancement, and normalized ADC value showed the best accuracy in predicting estrogen receptor expression, while combining lesion diameter, morphology and ADC value showed the best diagnostic accuracy in predicting progesterone receptors expression, and combining lesion diameter, morphology, and normalized ADC value showed the best accuracy in predicting the HER2 receptor expression. For the phenotypes characterization, the multivariate diagnostic model combining lesion morphology, kinetic curve type, and normalized ADC value showed the best diagnostic accuracy (AUC 0.83)

CONCLUSION

Multiparametric MRI including morphology, DCE and DWI can characterize breast cancer phenotypes with a very good diagnostic accuracy (AUC =0.83) at 3T
Breast cancer tumors with the same histological characteristic may carry different prognosis and response to treatment due to the difference at the molecular level. In vivo identification of different breast cancer phenotypes can improve our ability to detect more aggressive regions within the tumor and evaluate treatment response.

**LEARNING OBJECTIVES**

1) To list shortcomings of mammographic breast cancer screening. 2) To describe methods of non-mammographic breast cancer screening. 3) To list possible advantages and disadvantages of non-mammographic breast cancer screening.

**Sensitivity of an Abridged Breast MRI Protocol to Detect Biologically Significant Breast Cancers**

Laura Heacock MS, MD (Presenter): Nothing to Disclose, Amy Noel Melsaether MD: Nothing to Disclose, Kristine M. Pysarenko MD: Nothing to Disclose, Hildegard B. Toth MD: Nothing to Disclose, Linda Moy MD: Nothing to Disclose

**PURPOSE**

Critics of breast MRI point to the high cost of the exam, the false-positive rates and the detection of indolent breast cancers. A shorter MRI may be cheaper and still allow the detection of breast cancer. The purpose of our study was to evaluate the ability of an MRI protocol with one post-contrast (and subtracted) sequence at 90 seconds to detect biologically significant cancers.

**METHOD AND MATERIALS**

An IRB approved retrospective review of 103 women with 180 findings who underwent a breast MRI at 3T was performed by 2 readers. 90 women were newly diagnosed with breast cancer and 13 were asymptomatic high-risk women. Prior to this study, each reader interpreted 228 abridged MRI exams. The scan time for the 3 T1-scans was 4 minutes; the scan time for the T2-sequence was 4 minutes. Final BIRADS assessment and confidence score was assessed for each lesion. Comparison was made to the original diagnostic interpretation.

**RESULTS**

Of 125 cancers, 4 were foci, 86 were masses, 25 were NME and 10 were categorized in the original report as both masses and NME. Seventy-nine were IDC, 10 were ILC, 23 were DCIS, and 13 were IDC and DCIS. The mean size was 1.7 cm (range 0.4 - 8.6 cm). All 11 mammographically occult contralateral malignancies were detected. Cancers with rim enhancement, spiculated margins or washout kinetics were identified with high confidence by both readers. The sensitivity for reader 1 was 99.2% (CI 95.0-99.9%) and reader 2 was 96% (CI 90.4-98.5%). Of 6 missed cancers, one was IDC, one was ILC and 4 were DCIS. Both invasive cancers were moderately differentiated and all DCIS were intermediate grade. Their mean size was 1.1 cm, range 0.4 - 2cm. All 6 malignancies were seen on the 2nd post-contrast scan and they had Type 1 kinetics. Three were NME and 3 were masses. Eight of 55 (14.5%) MR biopsy proven benign lesions were not identified by each reader, although 4 additional findings were identified by both readers.

**CONCLUSION**

An abridged breast MRI protocol yielded 98% sensitivity for invasive cancers, 83% sensitivity for DCIS and increased specificity as compared with a routine breast MR exam. Total acquisition time is 7 minutes compared to 35 minutes for the conventional exam.

**CLINICAL RELEVANCE/APPLICATION**

Almost all biological significant cancers are detected with an abridged MRI protocol.

**Importance of MRI Monitoring of Patients with a History of Pre-menopausal Breast Cancer**

Stamatia V. Destounis MD (Presenter): Investigator, FUJIFILM Holdings Corporation Investigator, Seno Medical Instruments, Inc, Andrea Lynn Arieno BS : Nothing to Disclose, Renee Morgan RT : Nothing to Disclose, Jennifer Gruttadauria : Nothing to Disclose

**PURPOSE**

To review patients undergoing high risk breast MRI due to personal history of pre-menopausal breast cancer and to determine the incidence of additional cancers found.

**METHOD AND MATERIALS**
With Institutional Review Board approval and waiver of informed consent, a retrospective review was conducted to determine patients diagnosed with pre-menopausal breast cancer undergoing screening high risk MRI. 296 High risk MRI exams were performed in 127 patients from 2003 to 2014. Data recorded included patient age and breast density, lesion size on MRI (if applicable), type of biopsy procedure (if applicable), and pathology results (if applicable).

RESULTS

Total number of MRI exams performed per patient ranged from 1 to 8. Average patient age at the time of first cancer diagnosis was 40.6 years (range 19-48). 76% of patients had heterogeneously dense or extremely dense breast tissue. Of 296 exams, there were 68 (23%) suspicious MRI findings. 47 needle biopsy procedures were performed (69%); 3 did not have a biopsy and proceeded to surgery. MRI biopsy was performed in 30 and ultrasound biopsy in 13. One stereotactic biopsy was performed and FNAC was performed in 3. The remaining 18 findings were determined to be benign by targeted ultrasound, were no longer visualized when MRI biopsy was attempted or were followed and remained stable. Pathology revealed 15 malignancies (10 invasive and 5 non-invasive), 30 benign findings, and 5 atypical findings. Of those diagnosed with cancer, average time between diagnoses was 6.6 years (range 3-16). Seven cancers were in the ipsilateral breast; 5 were of the same pathology as the original malignancy and 2 were different. Eight new cancers were diagnosed in the contralateral breast.

CONCLUSION

Screening MRI in patients with a personal history of pre-menopausal breast cancer detected a new suspicious finding in 23% of exams. Of 127 patients screened, malignancy was detected in 15 (12%). The cancer diagnoses were detected up to 16 years after initial diagnosis, which demonstrates the importance of monitoring these patients.

CLINICAL RELEVANCE/APPLICATION

Monitoring women with a history of pre-menopausal breast cancer is important as these patients are at increased risk of a second breast cancer diagnosis.

VSBR21-16  Investigate the Value of Multiple B-Value Diffusion-Weighted Imaging based on Intravoxel Incoherent Motion (IVIM) in Differentiating Benign and Malignant Breast Lesions

Baoying Chen (Presenter): Nothing to Disclose, GUANGBIN CUI : Nothing to Disclose, Zhuo Xie : Nothing to Disclose, Linfeng Yan : Nothing to Disclose, Yuchuan Hu : Nothing to Disclose

PURPOSE

To show the diagnostic value of bi-exponential ADC based on IVIM with multiple b-value DWI in benign and malignant breast lesions, in comparison to the conventional mono-exponential apparent diffusion coefficient (ADC) with single b-factor DWI.

METHOD AND MATERIALS

32 patients diagnosed with 20 malignant and 15 benign breast lesions were enrolled in the study. Consent form has been obtained prior to the study. Patients underwent DWI at 3.0T with single b-factor range (b=0, 1000 s/mm$^2$) and multiple b-factor range (b=0, 25, 50, 75, 100, 300, 500, 800, 1000, 1200, 2000, 3000 s/mm$^2$). 32 contralateral normal healthy glandular tissues from the same cohort were considered as control. ADC (b=0 and 1000 s/mm$^2$) and IVIM parameters (tissue diffusivity D, pseudo-diffusion coefficient D*, perfusion fraction f) were calculated respectively based on mono-exponential and bi-exponential analysis. The data were compared in between malignant, benign lesions and normal healthy glandular tissues. The diagnostic efficiency of these parameters was evaluated by ROC curve and area under the ROC curve (AUC).

RESULTS

It was found out that ADC and D values of malignant group were significantly lower than those of benign group and control group ($P<0.05$). There were significant differences between benign and malignant group, benign and control group, malignant and control group in value of f ($P<0.01$, $P<0.05$, $P<0.01$ respectively). Importantly, the f value of malignant tumors was significantly higher than that of benign lesions especially in the b-factor range of 0-800 s/mm$^2$ ($P = 0.000$). D* value was not significantly different between benign and malignant group in the b-factor range of 800-3000 s/mm$^2$. The diagnostic sensitivity of D, ADC, f, D* decreased progressively. D and ADC values showed higher specificity than f, D*. The combination of D and f represented higher sensitivity and specificity.

CONCLUSION

Quantitative IVIM parameters provide separate information of fast and slow diffusion component by bi-exponential decay model. They can be used in differential diagnosis of benign and malignant lesions.

CLINICAL RELEVANCE/APPLICATION

Multi-b-value DWI has been most simply performed, and IVIM can separately estimate tissue perfusion and diffusivity. Although some questions are remained to be clarified, multi-b-value DWI and IVIM will certainly be of great help for the diagnosis of breast lesions.
Ahmed El Sayed Sayedin MBCh : Nothing to Disclose, Aalaa Salaheldin Kambal MBBS : Nothing to Disclose, Imaad Bin Mujeeb MD : Nothing to Disclose

PURPOSE

To evaluate 3-D fused gadolinium-enhanced and diffusion-weighted images in preoperative assessment of multicentricity, multifocality, and bilaterality in patients with breast carcinoma

METHOD AND MATERIALS

72 patients with biopsy-proven breast carcinoma have been sent to MR imaging for preoperative assessment of multicentricity, multifocality, and bilaterality. Based on mastectomy/lumpectomy specimens, 47 patients had single lesions, 12 multicentric, 10 multifocal, and 3 bilateral carcinoma with a total number of 116 proven malignant foci. The preoperative MR images were post-processed on an advanced workstation to obtain 3D fused images of the unenhanced breast parenchyma, early gadolinium enhancement (coded red), and diffusion-weighted images with b=1500 s/mm² (coded green). To eliminate the T2-shine-through effect, lesions with ADC ≥ 1× 10⁻³ mm²/s were eliminated. The post-processed images were reviewed by an experienced radiologist, blinded to the histopathology, who noted all the lesions with a diameter ≥ 5 mm classifying them into three groups: matched enhancement and diffusion restriction, unmatched diffusion restriction, and unmatched enhancement.

RESULTS

313 Lesions with a diameter ≥ 5 mm have been identified. 101 lesions showed matched enhancement and diffusion restriction. Taking matched lesions as indicative of malignancy, the sensitivity, specificity, positive predictive value, negative predictive value, and accuracy for diagnosis of malignant foci have been 84.5, 98.5, 97, 91, and 93.3 % respectively. Three false positive foci of matched E-DR were due to fibroadenomas. 18 false negative foci have been due to foci of DCIS less than 1 cm in diameter. The method correctly identified all cases of bilateral and multifocality. Three patients with multicentric malignancy were diagnosed as individual lesion. Three patients with multicentricity were diagnosed as multifocal because of fibroadenomas. Three patients were correctly classified as multicentric with underestimated number of foci.

CONCLUSION

Fused gadolinium-enhanced and diffusion-weighted MR images of the breast offer a reasonably accurate assessment of bilaterality, multifocality, and multicentricity in patients with breast carcinoma.

CLINICAL RELEVANCE/APPLICATION

The technique may be useful in patients with breast carcinoma suspected to have multiple lesions. The 3D and color coded images are easy to read and optimal to use by the surgeon for surgical planning.

BRS-MOA

Breast Monday Poster Discussions

Scientific Posters

AMa PRA Category 1 Credits™: .50
Mon, Dec 1 12:15 PM - 12:45 PM Location: BR Community, Learning Center

Participants

Moderator
Debra Somers Copit MD : Scientific Advisory Board, Hologic, Inc

Sub-Events

BRS245

On the Statistical Relationships Between Quantitative DCE-, DW-, and APT-CEST-MRI: A Hypothesis Generating Study (Station #1)

Elizabeth Vera Gadwood MD (Presenter): Nothing to Disclose

PURPOSE

New MRI techniques are being developed to quantitatively evaluate breast tumors in the diagnostic and prognostic settings. One such method is amide proton transfer (APT), a type of chemical exchange saturation transfer (CEST) imaging. APT provides information about protein content and distribution in tumors. Studies have shown that APT can distinguish healthy tissue from tumor and may be sensitive enough to detect subtle changes related to chemotherapy. This study aims to evaluate APT-CEST-MRI in relation to diffusion weighted MRI (DW-MRI) and dynamic contrast enhanced MRI (DCE-MRI) in breast cancer patients.

METHOD AND MATERIALS

12 patients with invasive mammary carcinoma underwent MR imaging prior to therapy, which included DW-, DCE-, and APT-CEST-MRI. Analysis of the DCE-MRI data returned the volume transfer constant (Ktrans), extravascular extracellular volume fraction (ve), efflux constant (kep), and blood plasma volume fraction (vp). The apparent diffusion coefficient (ADC) was estimated from the DW-MRI data, while the mean APT was calculated from the CEST data. The Spearman’s rank correlation coefficient was calculated to test for a significant statistical relationship between all of these parameters at the whole tumor region of interest level.

RESULTS
APT and Ktrans demonstrated a strong and significant correlation \((r^2=0.82, p=0.002)\) while a modest but non-significant correlation was seen between APT and \(vp\) \((r^2=0.6, p=0.051)\). There was no correlation between APT and ADC \((r^2=0.08, p=0.8)\).

**CONCLUSION**

The significant correlation between APT and Ktrans, a marker of tumor vessel perfusion and/or permeability, suggests that protein synthesis may be related to tumor associated angiogenesis. This hypothesis is strengthened by the positive correlation between APT and \(vp\). Lack of correlation between APT and ADC suggests that APT is a stronger marker of extracellular protein, rather than intracellular protein, as it appears to be independent from tumor cell density.

**CLINICAL RELEVANCE/APPLICATION**

Initial results suggest APT is independent from DW-MRI and complimentary to DCE-MRI. If this can be validated in a larger patient set, measurements of APT could impact standard MRI breast protocols.

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**BRS246**

**Initial Testing of an In-bore MRI-guided Real-time Breast Biopsy System (Station #2)**

Frederick Kelcz MD, PhD (Presenter): Nothing to Disclose  
Raymond Harter MS : President, Marvel Medtech, LLC  
Ethan K. Brodsky PhD : Nothing to Disclose  
Walter F. Block MD : Research support, General Electric Company  
Roberta Marie Strigel MD : Speaker, Bracco Group  
Graham T. Reitz : Research funded, Marvel Medtech, LLC  
Sergey N. Kuro : Employee, Marvel Medtech, LLC

**PURPOSE**

The current method of MRI-assisted breast biopsy requires that the patient be moved into the bore for planning and verification, then out of the bore for the biopsy procedure. This approach is subject to error due to patient motion or trocar-induced lesion displacement between image sets. We are developing an in-bore system for robotic interactive MR image guided interventions (iMR-IGI) using MRI-compatible actuators and a ceramic trocar. This will allow the radiologist to efficiently and rapidly control, in real time, all aspects of the intervention process.

**METHOD AND MATERIALS**

We have developed a multi-degree-of-freedom robotic proof-of-concept prototype system for in-bore MR image guided biopsy (IGB) trocar placement. The MRI-compatible system configuration is not limited to lateral or medial access to the breast and is constructed so as to permit a real-time imaging interface to the MRI scanner. The system also has its own integrated radiofrequency (RF) breast coil to maximize signal to noise ratio (SNR) and uses piezoelectric actuators. The in-bore tool positioner is mounted on a circular track surrounding the breast cup and RF coil.

**RESULTS**

Video will be presented, taken during real-time MR imaging, demonstrating robotic controlled insertion of the fluid filled, MR visible ceramic trocar into a gel breast phantom. We tested SNR levels using phantoms with all electronics unpowered \((SNR = 44)\) vs. a fully activated state \((SNR = 31)\) using an 8 channel commercial receive breast coil (GE Healthcare, Waukesha, WI). While SNR degradation is measurable in this early prototype, it is modest and acceptable given the clinical requirements for identifying and tracking a known lesion.

**CONCLUSION**

We have demonstrated proof-of-concept novel in-bore actuation capability with concurrent real-time imaging. Our proposed system will provide a rapid, interactive method for placing diagnostic and therapeutic tools into the breast under real-time MRI guidance.

**CLINICAL RELEVANCE/APPLICATION**

Some literature has used the term "real-time" to simply describe a surgery that can be completed entirely within the MR suite. In such cases, the imaging guidance itself is not in real-time and device guidance is performed by iterating between diagnostic imaging and discrete device manipulations. We have demonstrated novel true in-bore actuation capability with concurrent real-time imaging, now to be applied to the breast, but with potential for use in other body regions.

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**BRS247**

**Heterogeneity of Background Parenchymal Enhancement on MRI Strongly Predictive of Breast Cancer Molecular Subtypes (Station #3)**

Jeff Wang (Presenter): Nothing to Disclose  
Fumi Kato : Nothing to Disclose  
Kohsuke Kudo MD : Nothing to Disclose  
Hiroko Yamashita : Nothing to Disclose  
Hiroki Shirato MD, PhD : Nothing to Disclose

**PURPOSE**

Despite many efforts having studied lesion texture as imaging biomarkers of breast cancer (BC) subtypes, it appears none have yet been published assessing the same of background parenchymal enhancement (BPE). This study aims to determine the prognostic ability of BPE texture surrogates with molecular subtypes of BC.

**METHOD AND MATERIALS**
Building evidence continues to show BC is a diverse disease. Molecular subtyping based on estrogen (ER), progesterone (PgR), and human epidermal growth factor 2 (HER2) receptor expression provides valuable information for treatment. Dynamic contrast-enhanced (DCE)-MRI is standard in diagnostic breast imaging, known for its high sensitivity. Increased BPE on DCE-MRI has been associated with higher rates of abnormal interpretation and obscured breast masses. There is also evidence it may provide insight with BC risk. This retrospective study included 64 women with 69 invasive mass carcinomas, who had DCE-MRI. ER, PgR, and HER2 receptor expression of the lesions were determined by immunohistochemistry in specimens. The cancers were also categorized triple-negative (TN) or Luminal A (LumA), as clinically significant. Segmentation of parenchyma tissue was performed from DCE-MRI of the affected breast and BPE texture was then quantified as first and second-order statistical features of pharmacokinetic parameter maps calculated from the tissue compartment. Logistic regression models were learned, using reduced BPE texture features to classify receptor status. Accuracy (ACC), sensitivity (TPR), specificity (TNR), and area under the ROC curve (AUC) of performance were calculated from leave-one-out cross-validation.

RESULTS

TN BC were classified with ACC of 95%, TPR of 89%, TNR of 97%, and AUC of 0.89. ER BC were classified with ACC of 88%, TPR of 67%, TNR of 96%, and AUC of 0.81. PgR BC were classified with ACC of 68%, TPR of 42%, TNR of 86%, and AUC of 0.61. HER2 BC were classified with ACC of 83%, TPR of 36%, TNR of 94%, and AUC of 0.63. LumA BC were classified with ACC of 61%, TPR of 65%, TNR of 57%, and AUC of 0.66.

CONCLUSION

BPE texture is demonstrated as able to predict TN and ER BC with great accuracy and discriminative ability; PgR, HER2, and LumA BC to lesser degrees.

CLINICAL RELEVANCE/APPLICATION

BPE heterogeneity can extend the diagnostic ability of DCE-MRI, as it is strongly predictive of some molecular subtypes of breast cancer, particularly the more aggressive triple-negative subtype.

Incidental Findings on Breast MRI: The Added Value of Second-look Digital Breast Tomosynthesis (Station #4)

Paola Clauser MD (Presenter): Nothing to Disclose, Luca Alessandro Carbonaro MD : Research Consultant, im3SpA, Martina Pancot : Nothing to Disclose, Massimo Bazzocchi MD : Nothing to Disclose, Chiara Zuliani MD : Nothing to Disclose, Francesco Sardanelli MD : Speakers Bureau, Bracco Group Research Grant, Bracco Group Speakers Bureau, Bayer AG Research Grant, Bayer AG Research Grant, IMS International Medical Scientific

PURPOSE

To assess the clinical utility of second-look digital breast tomosynthesis (SL-DBT) to look for lesions detected initially on MRI and to compare SL-DBT with second-look ultrasound (SL-US).

METHOD AND MATERIALS

This multicentric retrospective study included 143 patients with biopsy-proven breast cancer that underwent both BT and MRI as staging. The study obtained IRB approval and patients signed the informed consent for the examinations. Four readers with experience in breast imaging reviewed MRI examinations to find incidental lesions not suspected on the basis of previous imaging. MRI lesions characteristics were evaluated: morphology (mass like enhancement ML, non mass like enhancement NML or foci), dimensions (≤10 mm or > 10 mm) and ACR BIRADS classification (3 or 4-5). DBT was then re-evaluated looking for MRI findings. Data on SL-US were also collected for all incidental findings. Standard of reference was biopsy, surgical excision or follow up (≥1 year).

RESULTS

Eighty-two MRI incidental findings were detected in 51 patients. At SL-DBT a correlation was made in 40 cases (49%) including 29 malignant lesions and 11 benign lesions. At SL-US a correlation was made in 41 (50%) including 25 malignant and 16 benign lesions. Overall, 61 (74.4%) of the lesions were visible with at least one technique other than MRI, including 40 malignant and 21 benign lesions. Of the 21 lesions non-visible at second look, 17 were malignant and 4 were benign. When the type of lesion found at SL-DBT, no significant differences were found regarding morphology (ML vs NML vs foci), dimensions (≤10 mm or > 10 mm) and BIRADS classification (3 vs 4-5). Though the difference was not significant, SL-DBT found more frequently NML lesions compared to SL-US (44% vs 26%).

CONCLUSION

SL-DBT allowed to add almost 25% additional lesions in adjunct to SL-US, and it could be particularly helpful for areas of NML enhancement. The absence of a DBT or US correlate does not warrant to avoid MR-guided biopsy for suspicious findings.

CLINICAL RELEVANCE/APPLICATION

With the introduction of systems to perform biopsy under Tomosynthesis guidance, the use of SL-DBT could help avoiding MR-guided biopsy, thus reducing costs and discomfort for the patients.
Usefulness of Combined Diffusion-weighted Imaging to Dynamic Contrast-enhanced Breast MRI for Diagnosis of the Multifocal and Multicentric Breast Cancer (Station #5)

Eun Kyung Park MD (Presenter): Nothing to Disclose, Kyu Ran Cho MD, PhD: Nothing to Disclose, Bo Kyoung Seo MD, PhD: Nothing to Disclose, Ok Hee Woo MD: Nothing to Disclose, Sung Bum Cho: Nothing to Disclose, Kyung Hwa Park: Nothing to Disclose

PURPOSE

The purpose of this study was to investigate the diagnostic value of an imaging protocol that addition of diffusion-weighted imaging (DWI) to dynamic contrast-enhanced breast MRI (DCE-MRI) for diagnosis multifocal and multicentric breast cancer.

METHOD AND MATERIALS

The prospective study included 82 consecutive women with 136 enhancing lesions on DCE-MRI for preoperative staging in breast cancer. Morphologic and kinetic assessments were performed on DCE-MRI and findings were classified according to the Breast Imaging Reporting and Data System (BI-RADS) lexicon. Apparent diffusion coefficient (ADC) values were compared for benign and malignant lesions. For the combined MRI protocol, lesions which were classified as BI-RADS 4a and had an ADC value more than the calculated cutoff value were considered as benign. Sensitivity (SE), specificity (SP) and positive predictive value (PPV) were evaluated for DCE-MRI alone and combined MRI protocol for unexpected additionally detected lesions on DCE-MRI. Results were further compared by lesion size (>1cm or ≤1cm).

RESULTS

Of the 136 lesions, 26 were benign and 110 were malignant (15 ductal carcinoma in situ, 95 invasive carcinoma). The malignant lesions (mean ADC, 0.93±0.22×10-3 mm2/s) exhibited lower mean ADC than benign lesions (1.20±0.24×10-3 mm2/s, P<0.01). Of the 136 lesions, 49 lesions were additionally detected lesions on DCE-MRI. DCE-MRI alone showed 97% SE, 18% SP, and 69% PPV. The combined MRI protocol produced 97% SE, 71% SP, and 86% PPV, and showed statistically significant increase of SP (P<0.01) and PPV (P=0.02). PPV of combined MRI protocol for larger lesions (100%) was higher than that of smaller lesions (76%), however, combined DWI increased PPV similarly for larger lesions and small lesions.

CONCLUSION

The combined DWI to DCE-MRI has the potential to increase the SP and PPV to diagnose multifocal and multicentric breast cancer.

Incidence of Internal Mammary Lymph Nodes on Breast MRI Following Oncoplastic Surgery (Station #6)

Elizabeth Jennifer Watson MD, MPH: Nothing to Disclose, Elizabeth J. Sutton MD (Presenter): Nothing to Disclose, Girard Gibbons BA: Nothing to Disclose, Elizabeth A. Morris MD: Nothing to Disclose

PURPOSE

Breast cancer oncoplastic surgery allows a tandem approach to treatment and reconstruction, which may involve silicone implant placement. Postoperatively, magnetic resonance imaging (MRI) can diagnose silicone implant rupture. Enlarged internal mammary lymph nodes (ILMN) can develop after silicone implant placement but inaccessibility makes tissue diagnosis difficult. The purpose of this study was to assess among women with a history of breast cancer and silicone implant placement, the incidence of benign and malignant internal mammary lymph nodes on MRI.

METHOD AND MATERIALS

This retrospective study received institutional review board approval and need for informed consent waived. Between 2000-2013, we identified women who had: a) breast cancer, b) oncoplastic surgery, c) postoperative implant protocol MRI. Clinical and pathologic data were collected. Short and long axis measurements of the largest ILMN, per side, were recorded. A benign ILMN was defined as having, at minimum, two years of either: 1) imaging stability and/or 2) no clinical evidence of recurrent disease. A malignant ILMN was defined if patient had biopsy proven metastatic disease.

RESULTS

956 women with breast cancer were identified who underwent oncoplastic surgery and a postoperative implant protocol MRI (n=552 bilateral and n=404 unilateral). The mean time between surgery and MRI was 84.4 months (range 0.5-512 months). 32 percent of patients (n=306) had ILMN. Mean short and long axis measurements were 0.5 cm (SD 0.2) and 0.7 cm (SD 0.3), respectively. ILMN were significantly more likely to be benign than malignant (p<0.05). Less than 5% of ILMN were metastatic.

CONCLUSION
IMLN identified on silicone implant protocol breast MRI following oncoplastic surgery for breast cancer are significantly more likely to be benign than malignant. The results support imaging follow-up instead of immediate metastatic work-up.

**CLINICAL RELEVANCE/APPLICATION**

IMLN identified on implant protocol MRI are probably benign and imaging follow-up should be considered instead of an immediate work-up to exclude metastatic disease.

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**BRE235**

**The Sonographic Appearance of Benign Masses of the Breast in Children and Adolescents (Station #7)**

Karina Pesce: Nothing to Disclose, Flavia Beatriz Sarquis MD (Presenter): Nothing to Disclose, Monica Colombo: Nothing to Disclose, Eun Ae Park: Nothing to Disclose, Bernardo Oscar Blejman MD: Nothing to Disclose

**TEACHING POINTS**

1. To recognize the normal ultrasound appearance of the breast in children and adolescents
2. To describe benign masses of the breast in children and adolescents
3. To recognize the ultrasound characteristics of the benign breast masses in children and adolescents.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction
2. Normal Breast Development, Stages of Tanner
3. Sonographic normal appearance of the breast in children and adolescents
4. Spectrum of benign masses of the breast in children and adolescents: the sonographic appearance
5. Clinical cases
6. Conclusion

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**BRE200**

**Nipple Discharge: Evaluation, Diagnosis, and Management (Station #8)**

Lilian Wang MD (Presenter): Nothing to Disclose, Ellen Bachman Mendelson MD: Research support, Siemens AG Speakers Bureau, Siemens AG Medical Advisory Board, Quantason, LLC Consultant, Quantason, LLC

**TEACHING POINTS**

The purpose of this exhibit is to review the causes, imaging findings, and management of benign and malignant nipple discharge. In patients with negative mammography and ultrasound and unsuccessful ductography, MRI is an important adjunct imaging modality in nipple discharge evaluation.

**TABLE OF CONTENTS/OUTLINE**


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**BRE183**

**From Lymphoma to Melanoma: Metastatic Disease to the Breast and Axilla from Extramammary Malignancies (Station #9)**

Kopal Shama Kulkarni MD (Presenter): Nothing to Disclose, Ashley Cimino-Mathews MD: Nothing to Disclose, David J. Eisner MD: Nothing to Disclose, Ergeba H. Sheferaw MD, MPH: Nothing to Disclose, Bonmyong Lee MD: Nothing to Disclose, Susan Caroline Harvey MD: Nothing to Disclose, Dorothy Amy Sippo MD: Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is:

1) To review the sources of metastatic disease to the breast and axilla.
2) To explain how metastatic disease can spread to the breast via either hematogenous or lymphatic routes.
3) To review the clinical and imaging presentations of metastatic disease to the breast and axilla.

**TABLE OF CONTENTS/OUTLINE**

Overview of metastatic disease to the breast and axilla: -Frequency of occurrence -Sources of metastatic malignancy -Routes of spread -Hematogenous -Lymphatic Clinical presentation Review of imaging findings Sample cases -Lung cancer -Adenocarcinoma -Squamous cell carcinoma -Lymphoma/leukemia -Melanoma -Ovarian cancer -Plasmacytoma -Renal cell carcinoma Other breast lesions that may have imaging features similar to metastatic disease -Complicated cyst -Invasive ductal carcinoma -Invasive lobular carcinoma Summary

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**BRE008-b**

**When Cancer's Not the Answer: A Radiologic Review of Infectious and Inflammatory Breast Pathologies (hardcopy backboard)**

Nancy Anne Resteghini DO, MS (Presenter): Nothing to Disclose, Sue A. MacMaster MD: Nothing to Disclose, Rebecca Hultman DO: Nothing to Disclose

**TEACHING POINTS**
1. To review imaging presentations of commonly encountered breast infections in both healthy and immunocompromised women. Cases will include: subareolar abscess, infected sebaceous cyst, mastitis, fat necrosis, post-biopsy infection, and Filariasis. 2. To review imaging presentations of inflammatory breast conditions such as Granulomatous Mastitis, Breast Amyloidosis and Diabetic Mastopathy. 3. To present imaging features that are important for the radiologist to be able to identify to characterize infectious and inflammatory lesions. 4. To provide a multimodality pictorial review of pathologies of the infected or inflamed breast, while highlighting optimal imaging modalities.

**TABLE OF CONTENTS/OUTLINE**

1. Overview of multimodality imaging appearance of common infectious and inflammatory breast pathologies. 2. Present imaging examples of infectious and inflammatory breast pathologies: Subareolar abscess, infected sebaceous cyst, cellulitis, mastitis, fat necrosis, post-biopsy infection and Filariasis Granulomatous Mastitis, Breast Amyloidosis and Diabetic Mastopathy 3. Review relevant clinicopathologic features and radiologic manifestations of each pathologic process. 4. Discuss the diagnostic value of each modality, and the importance of differentiating infection and inflammation from breast malignancy

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**Sub-Events**

**BRS251**

**Characterization of Tumor and Adjacent Stromal Tissue in Patients with Breast Cancer using High-Resolution DWI with Reduced FOV (Zoomit): Correlation with Pathologic Parameters (Station #1)**

Jin Young Park (Presenter): Nothing to Disclose, Hee Jung Shin MD: Nothing to Disclose, Yu Sub Sung: Nothing to Disclose, Jeong Kon Kim MD: Nothing to Disclose, Hak Hee Kim MD: Nothing to Disclose, Ki Chang Shin: Nothing to Disclose, Woo Hyun Shim: Nothing to Disclose, Joo Hee Cha MD: Nothing to Disclose, Eun Young Chae: Nothing to Disclose, Woo Jung Choi MD: Nothing to Disclose

**PURPOSE**

The aim of this study was to evaluate whether the apparent diffusion coefficient (ADC) values of tumor and adjacent stromal tissue provided by high-resolution diffusion-weighted imaging (DWI) with reduced field-of-view (FOV) (Zoomit) varies according to pathologic biomarkers in patients with breast cancer.

**METHOD AND MATERIALS**

Between November 2013 and January 2014, 34 patients (age range, 30 - 63 years; mean age, 48.5 years) with 35 pathologically proven breast cancer were retrospectively enrolled in this study. In all patients, RESOLVE and Zoomit imaging was performed with a 3.0T MRI. The tumor region of interests (ROIs) were manually drawn to exact margin of the tumor, generally hyperintense on high b-value Zoomit DWI. The same ROIs were mapped to the ADC maps and then the ADC images were manually segmented into enhancing tumor and surrounding stromal tissue. The mean ADC value was segmented in one pixel increments around the tumor boundary. ADC values of each segmented shell was compared with pathological surrogate markers (nuclear grade, histologic grade, estrogen receptor (ER), HER-2 status, molecular subtypes, and lymph node metastasis) of breast cancer using Mann-Whitney U test.

**RESULTS**

Minimum, maximum, and mean ADC values of stromal tissue showed statistically significant difference between ER-positive and ER-negative tumor (P=0.021, 0.033, and 0.043). A trend was observed between maximum ADC of tumor boundary and ER status (P=0.055). Minimum inner tumor ADC values was significantly lower for high nuclear grade tumor than for low nuclear grade tumor (0.302 x 10^-3 s/mm² vs. 0.556 x 10^-3 s/mm²; P=0.043). In addition, stromal ADC values were significantly lower for luminal tumors than for HER2-positive and triple-negative tumors (P=0.008).

**CONCLUSION**

ADC values of tumor and adjacent stromal tissue provided by high-resolution DWI with reduced FOV vary significantly according to several pathologic biomarkers, suggesting that stromal tissue in addition to tumor influences DWI.

**CLINICAL RELEVANCE/APPLICATION**

ADC values of tumor and adjacent stromal tissue provided by high-resolution DWI may be used to predict pathologic parameters of breast cancers.
**BRS252**

**Focusing on Viable Tissue Identified by DCE-MRI Improves the Ability to Predict Response to Neoadjuvant Therapy in Breast Cancer (Station #2)**

Xia Li PhD (Presenter): Nothing to Disclose, Lori R. Arlinghaus PhD: Nothing to Disclose, Richard Glenn Abramson MD: Consultant, ICON plc Board Member, Partners in the Imaging Enterprise LLC, Anuradha Bapsi Chakravarthy MD: Research Grant, Bayer AG Research Grant, Onyx Pharmaceuticals, Inc, Vandana Gupta Abramson MD, MS: Nothing to Disclose, Jaime Farley: Nothing to Disclose, Thomas Yankelevich PhD: Research Consultant, Eli Lilly and Company

**PURPOSE**

To test the hypothesis that physiological MRI parameters associated with viable tissue, as segmented by the DCE-MRI parameter Ktrans, can improve the ability to predict which breast cancer patients will achieve pathologic complete response (pCR) at the conclusion of neoadjuvant chemotherapy (NAC).

**METHOD AND MATERIALS**

33 patients underwent DCE-MRI at baseline (t1) and after one cycle of NAC (t2). At surgery, 12 patients achieved pCR. Analysis of the DCE-MRI data returned the volume transfer constant (Ktrans), extracellular volume fraction (ve), efflux constant (kep), and blood plasma volume fraction (vp). The apparent diffusion coefficient (ADC) was estimated from DW-MRI data. For each patient at t2, a K-means algorithm classified tumor voxels into two classes according to their Ktrans. For voxels with a higher mean Ktrans (indicating higher tumor vascular perfusion and permeability), the mean kep/ADC was calculated for each patient and receiver operating characteristic (ROC) analysis was performed to determine if kep/ADC in the highly-perfused ROI-subset can improve the predictive ability over kep/ADC of the whole tumor ROI. The Wilcoxon rank sum test was also performed to determine if there is a significant difference between pCRs and non-pCRs.

**RESULTS**

kep/ADC in the subset of the tumor classified by high Ktrans yielded an area under the receiver operator characteristic curve (AUC) of 0.91. The sensitivity, specificity, accuracy, and precision were 0.91, 0.84, 0.87, and 0.79, respectively. The kep/ADC from these high Ktrans regions was statistically different between pCRs and non-pCRs (p = 0.0001).

**CONCLUSION**

Our previous studies have shown that the mean kep/ADC of the whole tumor ROI yielded an AUC of 0.86. This study demonstrates that the mean kep/ADC of the voxels with high Ktrans improves the ability to predict eventual response in breast cancer patients undergoing NAC (AUC = 0.91). Therefore, focusing on DCE-MRI parameters within the viable portion of the tumor may improve the ability to predict pathologic response.

**CLINICAL RELEVANCE/APPLICATION**

Using spatial heterogeneity to segment the tumor ROI into highly perfused areas, allows for improved predictive value of DW- and DCE-MRI data obtained in breast cancer patients after the first cycle of therapy.

**BRS253**

**Diagnostic Performance of Diffusion-weighted Imaging in Breast Lesions: Comparison Among Diffusion-weighted Imaging, Dynamic Contrast Enhanced MRI, and Combination of DWI and DCE MRI (Station #3)**

Keum Won Kim MD (Presenter): Nothing to Disclose, Jae Young Seo: Nothing to Disclose, Young Joong Kim MD: Nothing to Disclose, Cheol Mog Hwang MD: Nothing to Disclose, Young Jun Cho MD: Nothing to Disclose, Dae Ho Kim: Nothing to Disclose, You Mi Ra: Nothing to Disclose

**PURPOSE**

The purpose of our study was to compare the accuracy and diagnostic values among diffusion-weighted imaging (DWI), dynamic contrast enhanced (DCE) MRI, and combination of DWI and DCE MRI in patients with suspicious breast lesions.

**METHOD AND MATERIALS**

65 breast lesions of 35 patients who underwent subsequent biopsy or operation, were enrolled. They underwent DCE-MRI and DWI (b values of 1000 s/mm2). Morphologic and kinetic analyses on DCE-MRI were classified according to the BI-RADS lexicon. The ADC values were calculated from the DWI. On DWI set, we were sorted according to the confidence levels for lesion characterization into five grades by comparing DWI and T2WI (confidence level 1, 2-benign, Confidence level 3, 4, 5-malignant). For the combined analysis, morphologic, kinetic features and DWI set confidence levels were evaluated together. Diagnostic values of DCE-MRI assessment, DWI set and combined analysis were calculated.

**RESULTS**

Of the 65 breast lesions, 27 were benign and 38 were malignant (8 DCIS, and 30 IDC). The mean ADCs of the invasive ductal carcinoma (0.86± 0.19 x 10-3 mm2/s) and DCIS (1.04 ± 0.27 x 10-3 mm2/s) were significantly lower than those of the benign lesions (1.35± 0.23x10-3 mm2/s). An ADC cutoff value of 1.1875x 10-3 mm2/s allowed discrimination between malignant and benign lesions (sensitivity: 85.2%, specificity: 87.9%). DCE-MRI assessment showed 94.74% sensitivity, 51.85% specificity and 73.5% positive predictive value (PPV). DWI set showed 93.51% sensitivity, 77.78% specificity and 85.1% PPV. Combined analysis provided 97.37% sensitivity, 81.4% specificity and 88.1% PPV. The specificity and PPV of combined analysis improved significantly (p< 0.05). The characterization accuracy on combined analysis (Az = 0.894) and the DWI set (Az=0.863) were
higher than that on the DCE-MRI assessment (Az=0.733) for the breast lesions (p< 0.05).

CONCLUSION

The DWI set provided a higher accuracy for differentiation between benign and malignant breast lesions than DCE-MRI. The combination of DWI and DCE-MRI has the potential to increased specificity and accuracy of breast MRI.

CLINICAL RELEVANCE/APPLICATION

The DWI set provides a higher accuracy than the DCE-MRI for differentiation between benign and malignant lesions. ADC value is useful to differentiate the malignant breast lesion from that of the benign lesion. The combined analysis of DCE MR and DWI is important for the differentiation between benign and malignant lesions.

BRS254

Diagnostic Workup of Malignant Lesions Using Digital Breast Tomosynthesis Combined with Full Field Digital Mammography and Ultrasound Examination (Station #4)

Asif Iqbal MBBS (Presenter): Nothing to Disclose, Michael J. Michell MBCh : Nothing to Disclose, Rema Wasan MBCh : Nothing to Disclose, Abdel Douiri PhD : Nothing to Disclose, David Evans MBBS : Nothing to Disclose, Clare Peacock MBBS : Nothing to Disclose, Juliet Clare Morel MBChB, MRCP : Nothing to Disclose

PURPOSE

In the diagnostic and assessment setting, imaging workup essentially involves full field digital mammography (FFDM) and ultrasound (US) examination. This study examines the impact of the addition of digital breast tomosynthesis (DBT) on the diagnostic accuracy of FFDM and US combined.

METHOD AND MATERIALS

The study included cancer patients from assessment and symptomatic clinics who underwent FFDM, DBT and US scans. The diagnostic work up was carried out by five specialist breast radiologists. Three examinations were viewed sequentially and probability of malignancy was recorded as (M3 = probably benign, M4 = suspicious, M5 = malignant). A retrospective analysis was carried out between two combined imaging modes comprising of [FFDM and US] and [DBT plus FFDM and US]. An overall imaging opinion was given by taking the highest M score. Statistical analysis using weighted Kappa coefficients was used to assess the agreement between the two combined imaging modes.

RESULTS

243 histology proven malignant lesions were assessed in 237 patients. The percentage of cases classified as indeterminate (M3) by [FFDM+US] were 13.5% (33) and by [DBT+FFDM +US] were 10.7% [26]. The corresponding figures for suspicious (M4) were 20.1% [49] and 18.1% [44] respectively. For malignant (M5); [FFDM+US] mode scored 66.2% [161] and [DBT+FFDM +US] combined mode assigned 71.2% [173]. Five of the indeterminate (M3) from [FFDM+US] were reclassified as suspicious (M4) on [DBT+FFDM +US]. Similarly, DBT upgraded two of 33 indeterminate (M3) and 10 of 49 suspicious (M4) on [FFDM+US] into malignant(M5). Kappa agreement for [FFDM+US] was substantial, (κ = 0.7690; p <0.0001). After the addition of DBT, the agreement was almost perfect, (κ = 0.9034; p <0.0001).

CONCLUSION

These results demonstrate improvement in diagnostic accuracy with additional information from combining DBT. Fewer lesions were classified as uncertain and suspicious and more lesions were classified as malignant. Therefore, combining DBT with FFDM and US is an efficient multimodality tool.

CLINICAL RELEVANCE/APPLICATION

Combined use of DBT with FFDM and US will improve the diagnostic accuracy of mammographic workup of breast lesions, therefore should be performed and interpreted in tandem.

BRS255

Breast DCE-MRI Pharmacokinetic Heterogeneity as Prognostic Biomarker for Breast Cancer Recurrence (Station #5)

Majid Mahrooghy (Presenter): Nothing to Disclose, Ahmed Bilal Ashraf PhD : Nothing to Disclose, Dania Daye MD, PhD : Nothing to Disclose, Mark Alan Rosen MD, PhD : Nothing to Disclose, Carolyn J. Mies MD : Advisory Board, Genomic Health, Inc, Michael D. Feldman MD, PhD : Nothing to Disclose, Despina Kontos PhD : Nothing to Disclose

PURPOSE

Breast cancer tumors have been shown to be heterogeneous, and this presents challenges in targeted therapeutics. We investigate tissue permeability heterogeneity information of breast cancer tumors using DCE-MRI as a prognostic biomarker for assessing the risk of breast cancer recurrence as determined by a validated tumor gene expression assay.

METHOD AND MATERIALS

Breast DCE-MRI scans were retrospectively analyzed from 56 women with estrogen receptor positive/node negative invasive breast cancer. The women had previously undergone Oncotype Dx (Genomic Health Inc.) profiling of their tumor, a gene expression assay that provides a score for 10-year risk of recurrence (risk: low/medium ≤ 30, high > 31). Using the "compartment modeling based on convex analysis of mixtures"...
(CM-CAM) technique, we estimate pharmacokinetic parameters of the local volume transfer constants for tissue types (Ktrans) and plasma volume (Vp) for each pixel. Fuzzy c-means clustering is applied to the pharmacokinetic parameter maps to group pixels into intra-tumor heterogeneity partitions and wavelet coefficients are extracted within each partition to measure spatial frequencies. Multivariable logistic regression is performed with leave-one-out cross-validation and feature selection to classify tumors as high vs. low/medium risk for recurrence based on the extracted features. We compare our proposed DCE-MRI heterogeneity features against standard MR descriptors including kinetic, textural, and morphologic features. Area under the curve (AUC) of the receiver operating characteristic (ROC) is used to evaluate classification performance.

RESULTS

DCE-MRI features based on pharmacokinetic heterogeneity have ROC AUC of 0.88, outperforming standard features (AUC=0.65). Performance is improved when heterogeneity features are combined with standard features (AUC=0.94). Both standard and pharmacokinetic heterogeneity features are selected by the model, including Enhancement Ratio, Enhancement at First Post-contrast, Peak Enhancement, Curve Shape Index, and high frequency wavelet information.

CONCLUSION

DCE-MRI features of pharmacokinetic heterogeneity could be used as prognostic markers for assessing risk of breast cancer recurrence.

CLINICAL RELEVANCE/APPLICATION

Breast DCE-MRI pharmacokinetic heterogeneity features could be used to assess risk of recurrence and ultimately help guide treatment decisions. Larger studies are needed to validate our findings.

BRS256 Dynamic Contrast-enhanced Breast MRI at 7T and 3T: An Intra-individual Comparison Study (Station #6)

Bertine Luus Stehouwer MD (Presenter): Nothing to Disclose, Dennis W. J. Klomp: Nothing to Disclose, Tijl A. van der Velden: Nothing to Disclose, Maurice A. Van Den Bosch MD, PhD: Nothing to Disclose, Vincent Boer PhD: Nothing to Disclose, Gisela de Lima Gomes de Menezes BArch: Nothing to Disclose, Peter R. Luijten PhD: Nothing to Disclose, Wouter B. Veldhuis MD, PhD: Nothing to Disclose

PURPOSE

7T MRI has the potential to increase diagnostic accuracy in breast MRI with, among others, the possibility to acquire ultra-high spatial resolution images for an improved morphological assessment, and with the possibility to acquire metabolic information using 31P MRS. However, the validation of a conventional breast MRI protocol, delivering results that compare at least equal to clinical imaging, is the first step to take before allowing gradual introduction of techniques that exploit the specific properties of 7T MRI. Therefore, the purpose of this study was to evaluate 7T DCE-breast MRI compared to 3T MRI on an intra-individual basis.

METHOD AND MATERIALS

Twenty female patients (mean 55; SD 9; range 32-74 y.o.) with 22 suspicious breast lesions on conventional imaging (12 cases BI-RADS 4, and 8 cases BI-RADS 5) of which histopathology was obtained, underwent 7T and 3T MRI using conventional imaging parameters for the dynamic series. Examinations were rated by two radiologist (R1 and R2) on qualitative image quality, and lesion identification and classification according to the BI-RADS-MRI lexicon. Sensitivity, specificity, NPV and PPV were assessed for both field strengths, as well as observer agreement for BI-RADS-MRI categories, and lesion sizes and contrast-enhancement-to-noise ratios (CENRs) of invasive mass lesions.

RESULTS

Ten of eleven histopathological proven malignant lesions were detected at both field strengths, and classified BI-RADS-MRI 4 or 5. Image quality for the dynamic series was good at 7T (R1 and R2), and excellent (R1 and R2, and good at 3T (R2, P>0.05). Sensitivity, specificity, NPV and PPV at 3T for R1 were 0.91, 0.67, 0.86 and 0.77, and at 7T 0.91, 0.78, 0.88 and 0.83, respectively. For R2 results were equal at both field strengths; 0.91, 0.78, 0.88 and 0.83, respectively. The observers showed excellent and good agreement for BI-RADS-MRI categories (κ = 0.79 for 7T and 0.89 for 3T). Lesion sizes did not differ significantly (P>0.05), while CENRs were higher at 7T (P=0.05).

CONCLUSION

The establishment of an at least equal diagnostic performance of 7T DCE-breast MRI compared to 3T MRI allows for the full potential of 7T breast MRI to be further explored.

CLINICAL RELEVANCE/APPLICATION

This intra-individual comparison study established the at least equal diagnostic performance of dynamic contrast-enhanced breast MRI at 7T compared 3T, allowing for the full potential of 7T breast MRI to be further explored.

BRE190 In Breast Imaging Appearances Can be Misleading (Station #7)
To describe the differential diagnoses of various lesions that may mimic primary breast cancer. To discuss the imaging techniques that can help distinguish between these lesions and primary breast neoplasia. To describe how to distinguish benign tumors from breast cancer on the basis of clinical and imaging data.

**TABLE OF CONTENTS/OUTLINE**


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**TEACHING POINTS**

The majority of radiology residents have suboptimal exposure to the procedural aspects of breast imaging. By gaining basic technical skills, residents will feel more comfortable with breast intervention and will project confidence to patients, both critical components of successful procedures. The aim of our exhibit is for residents to: 1. Gain familiarity with the commonly used techniques and biopsy devices for interventional breast procedures. 2. Learn a reproducible, step-by-step approach to planning and performing common procedures in breast imaging.

**TABLE OF CONTENTS/OUTLINE**

1. Images of commonly used biopsy devices and localizing wires with labeled diagrams 2. Flow chart outlining which imaging modality to choose for biopsy 3. Step-by-step approach of common breast procedures with pictorials: a. US-guided fine needle aspiration b. US-guided core biopsy of solid indeterminate masses c. Stereotactic biopsy of calcifications, architectural distortion or masses d. 3D digital breast tomosynthesis guided biopsy for architectural distortion seen only on tomosynthesis e. MRI-guided biopsy f. Pre-operative wire localization g. Overview of image-guided radioactive seed localization h. Pearls and pitfalls: tips on how to plan and perform a successful biopsy i. Sample cases with question and answer ("what to do next") scenarios

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**TEACHING POINTS**

Familiarize participants with the novel 3 Compartment Breast (3CB) imaging technique which is based on dual-energy mammography and quantifies the lipid, protein, and water content within the breast. The underlying hypothesis is that 3CB ‘signatures’, i.e., image-based biomarkers, are unique for different lesions. This could potentially reduce the number of unnecessary breast biopsies and increase their positive predictive value.

**TABLE OF CONTENTS/OUTLINE**

- Purpose: To introduce a new quantitative dual energy mammography technique (3CB) for characterizing breast lesions
- Background: Explanation of 3CB imaging technique as a combination of dual energy mammography with a thickness phantom
- Quantification of 3CB ‘signatures’ (lipid, water, and protein)
- Potential advantages and disadvantages of 3CB imaging
- Advantages: Better specificity, reduced benign biopsy rates, quantitative and reproducible information (water, lipid, protein content of a lesion)
- Disadvantages: 10% higher dose than standard digital diagnostic views
- Case examples (images and results)
- Benign lesions (fibroadenoma, cysts)
- Malignant lesions (invasive carcinoma, DCIS)
- High risk lesions (atypia)
- Description of ongoing clinical trials and future plans
**Participants**

Moderator
Dana Aragon RT: Nothing to Disclose

**Sub-Events**

**MSAS23A**

The Team Approach to Breast Imaging: A Model for All of Radiology
Michael N. Linver MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the new clinical role of each member of the breast cancer imaging team in providing total patient care. 2) Discern the importance of appropriate interactions with the other members of the imaging team. 3) Apply the changing paradigm of patient care within the breast imaging model to other areas of diagnostic and interventional radiology.

**ABSTRACT**

Over the past 15 years, breast imaging as a subspecialty has been transformed from a purely imaging-based modality to a true clinical specialty, requiring a specialized team of individuals sensitized not only to the imaging aspects, but also to the clinical, pathology and treatment aspects of breast cancer care. The role of each team member and the important interactions with other members will be expanded upon, with emphasis on the need to include the patient in all such interactions. Further emphasis will be placed on the changing face of all of radiology toward more direct interactions with patients, and how the breast imaging model can be modified and adapted to the rest of diagnostic and interventional radiology to better serve patient needs, thereby improving patient outcomes.

**MSAS23B**

Speak To Me! Unsaid Is Risky and Expensive
Patricia Kroken (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the financial and compliance implications of substandard documentation. 2) Identify opportunities to improve communications and documentation. 3) Apply suggestions and/or recommendations given in the presentation.

**Handout:** Patricia Kroken
http://media.rsna.org/media/abstract/2014/14000886/Speak to Me! RSNA 2014 with ARS Questions.pot

**SSE01**

**Breast Imaging (Breast MRI Staging)**

**Scientific Papers**

**PURPOSE**
To investigate the effect of preoperative breast MRI on disease-free survival (DFS) outcomes in newly diagnosed breast cancer patients.

**METHOD AND MATERIALS**

Between 2004 and 2006, we identified 2040 consecutive breast cancer patients (median age, 54.5; range, 20 - 89 years) who had undergone curative surgery for breast cancer (stage 0, 270; I, 734; II, 795; III, 241). Among them, 1597 (78.3%) underwent preoperative MRI (MRI group) and 443 (21.7%) did not (non-MRI group). A total of 330 women of the MRI group were able to be matched with 330 women of the non-MRI group (both groups, median age, 51.2; range, 20 - 81 years) for age, menopausal status, tumor size, histologic type, histologic/nuclear grade, hormonal receptor status, molecular subtype, lymphovascular invasion, resection margin status, nodal status, pathologic stage, surgery type, and adjuvant treatment. A marginal model was used for the matched cohort to evaluate the effect of preoperative MRI on DFS. Kaplan-Meier survivals were also compared between MRI and non-MRI groups using the log-rank test.

**RESULTS**

The effect of preoperative MRI on DFS was not statistically significant (hazard ratio, 1.25; P=0.282). Kaplan-Meier survival was not significantly different between MRI and non-MRI groups (log-rank, 1.22; P=0.338).

**CONCLUSION**

DFS outcome is not significantly different between MRI and non-MRI groups in the matched cohort of newly diagnosed breast cancer patients.

**CLINICAL RELEVANCE/APPLICATION**

Routine application of preoperative MRI for newly diagnosed breast cancer patients is not recommended as no additional benefit in DFS of the MRI group was observed in our matched cohort study.

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**Preoperative Breast MR Imaging in the Assessment of Primary Breast Cancer: Impact on Surgical Procedure and Re-excision Rate**

**SSE01-02**

Heike Preibsch (Presenter): Nothing to Disclose, Laura Kathrin Wanner: Nothing to Disclose, Sonja Dorothée Bahrs: Nothing to Disclose, Ernst Oberlechner: Nothing to Disclose, Annette Staebler: Nothing to Disclose, Claus Detlef Claussen MD: Nothing to Disclose, Konstantin Nikolaou MD: Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG, Katja Claudia Siegmann-Luz: Nothing to Disclose

**PURPOSE**

Preoperative breast MR Imaging is not routinely obtained in the assessment of primary breast cancer. German guidelines recommend MRI in individual cases, such as invasive lobular carcinoma, to optimize local staging and therapy. The impact of preoperative MRI on re-excision and mastectomy rate is discussed controversially in the literature. The aim of this study was to evaluate the effect of preoperative breast MRI on surgical procedure and re-excision rate.

**METHOD AND MATERIALS**

After institutional review board approval, a retrospective analysis of 991 consecutive patients with 1036 primary breast cancers was performed. Of these 991 patients, in a total of 599 patients with 626 breast cancers, preoperative breast MRI was obtained. Planned surgical procedure before and after MRI was compared. Also, the number of re-excisions in patients with preoperative MRI and in patients who had no preoperative MRI was compared.

**RESULTS**

In 26% (164/626) of the cases with preoperative MRI, the result of MRI changed the surgical procedure (wider local excision (n=52), local excision to a lesser extent (n=5), excision of a contralateral carcinoma (n=7), or mastectomy (n=100). In 82% of those cases (134/164), MRI was beneficial for the patients, as a wider surgical excision or the excision of an MRI-detected contralateral carcinoma removed otherwise occult carcinomas (n=129) or further biopsy or removal of benign tissue could be prevented (n=5). In 30 cases, the carcinomas were overdiagnosed by MRI as the histopathologic size after extended excision showed a better correlation in size with mammography and ultrasound than with MRI. Patients with and without preoperative MRI showed no difference in mastectomy rates (39% vs. 39%). Without reaching statistical significance, patients with preoperative breast MRI showed a lower re-excision rate in case of tumor stages pT1b, pT1c and pT3, and an elevated re-excision rate in case of tumor stages pT2 and pT4, if compared to patients who did not undergo preoperative MRI.

**CONCLUSION**

In the present cohort and retrospective analysis, in 21% of primary breast cancers (134/626), patients had a clear benefit from preoperative breast MRI, due to the removal of otherwise not detected carcinomas. Also, preoperative breast MRI did not increase the rate of mastectomy.

**CLINICAL RELEVANCE/APPLICATION**

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Preoperative breast MRI is helpful to optimize surgical therapy in patients with primary breast cancer.

**Are Patients with Greater Background Parenchymal Enhancement on MRI at Increased Risk for More Extensive Breast Cancer?**

Richard S. Ha MD: Nothing to Disclose, Brian Jin MD: Nothing to Disclose, Victoria Mango MD: Nothing to Disclose, Lauren C. Friedlender MD: Nothing to Disclose, Rend Al-Khalili MD, MBBCh (Presenter): Nothing to Disclose, Vesselin Miloushev MD, PhD: Nothing to Disclose, Ralph Thomas Wynn MD: Nothing to Disclose

**PURPOSE**

Compared to breast density, breast MRI background parenchymal enhancement (BPE) is a less well established risk factor for breast cancer. We sought to determine whether a stronger association between BPE and breast cancer risk can be identified by stratifying breast cancer based on extent of disease.

**METHOD AND MATERIALS**

A HIPAA compliant IRB waived retrospective study identified 330 consecutive pre-operative breast MRI cases with biopsy proven carcinoma from 1/2010-12/2013. Each case was categorized as multicentric disease (MCD, involving more than 1 quadrant or greater than 5 cm), multifocal disease (MFD) or unifocal disease (UFD). A fellowship trained radiologist, blinded to history, classified contralateral breast BPE as minimal, mild, moderate, or marked utilizing BI-RADS criteria. The contralateral breast was used for BPE evaluation to minimize bias and the effects of malignancy including edema and inflammation. In addition, the amount of fibroglandular tissue (FGT) was graded, as fatty, scattered, heterogeneously dense, or dense. Age and menopausal status was recorded. Univariate and multivariate logistic regression analysis were performed.

**RESULTS**

A total of 55 MCD, 80 MFD and 195 UFD cases were identified in 330 patients with histopathologic confirmation. The frequency of minimal, mild, moderate and marked BPE was 21.5% (71/330), 42.7% (141/330), 27.8% (92/330) and 7.8% (26/330). MCD was 3.8 times more likely to be associated with moderate/marked BPE compared to UFD (95% CI, 2.04 - 7.14, P < 0.0001). MFD was 1.4 times more likely to be associated with moderate/marked BPE but this was not statistically significant (95% CI, 0.82 - 2.45, P = 0.2114). On multivariate analysis, the association between elevated BPE and MCD was independent of patient age, menopausal status and the amount of FGT.

**CONCLUSION**

Patients with greater BPE may be at higher risk for more extensive breast cancer.

**CLINICAL RELEVANCE/APPLICATION**

Breast MRI background parenchymal enhancement may be an important factor in breast cancer risk stratification.

**Utility of Preoperative Breast MRI in Women with Breast Cancer Detected by Screening Ultrasound**

Min Sun Bae MD, PhD (Presenter): Nothing to Disclose, Woo Kyung Moon: Nothing to Disclose, Su Hyun Lee MD: Nothing to Disclose, Jung Min Chang MD: Nothing to Disclose, Ann Yi MD, PhD: Nothing to Disclose, Nariya Cho MD: Nothing to Disclose, Sung Eun Song MD: Nothing to Disclose, Won Hwa Kim MD, PhD: Nothing to Disclose

**PURPOSE**

To determine the added cancer yield of preoperative breast MRI in women with breast cancer detected by screening ultrasound (US)

**METHOD AND MATERIALS**

A retrospective review of the radiology department database identified 379 women (median age 48 years, range 29 to 78) with 382 breast cancers (323 invasive, median size 1cm on US) detected by screening US who underwent preoperative bilateral breast MRI between December 2007 and December 2013. Forty-five women (12%) had a family history and/or personal history of breast cancer. Additional MRI-detected breast cancers were characterized as multifocal (additional disease within the same quadrant and/or underestimation of index cancer on US by > 2 cm compared to MRI with pathologic confirmation), multicentric (additional disease within a separate quadrant), or contralateral disease. The added cancer yield and positive biopsy rate were determined.

**RESULTS**

Fifty-three of 379 (14%) women underwent biopsy for suspicion lesions identified on preoperative breast MRI. Of these women, 21 had additional foci of cancer diagnosed with a positive biopsy rate of 40% (21/53). Cancer was identified in 19 of 48 (40%) MRI-detected ipsilateral lesions that underwent biopsy and in two of five (40%) MRI-detected contralateral lesions that underwent biopsy. Of the 21 additional sites of cancer detected, 17 (81%) represented multifocal disease, 2 (9%) represented multicentric disease, and 2 (9%) represented contralateral breast cancers. There were 20 invasive cancers and one ductal carcinoma in situ.
CONCLUSION
Preoperative breast MRI in women with screening US-detected breast cancer detected additional unsuspected sites of cancer in 6% of patients, which were mostly invasive cancers.

CLINICAL RELEVANCE/APPLICATION
The addition of preoperative breast MRI to US in women with mammographically dense breasts resulted in not only an increased cancer detection but also an increase in false-positive findings.

SSE01-05
Can Ki-67 Proliferative Marker and Breast Cancer Molecular Subtypes Predict which Patients would Benefit most from Pre-operative Breast MRI?

PURPOSE
Ki-67 proliferative marker and molecular subtypes of breast cancer are known prognostic indicators. This information may assist in clinical staging and treatment planning by predicting patients most likely to have additional disease on pre-operative breast MRI.

METHOD AND MATERIALS
A HIPAA compliant IRB waived retrospective review of our database from 1/2010 to 12/2013 identified 299 patients who underwent pre-operative breast MRI with tumors classifiable into molecular subtypes and 198 patients that had Ki-67 values. Subtypes were classified by IHC surrogates as luminal A (ER and/or PR+, HER2-), luminal B (ER and/or PR+, HER2+), HER2 (ER and PR-, HER2+) or basal (ER, PR, HER2-). Ki-67 index was classified as high (>=15% positive cancer nuclei) or low (< 15%). Univariate and multivariate logistic regression analyses were used to determine associations between subtype, Ki-67 index and additional breast MRI findings including multicentric/multifocal disease (MCD/MFD), contralateral disease, chest wall involvement, skin/nipple involvement and internal mammary and axillary lymphadenopathy.

RESULTS
The subtype distribution was luminal A, 71% (211/299); luminal B, 14.1% (42/299); HER2, 5.4% (16/299); and basal, 10% (30/299). 54% (107/198) of the tumors had a high Ki-67 index and 46% (91/198) a low Ki-67 index. HER2 and luminal B subtypes showed more MCD (31.3% and 28.7%), MFD (37.5% and 38.1%) and axillary disease (62.5 and 45.2%) compared to luminal A cancers (MCD (10.9%), MFD (23.2%) and axillary disease (17.1%))(P < 0.001). On multivariate analysis, after controlling for patient age, tumor size and nuclear grade, HER2 overexpressing tumors (luminal B and HER2 subtypes) were 3.4 times more likely to have MCD (P<0.0006), 2.0 times more likely to have MFD (P < 0.0255), 4.9 times more likely to have skin/nipple involvement (P<0.0013) and 5.0 times more likely to have axillary disease (P<0.0001) compared with luminal A tumors. High Ki-67 index tumors were 3.9 times more likely to have axillary disease (P<0.0002) compared with low Ki-67 tumors.

CONCLUSION
Breast cancer disease extent differs among molecular subtypes and between Ki-67 indices. Pre-operative MRI is most useful for clinical staging and treatment planning in patients with tumors with HER2 overexpression and a high Ki-67 index.

CLINICAL RELEVANCE/APPLICATION
Breast cancer molecular subtypes and Ki-67 index can help identify patients most likely to benefit from pre-operative breast MRI.

SSE01-06
Association Between Rim Enhancement of Breast Tumors in Dynamic Contrast-Enhanced MRI and Outcome of Patients With Invasive Breast Cancer

PURPOSE
Rim enhancement on dynamic contrast-enhanced (DCE) MR imaging of breast cancer has been associated with high histologic tumor grade, increased VEGF expression, negative hormone receptor expression, and axillary lymph node metastases. However, association with patient outcome is largely unknown, and potential benefit as a predictive marker for therapy selection has not yet been established. The aim of this study was to determine if rim enhancement is associated with invasive breast cancer recurrence (IBCR) and death attributable to breast cancer (DBC) on follow-up (FU).

METHOD AND MATERIALS
A retrospective study was performed on 561 consecutively included women (age 26-86 years) in the MARGINS trial (2000-2008) who had pathology proven invasive breast cancer eligible for breast-conserving therapy on conventional imaging and clinical examination. Median FU was 87 months (range 3-150). Patients received an
additional preoperative DCE-MRI. Presence of rim enhancement was assessed according to BI-RADS. Tumor characteristics on pathology were assessed from surgical resection specimens. Patients were stratified upon immunohistochemical breast cancer subtype. Associations with IBCR and DBC were analyzed using Kaplan Meier and log-rank tests. Multivariate Cox regression was employed to discriminate between good and poor outcome.

RESULTS

Overall, IBCR was recorded in 53 and DBC in 39 women. For IBCR, association was seen with tumor grade (p=0.032), resection margin status (p=0.042), ER-status (p=0.050) and rim enhancement (p=0.056). Rim enhancement and grade retained independent significance in multivariate analysis to discriminate between good (95.7%) and poor (79.6%) survival. For DBC, no association with rim enhancement was observed (p=0.189). No associations were found in the ER+/Her2- subgroup (N=419), and in the Her2+ subgroup (N=75). However, in the triple negative subgroup (N=65), IBCR (N=10) was strongly associated with rim enhancement (p=0.001) and resection margin status (p=0.002). Moreover, rim enhancement was the only characteristic significantly associated with DBC (N=9; p=0.003).

CONCLUSION

Presence of rim enhancement on DCE-MRI may be a promising biomarker for tumor recurrence in patients with triple negative breast cancer.

CLINICAL RELEVANCE/APPLICATION

Patients with triple negative breast cancers with rim enhancement on MRI may benefit from adjusted therapy and follow-up procedures.

SSE02

Breast Imaging (Tomosynthesis Diagnostics)

Scientific Papers

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Mon, Dec 1 3:00 PM - 4:00 PM Location: E450A

Participants

Moderator
Donna M. Plecha MD: Advisory Board, Hologic, Inc Research Grant, SuperSonic Imagine
Debra Somers Copit MD: Scientific Advisory Board, Hologic, Inc

Sub-Events

SSE02-01 Digital Breast Tomosynthesis and Breast MRI in the Treatment Planning of the Newly Diagnosed Breast Cancers

Giovanna Mariscotti (Presenter): Nothing to Disclose, Manuela Durando: Nothing to Disclose, Fortunato Di Caterino: Nothing to Disclose, Pier Paolo Campanino: Nothing to Disclose, Laura Bergamasco: Nothing to Disclose, Paolo Fonio: Nothing to Disclose, Giovanni Gandini MD: Nothing to Disclose

PURPOSE

To evaluate the potential effect of the adjunction of digital breast tomosynthesis (DBT) and MRI to conventional imaging (mammography and ultrasound) on the surgical management of breast cancer.

METHOD AND MATERIALS

Between May 2010 and December 2013, 231 women (mean age: 53.6 years, range 26-79) with newly diagnosed breast cancers (proved by needle biopsy) consecutively underwent surgical treatment in our Institution. Prior to surgery, all women had digital mammography (2D) combined with DBT, breast ultrasound (US) and MRI. After surgery, all radiographic and pathologic results were reviewed to statistically evaluate the beneficial or inappropriate changes in surgical treatment due to the additional DBT and/or MRI findings. Lesions size and characteristics (unifocal, multifocal or multicentric), as well as involvement of nipple-areola complex, skin and pectoral muscle were considered for the indications as concerns the conservative or not conservative surgical approach.

RESULTS

In 231 women a total of 250 surgical treatments were performed. Pathology showed 186 unifocal, 26 multifocal or multicentric and 19 bilateral cancers, predominately ductal invasive with or without in situ component (52.8%) or lobular invasive (18.6%). By using 2D+US imaging only, inappropriate surgery would occur in 33/250 (13.2%) cases, by adding 3D to 2D+US in 26/250 (10.4%) cases (DBT would correctly change the surgical planning in 7/250 [2.8%]). By adding MR to 2D+US or to 2D combined with DBT+US inappropriate surgery (under/over treatment) was equally reduced to 10/250 (4.0%) cases (MRI correctly changed 23/250 [9.2%] surgical procedures). By using 2D+US only, instead of 2D+US+MR, the occurrence of inappropriate surgery is significant different (p=0.004) with a relative risk (RR) of 3.3 (CI 95%: 1.7-6.5). Using 2D+DBT+US instead of 2D+US+MR the difference remains significant (p=0.009), but the RR is reduced to 2.6 (CI 95%: 1.3-5.3).
CONCLUSION

In our population, MRI is the most effective tool for planning the correct surgical treatment of breast cancer. DBT improves the performances of 2D and US, but is not yet sufficient for significantly reduce the risk of inappropriate surgery.

CLINICAL RELEVANCE/APPLICATION

In our population, MRI is the most effective tool for planning the correct surgical treatment of breast cancer; however Tomosynthesis may improve the performances of 2D and US.

SSE02-02

Tomosynthesis 3D Mammography Compared with Contrast Enhanced Breast MRI in Pre-operative Evaluation of Patients Diagnosed with Breast Cancer

Mary Woo Yamashita MD (Presenter): Nothing to Disclose, Sandy Chia-En Lee MD: Nothing to Disclose, Qinghua Min: Nothing to Disclose, Lingyun Ji MS: Nothing to Disclose, Pulin Arun Sheth MD: Nothing to Disclose, Susan Groshen PhD: Nothing to Disclose, Ingrid He: Nothing to Disclose, Akshara Singareeka Raghavendra MBBS, MS: Nothing to Disclose, Linda Hovanessian-Larsen MD: Nothing to Disclose

PURPOSE

To evaluate the performance of 3D Tomosynthesis (3D Tomo) versus Contrast Enhanced MRI (CE-MRI) as an adjunct to the standard 2D mammography (2D) in detection of additional cancers in women diagnosed with breast cancer (BC).

METHOD AND MATERIALS

We retrospectively reviewed available imaging, surgical, and medical records of 29 women diagnosed with BC and underwent 3D Tomo as part of their initial screening study or diagnostic imaging workup between September 2012 and January 2014. All these women had a CE-MRI prior to any surgical, medical, or radiation therapy. 3 dedicated breast imagers independently interpreted each study acquired by: 1) 2D, 2) 2D + 3D Tomo, and 3) 2D + 3D Tomo with addition of clinical history. 10 negative 2D + 3D Tomo cases were added as controls; the order of studies was randomized for each radiologist. The presence of a suspicious lesion (agreement by 2/3 radiologists) was recorded. A retrospective analysis of the CE-MRI results was performed. The gold standard was histopathology obtained by needle core biopsy and/or surgery.

RESULTS

Among 29 women diagnosed with BC, 48 lesions had histopathology results: 36 malignant and 12 benign. CE-MRI identified all 36 cancers but falsely identified 8 out of 12 benign lesions as suspicious. 2D identified 23 of 36 cancers (64% sensitivity) and excluded all 12 benign lesions (100% specificity). 2D + 3D Tomo identified 27 of 36 cancers (75% sensitivity) and excluded all 12 benign lesions (100% specificity). 2D + 3D Tomo with clinical information identified 32 of 36 cancers (89% sensitivity) and excluded 10 of 12 benign lesions (83% specificity).

CONCLUSION

CE-MRI is highly sensitive in detecting invasive BC; however, its low specificity leads to unnecessary biopsies. In our pilot series, 3D Tomo mammography was found to be a valuable imaging modality for identifying additional cancers in newly diagnosed breast cancer patients with 89% sensitivity and 83% specificity.

CLINICAL RELEVANCE/APPLICATION

Further investigation with a larger cohort may prove that 3D Tomo can be an alternative method of evaluating additional cancers in newly diagnosed BC patients.

SSE02-03

Digital Breast Tomosynthesis versus Digital Mammography Detected Cancers: Assessment of Disease Extent on MRI

Amy Chudgar MD (Presenter): Nothing to Disclose, Elizabeth McDonald MD, PhD: Nothing to Disclose, Susan Weinstein MD: Nothing to Disclose, Phillip Andrew Yamartino BS: Nothing to Disclose, Marie Synnestvedt: Nothing to Disclose, Emily F. Conant MD: Scientific Advisory Board, Hologic, Inc

PURPOSE

To compare the utility of breast MRI in patients with newly diagnosed breast cancer detected on screening mammography in a digital breast tomosynthesis (DBT) screened population versus a digital mammography (DM) screened population.

METHOD AND MATERIALS

Retrospective IRB approved review of 24,563 DBT screened patients (10/1/2011-11/20/2013) and 10,751 DM screened patients (9/1/2010 - 8/30/2011) was performed. 235 of the DBT patients had a subsequent MRI. 83 of the MRIIs were obtained for staging of DBT detected newly diagnosed breast cancer. In the DM cohort, 83 patients had a subsequent MRI, 26 of which were for staging of DM detected newly diagnosed breast cancer. Three MRI exams were excluded from the DM group due to lack of sufficient follow-up leaving 23 studies. These two staging groups constituted our study population. Additional disease detected by MRI was defined as
malignancy in the contralateral breast or greater than 2 cm away from the index malignancy. Differences between groups were compared using Wilcoxon Rank Sum test.

RESULTS

In the DBT cohort, MRI detected additional disease in 8/83 (10%). There were 12/84 (14%) false positives and in 63/83 (76%) cases, MRI did not add any additional information. In the DM cohort, 23 staging MRIs were reviewed. 7 cases were true positives (30%), 3 were false positives (13%), and 13 offered no additional information (57%). The DBT cohort had significantly less true positive staging MR exams than the DM cohort (p=0.012). There was no significant difference in the incidence of false positive findings or no additional information between the two cohorts (p=0.87 and 0.70, respectively).

CONCLUSION

In both DM and DBT screened populations with new cancer diagnoses, MRI is able to detect additional cancer. However, with the implementation of DBT, the positive impact of MRI for this indication is diminished.

CLINICAL RELEVANCE/APPLICATION

With improved cancer detection by DBT, the role of MRI in screening for additional disease should be reevaluated.

SSE02-04

Malignancy in BI-RADS 3 Studies Performed with Tomosynthesis

Madhavi Raghu MD (Presenter): Nothing to Disclose, Jaime Lynn Geisel MD: Consultant, Siemens AG, Regina J. Hooley MD: Nothing to Disclose, Reni Simov Butler MD: Nothing to Disclose, Melissa Angeline Durand MD: Nothing to Disclose, Liane Elizabeth Philpotts MD: Nothing to Disclose

PURPOSE

Tomosynthesis has been shown to improve diagnostic confidence with fewer mammographic follow-up recommendations (BI-RADS (BR) 3). As this rate declines, the criteria for lesions previously thought to be probably benign may need to be re-evaluated. The purpose of this study was to determine the number, type and mammographic manifestations of malignancies detected with diagnostic mammograms performed with tomosynthesis, which were previously categorized as BR3.

METHOD AND MATERIALS

A retrospective review of all BR 3 diagnostic mammograms performed with tomosynthesis from Jan 2012 to June 2013 was conducted. Follow up data at 6-12 months was obtained and all studies re-classified as BR 4,5 with subsequent malignant outcomes were evaluated. The size, histology, US correlate and mammographic finding (asymmetry, calcifications, mass or architectural distortion) was reviewed for each malignancy.

RESULTS

5893 diagnostic mammograms were performed of which 1391 (23.6%) were categorized as BR3. These 1391 patients had 1688 findings: calcifications (658), asymmetries (511), masses (472), and architectural distortions (47). At the 6-12 month follow-up interval, 35 studies were re-classified as BR 4 or 5 resulting in 6 (0.5%) malignancies: 2 (2/472; 0.4%) 5 mm masses (stage I) appeared more suspicious on US at the 6 month interval and biopsy of both masses showed IDC. One patient (1/47;2%) presented with one view architectural distortion, not seen on US. Subsequent MRI demonstrated a 5 mm spiculated mass, which yielded IDC (stage I) at biopsy. Three patients (3/658;0.4%) had calcifications (2 of which were 6 mm and one 2 cm), which were more prominent at the 6 month interval and biopsy revealed DCIS. None of the asymmetries recommended for short interval follow-up resulted in malignancy.

CONCLUSION

The malignancy rate of all BR3 studies was low at 0.5%. All malignancies were early stage and evident as masses or calcifications. Therefore with tomosynthesis some calcifications, masses and architectural distortions may be appropriate for follow-up but benign appearing asymmetries likely do not need to be followed.

CLINICAL RELEVANCE/APPLICATION

Mammography with tomosynthesis is becoming an integral aspect of the diagnostic setting improving specificity and will ultimately redefine the BI-RADS criteria particularly for probably benign lesions.

SSE02-05

Combined Evaluation with Digital Mammography and Digital Breast Tomosynthesis versus Digital Mammography and Ultrasound: Interim Result of Diagnostic Performance in an Ongoing Clinical Trial

Won Hwa Kim MD, PhD (Presenter): Nothing to Disclose, Jung Min Chang MD: Nothing to Disclose, Su Hyun Lee MD: Nothing to Disclose, A Jung Chu MD: Nothing to Disclose, Min Sun Bae MD, PhD: Nothing to Disclose, Nariya Cho MD: Nothing to Disclose, Sung Ui Shin MD: Nothing to Disclose, Woo Kyung Moon: Nothing to Disclose

PURPOSE

To compare the diagnostic performance of combined digital mammography (DM) and digital breast tomosynthesis (DBT) versus combined DM and breast ultrasound (US).

METHOD AND MATERIALS

This study was approved by the institutional review board and participating women gave informed consent. A total of 771 women (mean, 48.6 years; range, 20-80), presenting for screening examination or for breast biopsy, were recruited to undergo mediolateral oblique and craniocaudal DM, DBT, and physician-performed
whole breast US examination. Two independent reading phases of DM plus DBT and DM plus US were done in parallel by radiologists masked to results of the other examination results, and the likelihood of malignancy score was separately recorded as a percentage from 0 to 100 along with the BI-RADS assessment categories. Reference standard was defined as a combination of pathology and 6-month follow-up. Diagnostic accuracy (assessed by the area under receiver operating characteristic curve), sensitivity, specificity, and positive predictive values (PPV) of DM plus DBT and DM plus US were compared.

RESULTS

A total of 138 cancers (mean size, 1.9 cm; range 0.1 cm-6 cm) were identified: 125 suspicious on DM plus DBT, 135 on DM plus US, and 3 on neither. The overall diagnostic accuracy for DM plus US was significantly higher than that for DM plus DBT (0.98 vs. 0.93, \( P = .0011 \)). The sensitivity was higher in DM plus US than DM plus DBT (97% [134/138] vs. 91% [125/138], \( P < .0001 \)). For invasive cancers (n = 117), the sensitivity was higher in DM plus US than DM plus DBT (98% [115/117] vs. 91% [107/117], \( P = .0030 \)). The specificity of DM plus DBT was higher than that of DM plus US (84% [533/632] vs. 73% [463/632]). The positive predictive value of biopsy recommendation after full diagnostic workup was 57% (125 of 218) for DM plus DBT, and 45% (135 of 303) for DM plus US.

CONCLUSION

DM plus US had overall superior diagnostic performance than DM plus DBT and enabled the detection of more invasive cancers. However, false positives were less frequent with DM plus DBT.

CLINICAL RELEVANCE/APPLICATION

Even with relative low PPV, combined reading of DM plus US will yield overall higher diagnostic performance than those of DM plus DBT, especially with superiority for detection of invasive cancer.

SSE02-06

Tomosynthesis in the Diagnostic Setting: Changing Rates of BIRADS Final Assessment Categories over Time

Madhavi Raghu MD (Presenter): Nothing to Disclose, Jaime Lynn Geisel MD: Consultant, Siemens AG, Reni Simov Butler MD: Nothing to Disclose, Regina J. Hooley MD: Nothing to Disclose, Melissa Angeline Durand MD: Nothing to Disclose, Liane Elizabeth Philpotts MD: Nothing to Disclose

PURPOSE

Prior studies have shown that tomosynthesis not only reduces false positives in screening, but also results in better assessment of lesions in the diagnostic setting suggesting that fewer studies may require close imaging follow up. The purpose of this study was to determine the impact of tomosynthesis on the rate of final BI-RADS (BR) assessments in the diagnostic setting over time by comparing rates in the first and second years after the introduction of tomosynthesis at our institution.

METHOD AND MATERIALS

A retrospective review of all diagnostic mammograms performed with tomosynthesis over a 12 month period (A: Jan 2012 to Jan 2013) was compared with those performed in the next six month period (B: Jan 2013 to June 2013, ongoing). The rate of final BR assessments (1-5) in both groups was determined. For all BR 3 studies, the mammographic findings (asymmetries, calcifications, masses and architectural distortions (AD)) as well as the rate of ultrasound use were compared between periods A and B.

RESULTS

In period A, 3723 tomosynthesis diagnostic mammograms were performed of which 2533 (68%) were categorized as BR 1 or 2, 943 (25%) as BR 3, and 247 (6.6%) as BR 4, 5. In period B, 2170 tomosynthesis diagnostic mammograms were performed of which 1584 (73%) were categorized as BR 1, 2, 450 (21%) as BR 3 and 136 (10.1%) as BR 4, 5. There was a significant decrease in the rate of final BR 3 assessments from 25% to 21% \( P \).

CONCLUSION

Tomosynthesis in the diagnostic setting has had a significant impact with continued decrease in the rate of BR 3, particularly for masses, with a concomitant significant increase in the rate of BR 1 or 2. Increase in US use is noted and may be related to improved accuracy of tomosynthesis in the assessment of masses.

CLINICAL RELEVANCE/APPLICATION

Diagnostic mammography with tomosynthesis has resulted in fewer close mammographic follow-up studies and more categorized as benign, thereby reducing costs and patient anxiety and indicating overall improved diagnostic confidence.
**A 4AFC Observer Study to Compare the Visibility of Masses in 2D-mammography and Digital Breast Tomosynthesis Systems**

Premkumar Elangovan PhD, MSc (Presenter): Nothing to Disclose, Alaleh Rashidnasab: Nothing to Disclose, Alistair Mackenzie: Nothing to Disclose, David Dance PhD: Nothing to Disclose, Kenneth C. Young PhD: Nothing to Disclose, Hilde Bosmans PhD: Co-founder, Qaelum NV Research Grant, Siemens AG, William Paul Segars PhD: Nothing to Disclose, Kevin Wells PhD: Nothing to Disclose

**PURPOSE**

To compare the visibility of spheres and simulated masses in 2D-mammography and digital breast tomosynthesis systems (DBT) using human observer studies.

**METHOD AND MATERIALS**

A selection of uniform spheres and simulated masses with varying size and contrast were embedded in volumetric ROIs taken from anthropomorphic Duke virtual breast phantoms. A set of validated simulation tools was then used to synthesise images representing challenging clinical visibility situations. A series of 4-alternative forced choice (4AFC) experiments (scored by 4 physicists) were conducted and contrast detection thresholds for 2D mammography and for DBT, and both target types (mass/sphere) were calculated. Data preparation involved: (i) extraction of volumetric ROIs from the breast phantoms; (ii) simulation of 3mm/7mm mass and sphere targets; (iii) insertion of the targets at random ROI depth by voxel replacement; (iv) adjustment of the object composition until a designated contrast was achieved; and (v) generation of realistic simulated images by modelling all image formation and degradation processes of a Hologic Selenia Dimensions 3D system. This led to 45 mass and 15 sphere images per experimental condition (i.e. contrast and size). The observers were presented with a series of signal detection tasks comprising 4 images per task - one with the target signal, and the rest with similar backgrounds with no signal present. Each observer was required to select the image containing the target signal. The minimum detectable contrast (at which the observers were correct 92.5% of the time) was calculated for all experimental conditions.

**RESULTS**

Observers needed approximately three times the signal contrast to correctly identify a mass in 2D-mammography (3mm: 0.030±.0035, 7mm: 0.034±.0001) compared with DBT (3mm: 0.010±.0004, 7mm: 0.010±.0002). Similar differences were found when spheres were used instead of simulated masses. However, the minimum detectable contrast for spheres was much lower in both 2D-mammography (3mm: 0.018±.0037, 7mm: 0.019±.0008) and DBT (3mm: 0.007±.0035, 7mm: 0.005±.0035) compared to masses.

**CONCLUSION**

The proposed method provides a quantitative means of comparing system designs and may help in optimisation.

**CLINICAL RELEVANCE/APPLICATION**

Tomosynthesis appears to have a lower detection limit than 2D-mammography for masses/spheres, and moreover, detection studies using spheres may produce overly-optimistic threshold contrast values.

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**Quality Assurance Testing in the 21st Century – Are We Still in the Dark Ages?**

Aoife Gallagher MSc (Presenter): Nothing to Disclose, Anita Dowling: Nothing to Disclose, Ronan Faulkner: Nothing to Disclose, Louise Bowden: Nothing to Disclose, Una O’Connor: Nothing to Disclose, Jim Malone: Nothing to Disclose, Geraldine O’Reilly: Nothing to Disclose

**CONCLUSION**

The design of an effective QA programme for diagnostic imaging equipment must aim to ensure that adequate clinical image quality is achieved at doses that are ALARA. These results highlight the need for the Medical Physics profession to review current QA guidance documents to ensure that tests are not being undertaken, just for the sake of it.

**Background**

The design of X-ray technology has become increasingly more sophisticated over the past 30 years. However, technological developments have not always been matched by a similar emphasis on updating associated Quality Assurance (QA) protocols. Thus many of the same tests undertaken 30 years ago are still performed today. This paper assesses the appropriateness of routinely undertaking some of these long established tests on modern systems. It compiles results of tests undertaken on approximately 100 systems in 1997 and on a similar number of systems 14 years later. All equipment was in clinical use at the time of testing and varied in age from 1 to 27 years.
Evaluation

More systems were found to be operating within tolerance in the recent QA assessment than when compared to those assessed 14 years previously. On average, while less than 10% of systems failed individual tests during the recent assessment, up to 35% of systems in the earlier appraisal failed to meet tolerances. Where issues were detected, problems were notably more significant in the earlier assessment. An example confirming this relates to the assessment of radiation output repeatability. Current assessments indicated that one system failed to produce a coefficient of variation within 10%, yielding 11%. Earlier results identified that three systems significantly exceeded the tolerance; one system producing a coefficient of variation of 47% while a second system returned a staggering response of 150%.

Discussion

These results confirm that certain cohorts of tests seldom fail to meet tolerances while others are less likely to pass. In addition, QA measurements on modern systems do not deviate from the limits of tolerance with such high magnitude as in the past. Based on these findings, there is scope to reassess the range of tests performed, extent of the range of settings assessed and frequency of testing.

SSE21-03

Microcalcification Visibility in Surgical Biopsy Specimens Using a Stationary Digital Breast Tomosynthesis System

Jabari Calliste (Presenter): Nothing to Disclose, Andrew Tucker: Nothing to Disclose, Otto Zhou PhD: Board of Directors, XinRay Systems Inc Research Grant, Carestream Health, Inc, Jianping Lu: Research Grant, Carestream Health, Inc, Cherrie M. Kuzmiak DO: Research Grant, Siemens AG Research Grant, Zumatek, Inc, Yueh Z. Lee MD, PhD: Research Grant, Carestream Health, Inc

PURPOSE

Digital breast tomosynthesis (DBT) involves acquiring images using a conventional x-ray source in continuous motion over an angular span. This results in anisotropic spatial resolution, with a subsequent reduction in microcalcification (MC) image quality compared to 2D mammography imaging. We have developed a stationary breast tomosynthesis system (s-DBT) using a CNT X-ray source array. This system allows for the acquisition of projection images over an angular span with zero tube motion in rapid succession. This study presents the comparison of s-DBT to continuous motion DBT.

METHOD AND MATERIALS

Twenty-three patients scheduled for needle-localized biopsies with breast lesions (BIRADS 4 or 5) were recruited under the university's institutional review board regulations. Surgical specimens were imaged using a continuous motion DBT Selenia Dimensions system (Hologic Inc., Bedford, MA) and an s-DBT system. Tomosynthesis data sets were acquired on both systems using the similar parameters, 15 projection images at a tube potential of 26 kVp and 100 mAs exposure. The angular span of the s-DBT system is 28° while that of the DBT is 15°. The estimated area of the MCs was used as the figure of merit in evaluating both DBT systems.

RESULTS

12 of the 23 patients had microcalcifications for analysis. Area estimates of MC were smaller by the s-DBT system compared to the DBT. Decreases in MC area in the x-y plane from DBT to s-DBT of up to 43% were observed. A narrower ASF was observed for every MC imaged by the s-DBT compared to the DBT. On average a reduction of 2 mm in FWHM of the ASF curve is observed.

CONCLUSION

Increased spatial resolution in the s-DBT system was apparent in all tomosynthesis data set. The results are indicative of s-DBT producing increased MC conspicuity in human breast tissue compared to a Selenia Dimensions DBT system. Reader studies are ongoing comparing the visibility of MC in s-DBT verses that of the DBT system.

CLINICAL RELEVANCE/APPLICATION

The use of a stationary breast tomosynthesis system in a clinical setting can offer superior image quality compared to DBT system. Improvement in MC imaging in DBT may eventually negate the need for a 2D mammography image, resulting in a reduction of patient dose.

SSE21-04

Comparison of Wireless Detectors for Digital Radiography Systems: Image Quality and Dose

Jurgen E.M. Mourik PhD (Presenter): Nothing to Disclose, Pieternel van der Tol: Nothing to Disclose, Wouter J. H. Veldkamp PhD: Nothing to Disclose, Koos Geleijns PhD: Nothing to Disclose

PURPOSE

Wireless detectors are more frequently used in digital radiography. The advantages of wireless detectors are greater flexibility and better hygiene. The purpose of this study was to compare dose and image quality of wireless detectors for digital chest radiography.

METHOD AND MATERIALS

A chest phantom was developed from perspex, aluminium, foam (air) and a contrast-detail phantom (CDRAD).
Entrance dose at both the detector (EDD) and phantom (EPD) were measured with a solid-state dosimeter. Dose and image quality (CDRAD) were measured for wireless detectors of 5 different vendors (A-E). Both the actual clinical protocols and a standard reference protocol (120kV, EDD: 4 μGy) were evaluated. For image quality, 6 successive images were acquired for each protocol and analyzed with automated software yielding averaged inverse image quality figures (IQFinv). In addition, dose corrected contrast-to-noise ratios, defined as CNR/vEDD, were assessed for the cylindrical holes on the first row of the CDRAD phantom. As the cylindrical holes vary in depth, this leads to an approximate linear relationship between CNR/vEDD and the depth of the cylindrical holes.

RESULTS

All wireless detectors used a CsI scintillator and differed mainly in size [34-43cm] and pixel size [125-200 µm]. Main differences in clinical protocols involved tube voltage [90-125 kV], tube current [0.5-1.4mAs], the use of a small (D and E) or large focus and the use of additional filtration (D and E). For the clinical protocols, large differences in EDD [A: 1.8; B: 5.6; C: 4.4; D: 7.0; E: 2.0 μGy] and EPD [A: 21.7; B: 68.8; C: 58.3; D: 54.2; E: 17.3 μGy] were observed. IQFinv varied between 2.4 (E) and 4.1 (C) for the clinical protocol and between 2.1 (B) and 3.8 (C) for the reference protocol. For both clinical and reference protocol, largest CNR/vEDD were found for vendor A (slope: 0.6, intercept: 0.6) and smallest for vendor B (slope: 0.3, intercept: 0.2) and D (slope: 0.3, intercept: 0.4).

CONCLUSION

Large differences in acquisition parameters, entrance dose and image quality were observed between the 5 different systems. Further improvement of imaging technology and acquisition protocols is warranted for optimization of wireless digital chest radiography.

CLINICAL RELEVANCE/APPLICATION

Wireless detectors offer greater flexibility and better hygiene but further improvement of imaging technology and acquisition protocols is warranted for optimization of wireless chest radiography.

SSE21-05

Performance Evaluation of Different DBT Systems: Dose and Image Quality Assessment

Paola Enrica Colombo : Nothing to Disclose, Daniela Origgi PhD (Presenter): Nothing to Disclose, Arcangela Maldera: Nothing to Disclose, Paolo De Marco: Nothing to Disclose, Mauro Campoleoni BS : Nothing to Disclose, Alberto Torresin MPH : Nothing to Disclose

PURPOSE

Digital Breast Tomosynthesis (DBT) is a recently introduced technique for the detection of breast cancer. The aim of this work is to give a physical characterization of three commercial systems in order to evaluate their performances in the clinical practice.

METHOD AND MATERIALS

The systems investigated are Senograph Essential GE, Mammomat Inspiration Siemens and Selenia Dimensions Hologic. They use different angular ranges (15°-50°), projection numbers (9-25), types of acquisition (step and shoot-continuous) and reconstruction algorithms (FBP - Iterative (IR)). Average Glandular Dose (AGD) and image quality parameters were taken into account. AGD was estimated with a calibrated ionization chamber according to the Dance model. Image quality parameters of 3D images include signal and noise uniformity, modulation transfer function (MTF, Zhao 2008) and contrast to noise ratio (CNR). The artefacts were investigated measuring the Artefact Spread Function (ASF, Wu 2004) of spherical details of various materials and diameters, while the effective reconstructed plane thickness was evaluated using a thin tilted wire.

RESULTS

Measured AGD is always under acceptable limits established for FFDM (EC 2006). Signal and noise uniformity are better than 95% for the three systems. For all the systems MTF is different in the front-back (FB) and left-right (LR) directions, showing a better result in the FB one. The MTF50% in the movement LR direction is 3.2 lp/mm for GE and 1.3 lp/mm for the others. The better resolution of GE could be due to the acquisition modality. As expected, ASF depends on detail dimension for all the systems; the persistency of the artefacts away from the in-focus plane is larger for smaller range systems. CNR depends also on reconstruction process and it is higher for GE probably due to the IR algorithm used. Effective thickness of the reconstructed planes depends on angular range: the slice thickness increases for smaller angular values.

CONCLUSION

Physical characterization of DBT systems is important to evaluate dose and to determine image quality parameters, which can influence clinical detectability of pathological tissues.

CLINICAL RELEVANCE/APPLICATION

Dose and image quality assessment are important in clinical practice because they affect the insight of the radiologists. However, these parameters are deeply influenced by the system design.

SSE21-06

Physical and Clinical Characterization of a New Breast Tomosynthesis (DBT) Unit

Stefano Rivetti PhD (Presenter): Research Consultant, FUJIFILM Holdings Corporation, Nico Lanconelli PhD : Nothing to Disclose, Virginia d’Andrea MD : Nothing to Disclose, Anna Sarnelli : Nothing to Disclose, Fabio Falcini : Nothing to Disclose.
A new DBT unit ("Innovality" by Fujifilm) has recently been introduced in the market, characterized by two new implementations: first, linked to the detector's design, is the TFT layout based on hexagonal geometry, instead the conventional square grid, and second, is the possibility to acquire images in two different geometries, respectively with a small (15°) and wide (40°) angle. We present the system's characterization and a preliminary clinical trial performed to characterize the two DBT acquisition geometries.

**METHOD AND MATERIALS**

This system is based on an aSe detector. The hexagonal TFT element used has an area similar to that achieved with a 68 um square pixel. The key issue is the higher signal sampling efficiency due to the hexagonal structure, compared to the square one: it permits, for obtaining similar spatial resolution, about 15% lower number of elements than those used with square sampling. The system's characterization was obtained in terms of MTF, NNPS, DQE. DBT modality was characterized for both angles in terms of dose, artifact spread function (ASF) and resolution. The clinical study was performed in a side by side layout. Hundred patients (second level examination in screening population) was enrolled for the DBT acquisitions. For each patient one single projection was performed in both DBT geometries (ethics committee and informed consent). Images were scored, in terms of qualitatively parameters, by two blinded expert readers.

**RESULTS**

System's MTF is similar to that achieved with a 50 um aSe detector while the NPS is much similar to a 68 um detector: resulting peak DQE is around 80%. The two acquisition geometries shown significantly differences in terms of technical parameters: the small acquisition angle presents higher in plane resolution but worst ASF. The impact on the clinical images is a slightly preference for wide angle images when coupled with 2D projection otherwise a slightly preference for small angle. Wide angle projection is always preferred for high density breast.

**CONCLUSION**

The system shows interesting performance and the possibility to choose the acquisition geometries is an opportunity to fit at best the DBT exam for each patient.

**CLINICAL RELEVANCE/APPLICATION**

The choice of the geometry can potentially help to optimize the DBT acquisition in function of the breast density and the clinical tasks.
Descriptors to Characterize Breast Lesions on Contrast Enhanced Spectral Mammography

Rasha Mohamed Kamal MD (Presenter): Nothing to Disclose , Maha Hussein Helal MD : Nothing to Disclose
Dorina Saleh Salem MD : Nothing to Disclose , Rasha Wessam MD, PhD : Nothing to Disclose , Sahar Mansour MD : Nothing to Disclose , Marwa Anas Haggag MSc : Nothing to Disclose , Radwa Essam MBBS : Nothing to Disclose , Lamia Adel MD : Nothing to Disclose , Yassmine Mounir MD : Nothing to Disclose , Iman Godda MD : Nothing to Disclose , Nelly Aledin MD : Nothing to Disclose

PURPOSE
The purpose of the study is to assess the potential impact of using the standardized MRI ACR BI-RADS lexicon lesion morphology descriptors in the characterization of breast lesions on Contrast Enhanced Spectral Mammography (CESM).

METHOD AND MATERIALS
Institutional review board approval and patient informed consent were obtained from 271 patients with 350 breast lesions who underwent CESM. According to the MRI morphology descriptors, lesions were classified into enhancing and non-enhancing. Enhancing lesions were classified into: focus, mass and non mass. For characterization of mass lesions, the shape, margins and internal enhancement characteristics were assessed. For non mass lesions, the distribution and internal enhancement pattern were assessed. The validity of each criterion was tested in correlation with data provided from revision of pathology specimens. The impact of applying the MRI morphology descriptors on the diagnostic performance of CESM was assessed.

RESULTS
The study included 148/350 (42.3%) benign and 202/350 (57.7%) malignant lesions out of which 261 lesions showed contrast uptake. The number of enhancing lesions were significantly higher (p value<0.05) in malignant lesions (192/202, 95.5%) than in benign ones (68/148, 45.0%). Enhancing lesions were classified into focus (12/261 cases, 4.6%), mass (168/261, 64.4% cases) and non mass (81/261 cases, 31%). Irregular mass shape (p value: 0.00), un-circumscribed margins (p value: 0.00) and heterogeneous enhancement (p value: 0.027) was significantly indicative of a malignant pathology. Ring pattern of contrast uptake was identified in 24 lesions: 13/24, (54.2%) benign and 11/24 (45.8%) malignant. Segmental and regional non mass enhancement with a heterogeneous or clumped pattern was significantly higher with malignant pathologies (p value: 0.003). Applying the MRI morphology descriptors to CESM yielded a sensitivity, specificity and accuracy of 92.2%, 81.9%and 88% respectively.

CONCLUSION
The standardized ACR BI-RADS morphology descriptors; with the exception of the ring pattern of contrast uptake, can be applied in the interpretation of CESM and thus provides accurate characterization of breast lesions.

CLINICAL RELEVANCE/APPLICATION
The current study can be used as a pilot study for constructing a CESM BI-RADS lexicon that is essential for precise lesion characterization and provides pertinent guidance for appropriate management procedures.

Added Value of Contrast-enhanced Spectral Mammography as Part of One Stop Breast Unit

Anne-Marie Tardivel (Presenter): Nothing to Disclose , Corinne Balleyguier MD : Nothing to Disclose , Sandra Canale : Nothing to Disclose , Suzette Delaloge MD : Nothing to Disclose , chafika mazouni : Nothing to Disclose , Marie Christine Mathieu : Nothing to Disclose , Clarisse Dromain MD : Nothing to Disclose

PURPOSE
To assess the added value on medical and surgical strategy of contrast-enhanced spectral mammography (CESM) in comparison to mammography (MG) and ultrasound (US) in breast cancer in a One Stop Breast unit.

METHOD AND MATERIALS
Between September 2012 and September 2013, 195 women with a suspicious or undetermined breast lesion on MG and US underwent bilateral CESM in a one shot-stop breast unit. BI-RADS categories and probability of malignancy, retrospectively and blindly estimated by two radiologists, were compared to pathology or follow-up for typically benign lesions. Diagnostic performances were estimated. Size measurement of index lesions on CESM, US and MG were compared to pathology. Changes of medical and surgical strategy were recorded.

RESULTS
299 lesions were detected including 221 malignant lesions (172 infiltrative ductal carcinoma, 28 lobular infiltrative carcinoma, 13 ductal carcinoma in situ, 4 infiltrative mixed carcinoma, 3 tubular carcinoma, 1 mucinous carcinoma) in 157 / 195 patients (81%). CESM sensitivity, specificity, positive predictive value and negative predictive value were 94% (IC 89%-96%), 74% (IC 63%-83%), 91% (IC 86%-94%) and 81% (IC 70%-89%), respectively, with 18 false-positive and 14 false-negative findings. In 115 index lesions, MG and CESM were more accurate than US compared to pathology (p

CONCLUSION
Routine use of CESM confirms its good clinical performances. CESM may be performed easily in a One Stop Breast unit and may change significantly the diagnostic and treatment strategy in breast cancer staging.

CLINICAL RELEVANCE/APPLICATION
CESM is a valuable imaging technique allowing to reduce mammogram uncertainty in a post screening one shot-stop breast unit.
Diagnostic Accuracy of Contrast-enhanced Breast Tomosynthesis and Dynamic Contrast-enhanced Breast MRI

Chen-Pin Chou MD (Presenter): Research funded, Hologic, Inc, Chia-Ling Chiang MD : Nothing to Disclose, Wei-Teng Wang : Nothing to Disclose

PURPOSE

To compare the diagnostic accuracy of contrast-enhanced breast tomosynthesis (CEBT) and dynamic contrast-enhanced breast MRI (DCE-MRI) for breast lesions detected on digital mammogram.

METHOD AND MATERIALS

Institutional review board approved the study. Written informed consent was obtained from all patients. A total of 212 consecutive women suspected of having breast lesions on digital mammogram between March 2012 and April 2014 were enrolled in this study. All women had both CEBT and DCE-MRI before biopsy. For the dual-energy CEBT, a modified Selenia Dimensions (Hologic, Inc.) machine was used. Simultaneously 2D mammogram and 3D tomosynthesis were taken after injection with 1.5 mL iodine contrast agent per kilogram of body weight of and imaged between 2 and 6 minutes after injection. Contrast-enhanced images were taken in the suspicious breast (pre-contrast MLO view, post-contrast CC and MLO view) and contralateral breast (post-contrast MLO view). The BI-RADS classifications on CEBT were finally determined based on findings on combinations of 2D mammogram, 3D tomosynthesis and post-contrast subtraction 2D and 3D images. Women were also evaluated at 1.5T (GE) or 3T MRI (Siemens) with dedicated breast coil. Different radiologists interpreted CEBT and DCE-MRI.

RESULTS

Total 259 histological findings were available in 212 women (mean age 51.3 years, range 31-70 years). About 79% women did not have clinical symptoms. 31 women had at least two breast lesions in unilateral breasts. 8 women had bilateral breast lesions. The most common findings of lesions was microcalcification (60%). The pathology revealed 167 benign lesions and 92 breast malignancies (52 carcinoma in situ, and 40 invasive breast cancers). The sensitivity/ specificity of CEBT and DCE-MRI for diagnosing breast cancers were 93%/53% and 86%/74%, respectively.

CONCLUSION

CEBT and DCE-MRI showed similar diagnostic performance for abnormal lesions on mammogram.

CLINICAL RELEVANCE/APPLICATION

CEBT is an flexible imaging tool for women who cannot undergo breast MRI for various reasons,

The Impact of Merging New Modalities of Digital Mammography on the Proper Staging of Breast Cancer

Maha Hussein Helal MD (Presenter): Nothing to Disclose, Mai Zaglol MBCh : Nothing to Disclose, Lami Adel MD : Nothing to Disclose, Omnia Mokhtar MD : Nothing to Disclose, Sahar Mansour MD : Nothing to Disclose, Nelly Allerdin MD : Nothing to Disclose, Iman Godda MD : Nothing to Disclose, Rasha Mohamed Kamal MD : Nothing to Disclose, Noha Abdel Shafey MD : Nothing to Disclose, nagat mansour khalifa : Nothing to Disclose

PURPOSE

Contrast-enhanced mammography and tomosynthesis are promising applications of digital mammography required to increase conspicuity of the different breast lesions. We aimed to compare the performance of these applications in staging of breast cancer to detect the proper modality required for accurate pre-operative evaluation.

METHOD AND MATERIALS

Ethics committee approval was obtained in this retrospective analysis where examinations of 115 masses in 103 cases were done. Evaluation methods included regular digital mammography, 3-D tomosynthesis and contrast enhanced spectral mammography. For acquisition the system attains a 'Combo-mode' imaging technique (2D+3D imaging) that acquires a traditional digital mammogram and a tomosynthesis scan in the same compression. For contrast-enhanced images: low (22-33 kVp) and high (44-49 kVp) energy exposures were taken in the same projections after IV injection of contrast agent. Evaluated masses were biopsied and proved malignancy (70 masses) were further evaluated regarding lesions' extension, size, multiplicity and related calcifications.

RESULTS

Tomosynthesis provided near estimation of cancer extension to pathology data (n=58, 83%) followed by contrast-enhanced (n=32, 46%) and regular mammography (n=51, 73%). Contrast-enhanced mammography presented the least assessment for calcifications, yet the most accurate size estimation with a median value of 0.4 compared to 0.5 and 1.5 for tomosynthesis and regular mammography respectively. Multiplicity was better demonstrated by contrast mammography equally with sensitivity of 92% followed by tomosynthesis (77%) and regular mammography (54%). The combined analysis of the three modalities provided an estimated accuracy of 88% in the pre-operative evaluation of breast cancer.
The combined application of tomosynthesis and contrast-enhanced digital mammogram enhance the performance of the standard mammogram and present an informative method in staging breast cancer.

Digital mammography (DM) is still limited by overlapped densities that may provide false negative/positive diagnosis. Advanced applications of DM: tomosynthesis and contrast-enhanced mammography could improve the performance and provide better evaluation of breast lesions.

Digital breast tomosynthesis (DBT) has demonstrated improved breast cancer detection and reduced FP (recall) rates. Dosimetry in the majority of combo exposures is ≥3 mGy; thus, substituting “synthetic 2D” for conventional DM images affords opportunities to better refine the dosimetric properties and image quality of DBT.
PURPOSE
To evaluate the effects of compression thickness (thickness), breast tissue density (density), and age on mean glandular dose (MGD) received from screening 3D Digital Breast Tomosynthesis (DBT).

METHOD AND MATERIALS
This IRB approved retrospective study included all screening DBT exams performed at our institution from 1/1/2014 to 1/31/2014. Our DBT protocol included 2D and 3D acquisitions. Patient age, density as determined by interpreting radiologist; compression thickness (mm) and total MGD (TMGD, mGy) for the 2 standard (cranio-caudal and mediolateral oblique) views per breast were recorded. TMGD was independently compared to thickness, density, and age using univariate and multivariate regression. Subgroup analysis for low vs high density (fatty and scattered vs heterogeneous and extremely dense) was performed.

RESULTS
There were 200 DBT exams with mean age of 56 ± 10.0 years (range 35-78). 110 exams were low density [33 fatty (16.5%), 77 scattered (38.5%)] and 90 were high density [67 heterogeneous (33.5%), 23 extremely dense (11.5%)]. The average TMGD was 14.95 mGy and average thickness was 57.3 mm. When correlated with radiation dose, there was a positive correlation with thickness (r=+0.92), but weak correlation with density (r=+0.20) and age (r=+0.21). Thickness is a significant determinant of total radiation dose (R²=0.87) and with density (R²=0.04) and patient age (R²=0.04) to a lesser extent. Using the multivariate model, we found that all three variables were statistically significant and increased the ability to predict patient total radiation dose (R²=0.90). For low density, the average TMGD was 15.3 mGy and average thickness was 61.2 mm. For high density, the average TMGD was 14.23 mGy and average thickness was 52.6 mm. Thickness showed a stronger correlation with radiation dose for patients with less dense than more dense breasts (less: r=+0.97, R²=0.96; more: r=+0.91, R²=0.85; p<0.0001), indicating that TMGD increases more quickly with an increase in thickness for patients with low density breasts than for patients with high density breasts.

CONCLUSION
Radiation dose received by patients undergoing screening DBT significantly correlates with patient’s breast thickness, and less so with breast density and age.

CLINICAL RELEVANCE/APPLICATION
For patients undergoing screening DBT, breast thickness should be considered as an important contributor to overall radiation dose in addition to breast density and patient age.

VSBR31-09 Assessing Radiologist Performance and Microcalcifications Visualization Using Combined 3D Rotating Mammogram (RM) and Digital Breast Tomosynthesis (DBT)

Nachiko Uchiyama MD (Presenter): Nothing to Disclose, Hitomi Tani: Nothing to Disclose, Minoru Machida MD, PhD: Nothing to Disclose, Mari Kikuchi MD: Nothing to Disclose, Yasuaki Arai: Nothing to Disclose

PURPOSE
RM (rotating mammogram) generates a 3D overview rendering of a reconstructed DBT volume. The purpose of this study is to compare the diagnostic accuracy of FFDM and DBT using and not using RM and to determine whether DBT plus RM will contribute to the assessment of breast cancer.

METHOD AND MATERIALS
55 patients including 34 breasts with malignancy and 76 normal or benign breasts were recruited. 6 dedicated breast imaging radiologists evaluated the images utilizing ROC analysis. The 55 patient cases were randomly divided into two groups: group A (28 patients) and group B (27 patients). First, FFDM from group A and DBT with and without RM from group B were evaluated. Second, DBT with and without RM from group A and FFDM from group B were evaluated. Each participant completed two reading sessions spaced 4 weeks apart to minimize recall bias. Modified BI-RADS and percentage probability of malignancy (POM) scale were used and the reader-specific area under the curves (AUC) were analyzed. In addition, the visualization of masses and microcalcifications as well as the appearance of noise were also compared and scored separately for each case in DBT and RM on a 4-point scale from 0 to 3.

RESULTS
For the BI-RADS scale, the average AUC for DBT plus RM was 0.907, DBT alone 0.901 and FFDM was 0.793. For POM, the average AUC for DBT plus RM was 0.915, DBT alone 0.907 and FFDM was 0.799. DBT plus RM demonstrated superior diagnostic accuracy compared with FFDM alone, as shown by significant difference in the average AUC (p<0.05). In terms of average AUC, only a small improvement was seen by DBT plus RM compared to DBT alone. Difference in the average AUC in BI-RADS between DBT plus RM and DBT alone was 0.006 and in POM was 0.008. For all 14 cancers manifesting as microcalcifications, the visualization was significantly better on RM than DBT (p<0.05).

CONCLUSION
With the RM parameter settings used in this study, the combination of DBT plus RM showed only small improvement compared to that of DBT alone in terms of ROC curve area, sensitivity and specificity. Adjunction of RM to DBT will offer the benefit of increased diagnostic accuracy and contribute to more accurate assessment of DBT alone. The visualization of microcalcifications was significantly better on RM than DBT.

CLINICAL RELEVANCE/APPLICATION
The RM could be used for improved 3D visualization of structures, e.g. microcalcifications, in DBT and could lead to faster DBT reading times.

**Comparison with Synthetic 2D Mammography Reconstructed from Digital Breast Tomosynthesis and Digital 2D Mammography for the Detection of T1 Breast Cancer**

Ji Soo Choi MD, PhD (Presenter): Nothing to Disclose, Boo-Kyung Han MD, PhD: Nothing to Disclose, Eun Young Ko MD, PhD: Nothing to Disclose, Eun Sook Ko MD: Nothing to Disclose, Soo Yeon Hahn MD: Nothing to Disclose

**PURPOSE**

To evaluate the interpretative performance of synthetic two-dimensional (2D) mammography (C-View) reconstructed from digital breast tomosynthesis (DBT) for detection and characterization of small invasive cancers, compared to digital 2D mammography (DM).

**METHOD AND MATERIALS**

This study consecutively enrolled 107 patients (mean age 52.1 years) with T1-stage invasive breast cancers (≤2cm in size, mean size 12.9±4.3 mm) confirmed by surgical excision from January to June 2013. For each patient, DM and DBT were performed, and C-View was reconstructed from each set of DBT slices. Three breast radiologists, blinded to histology, interpreted DM and C-view, and recorded visibility (four-point scale; 1 no visible finding, 2 low conspicuity, 3 medium conspicuity, 4 high conspicuity) and morphology of detected cancers. Diagnostic performance of C-View was compared with that of DM in terms of detectability and visibility. Subgroup analyses were performed according to mammographic density (dense 29/ non-dense 78).

**RESULTS**

There was no significant difference in detection sensitivity of T1 breast cancers between C-View (range 62.6-71.0%) and DM (60.7-71.0%) for all readers (P>0.05). The visibility scores of C-View and DM were also not significantly different for each observer (range of mean scores 2.6-2.9 for C-View, 2.4-2.9 for DM; P>0.05). Common presentation of detected cancers on both C-View and DM were irregular spiculated masses (67.7% vs. 69.0%) and microcalcifications (14.5% vs. 15.5%). In the subgroup analysis according to mammographic density, C-View and DM showed no significant difference in detectability and visibility of T1 breast cancers. These two modes of dense breast group showed lower detection sensitivity (range 53.8-65.4% for C-View, 51.3-65.4% for DM) and lower visibility scores (range of mean visibility score 2.3-2.7 for C-View, 2.1-2.7 for DM), compared to those of non-dense group (detection sensitivity 86.2% for C-View, 86.2% for DM; range of mean visibility score 3.2-3.4 for C-View, 3.1-3.5 for DM).

**CONCLUSION**

Diagnostic performance of C-View and DM are comparable for detection of T1 breast cancers. Therefore, our results indicate that C-view may eliminate the need for addition of DM during DBT-based screening.

**CLINICAL RELEVANCE/APPLICATION**

Synthetic 2D mammography may eliminate the need for addition of digital 2D mammography during DBT-based screening, and keep the dose of DBT the same as that of digital 2D mammography.

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**Clinical Evidence of DBT Utility**

Etta D. Pisano MD (Presenter): Founder, NextRay, Inc CEO, NextRay, Inc Research Grant, Koninklijke Philips NV Research Grant, Zumatek, Inc Research Grant, FUJIFILM Holdings Corporation Equipment support, Siemens AG Research Grant, Siemens AG Equipment support, Koninklijke Philips NV Research Grant, Koninklijke Philips NV

**LEARNING OBJECTIVES**

1) Review research data on the clinical utility of digital breast tomosynthesis (DBT). 2) Identify current gaps in evidence and directions for future research for DBT.

**The STORM II (Screening with Tomosynthesis or Mammography II) Trial: Interim Comparison of Screen-reading Strategies in Population Breast Screening**

Daniela Bernardi MD (Presenter): Nothing to Disclose, Marco Pellegrini MD: Nothing to Disclose, Marvi Valentini MD: Nothing to Disclose, Carmine Fanto MD: Nothing to Disclose, Nehmat Houssami MBBS: Nothing to Disclose

**PURPOSE**

To compare, in population breast screening, detection using various screening modalities including integrated synthetically reconstructed 2D images (syt2D) and 3D mammography (3D) with conventional mammography screening and integrated standard 2D and 3D.

**METHOD AND MATERIALS**

STORM II trial is a prospective study comparing 2D-only mammography with integrated 2D/3D and with integrated synthetic 2D images/3D. From June to November 2013, all the resident women aged from 49 to 70 who attended local population-based screening, after informed consent, had digital mammography in Combo® mode; synthetic 2D images were reconstructed from the data acquired during the tomo-exposures using...
dedicated software (c-view®, Hologic, USA). All screens had independent, double and sequential readings: two readers interpreted sequentially 2D then 2D/3D, whereas two other readers interpreted sequentially synt2D then synt2D/3D, thus each screen was read by 4 readers. Any positive screens at any reading phase was recalled. Paired data were compared using McNemar’s Chi-square test.

RESULTS

Based on 3312 screens, 27 breast cancers were detected in 24 women: 19 cancers were detected by standard 2D mammography, 21 cancers were detected with integrated 2D/3D screening (p=0.50) whereas 6 more cancers were detected only by integration of synthetic 2D/3D (p=0.125). None of the cancers were detected with 2D-only mammography or synt2D alone. There were 295 false positive (FP) recalls attributed to various screen-reading modalities: 30 from synt2D alone, 33 from standard 2D mammography alone, 91 from synt2D/3D alone and 100 from 2D/3D alone. FP recalls for the integrated readings was 155 using integrated 2D/3D versus 151 using integrated synt2D/3D (p=0.79).

CONCLUSION

Although not statistically different from 2D/3D, cancer detection was highest for integrated synthetic 2D with 3D mammography amongst various screen-reading methods evaluated in this interim analysis.

CLINICAL RELEVANCE/APPLICATION

Integrated synt2D/3D mammography may have the potential to enhance cancer detection in population breast screening providing a solution to concerns about the required double x-ray exposure in 2D/3D modality.

VSBR31-13

Interval Cancers in Patients Screened with Full Field Digital Mammography (FFDM) vs FFDM plus Digital Breast Tomosynthesis (DBT)

Nelly Salem MD (Presenter): Nothing to Disclose, Cheryl L Thompson: Nothing to Disclose, Donna M. Plecha MD: Advisory Board, Hologic, Inc Research Grant, SuperSonic Imagine

PURPOSE

To compare the rates and tumor characteristics of interval cancers diagnosed in patients screened with full field digital mammography (FFDM) versus those screened with FFDM plus digital breast tomosynthesis (DBT).

METHOD AND MATERIALS

Cancer patients diagnosed from 9/1/2011-12/31/2013 were evaluated, determining if they were interval cancers from a population screened from 9/1/2011-12/31/2012. Patients were separated into two groups: those who were screened with FFDM versus FFDM + DBT. Interval cancers were defined as those that presented less than a year of a negative screening mammogram with a symptom. Age, breast density, interval time period from a negative mammogram, tumor size, stage, lymph node status, and treatment regimens were recorded.

RESULTS

15,551 women were screened between 9/1/2011 and 12/31/2012 with 11,185 screened with FFDM and 4,366 women screened with FFDM + DBT. Overall 22 interval cancers were identified, 18 were patients who underwent screening with FFDM, and 4 were screened with FFDM + DBT. This is a non-significant 38% lower interval cancer rate of 1 cancer per 1000 patients screened with FFDM + DBT versus 1.6/1000 interval cancers in patients screened with FFDM alone (p=0.43). Overall mean cancer patient age was 62, and there was a mean of 7.7 months interval at time of diagnosis since the screening exam, with no significant difference between the two groups. When comparing the two groups of interval cancer patients, there was no statistical significance in breast density, cancer grade, stage, size, lymph node status, mastectomy rate, rate of chemotherapy or radiation therapy between the two groups.

CONCLUSION

Our results show a non-significant 38% lower interval cancer rate when screening with FFDM + DBT versus FFDM alone. We found no significant difference between the two groups of interval cancer patients comparing age, breast density, interval time at diagnosis, cancer grade, stage, size, lymph node status, mastectomy rate, rate of chemotherapy or radiation therapy.

CLINICAL RELEVANCE/APPLICATION

DBT is a promising supplement to mammographic screening for breast cancer. Studies have shown decreased recall rates and increased cancer detection rates, however the effect on interval cancers has not been evaluated. Our results demonstrate no significant difference in: the interval cancer rate or characteristics of the interval cancers between patients screened with DBT + FFDM versus FFDM alone.

VSBR31-14

Comparison of the Use of BIRADS Category 3 before and after Implementation of Digital Breast Tomosynthesis in a Large Screening Population

Elizabeth McDonald MD, PhD (Presenter): Nothing to Disclose, Susan Weinstein MD: Nothing to Disclose, Anne Marie McCarthy: Nothing to Disclose, Marie Synnestvedt: Nothing to Disclose, Mitchell Dennis Schnall MD, PhD: Nothing to Disclose, Emily F. Conant MD: Scientific Advisory Board, Hologic, Inc

PURPOSE

(1) Compare the utilization of BIRADS category 3 (BR3, recommend short-interval follow-up) after a recall from screening before and after implementation of screening digital breast tomosynthesis (DBT). (2) Determine
whether DBT will reduce the use of short-interval follow-up by lesion subtype.

METHOD AND MATERIALS

Retrospective IRB approved review of 15,633 screening DBT exams from 10/1/2011-2/28/2013 and 10,751 screening digital mammography (DM) exams from 9/1/2010-8/30/2011 was performed. The initial recall populations for DM and DBT were 1116 and 1372, respectively. That group was further searched for a de novo assignment of category 3. Exams were cataloged according to finding type: calcifications (C), asymmetry or focal asymmetry (A), mass (M), and architectural distortion (AD). Some exams were recalled for more than one finding type. Differences between groups were compared using Wilcoxon Rank Sum Test.

RESULTS

There were significantly less patients recommended for short-interval follow-up in the DBT cohort (172/10751, 1.6% DM versus 203/15633, 1.3% DBT, p=0.042). However, this difference was no longer significant when the lower recall rate of the DBT cohort was taken into account (172/1116, 15.4% DM versus 203/1372, 14.8% DBT, p=0.70). The finding types given a BR3 for the DM cohort were C (67/172, 39.0%), M (41/172, 23.8%), A (71/172, 41.3%), and AD (5/172, 2.9%) and DBT cohort, C (66/203, 32.5%), M (62/203, 30.5%), A (96/203, 47.3%) and AD (9/203, 4.4%). There was no significant difference in the use of BR3 for any finding type (p=0.20, 0.15, 0.24 and 0.44, respectively).

CONCLUSION

Screening DBT does not reduce the frequency of BR3 assessment after recall from screening and also does not change the types of findings recommended for short-interval follow-up.

CLINICAL RELEVANCE/APPLICATION

Screening with DBT does not reduce the number of patients recommended for short-interval follow-up after initial diagnostic evaluation.

Cancer Yield of Architectural Distortion Detected on Screening Tomosynthesis

Kelly Damico MD (Presenter): Nothing to Disclose, Ana P. Lourenco MD: Nothing to Disclose, Luke M. Partyka MD: Nothing to Disclose, Martha Beretta Mainiero MD: Nothing to Disclose

PURPOSE

To determine the cancer yield of architectural distortion (AD) seen only or better on digital breast tomosynthesis (DBT) compared to digital mammography (DM) during routine screening.

METHOD AND MATERIALS

An IRB approved, HIPAA compliant retrospective review of all screening DBT performed at an academic breast center from March 2012 through November 2013 identified all BIRADS 0 results. BI-RADS 0 reports were then reviewed to identify all cases of AD or possible AD. Cases were consensus reviewed by two fellowship trained breast radiologists and scored according to visibility of the AD (seen only on DM, better on DM, equally on DM and DBT, better on DBT, or only on DBT). All additional imaging and pathology results corresponding to the AD were reviewed, and results recorded in a database.

RESULTS

Of the 25,369 screening DBT exams, there were 1,769 (7%) BI-RADS 0 results. Of these, there were 84 (4.7%) reports of AD or possible AD. 32 were excluded, as AD or possible AD was not confirmed on consensus review. 52 cases of AD or possible AD detected at screening form the basis of this study. Of these, 26 (50%) were seen only on DBT, 23 (44%) seen better on DBT than DM, and 2 (4%) seen equally on DBT and DM. There were no cases seen only or better on DM. Of the 52 cases, 26 went on to biopsy (50%) with malignancy diagnosed in 54% (14/26) (biopsy positive predictive value). Biopsy also identified 7 radial scars and 5 benign findings. All 26 of the biopsied cases were either seen only on DBT or seen better on DBT. Of the malignancies, 57% (8/14) were DBT only findings. Surgical excision was required in 81% (21/26) of cases biopsied. Of the 26 cases that did not undergo biopsy, 8 (31%) were assessed as BI-RADS 3 and 13 (50%) as BI-RADS 1/2 on diagnostic evaluation. 1 case was lost to follow-up. 4 cases were assessed as BI-RADS 4/5 for lesions separate from the possible AD. Average follow-up for lesions not undergoing biopsy was 9.7 months. Overall cancer yield was 27% (14/52).

CONCLUSION

DBT detects areas of malignant AD not readily seen on DM. The 27% cancer yield in this study suggests that AD should not be dismissed even if detected only on DBT.

CLINICAL RELEVANCE/APPLICATION

The cancer yield and biopsy positive predictive value of AD detected only on DBT is high. This finding should not be dismissed when identified at routine screening DBT.
VSBR31-16  Comparison of Digital Mammography (FFDM) and FFDM Plus Digital Breast Tomosynthesis in Mammography Screening for Cancer Detection according to Breast Parenchyma Density


PURPOSE

To compare cancer detection using full-field digital mammography (FFDM) versus FFDM plus digital breast tomosynthesis (DBT) in a population-based screening according to BI-RADS density.

METHOD AND MATERIALS

The prospective screening trial was approved by Ethical Committee. All women signed a written consent. 25,547 women age 50-69 y. underwent FFDM and DBT. Prospective independent readings were performed, using a 5-point rating scale for probability of cancer (1-5) for each breast. Eight radiologists participated in the interpretation alternating between the two modes. The trial had 4 arms including one arm offering FFDM+CAD and another offering synthetic 2D in lieu of conventional FFDM. This analysis includes only two arms, namely FFDM alone versus FFDM+DBT. All cases with a positive score by at least one reader were discussed at arbitration meeting before final decision whether to recall the woman for diagnostic workup. At arbitration meeting case-based consensus BI-RADS density scores were recorded. Cancers detected on FFDM and FFDM+DBT were stratified by breast density. McNemar test was used to compare detection in each of the density groups by mode.

RESULTS

257 screen-detected malignancies were found: 20 in breasts with density 1; 105 in density 2; 110 in density 3; and 22 in breasts with BI-RADS density 4. Overall, a true positive (TP) score under the FFDM alone mode was 163/257 (63%) compared with 211/257 (82%) under the FFDM+DBT mode (p<0.05). For women with "fatty breast" (BI-RADS density 1 or 2), the number of cancers detected under the FFDM and FFDM+DBT were 85/125 (68%) and 105/125 (84%), respectively (p<0.05) and in women with "dense breast" (density 3 or 4), the detected cancers were 78/132 (59%) and 106/132 (80%), respectively (p<0.05). Stratifying the "fatty breast" into BI-RADS density 1 and 2 showed no difference in detection between FFDM and FFDM+DBT in BI-RADS density 1 (17/20 versus 16/20 detected caners, respectively). The higher detection rate in "fatty breasts" by FFDM+DBT was solely attributed to higher detection in women with breast density 2.

CONCLUSION

Tomosynthesis has the potential to significantly increase the cancer detection rate in mammography screening of women with breast density BI-RADS 2-4. We observed no increase in women with BI-RADS density 1.

CLINICAL RELEVANCE/APPLICATION

Tomosynthesis may significantly improve the cancer detection rate in mammography screening of women with BI-RADS density 2-4.

VSBR31-17  Screening Recalls after Tomosynthesis Mammography: Are Additional Mammographic Views Necessary?

Jaime Lynn Geisel MD (Presenter): Consultant, Siemens AG, Liva Andrejeva-Wright MD : Nothing to Disclose, Madhavi Raghu MD : Nothing to Disclose, Melissa Angeline Durand MD : Nothing to Disclose, Paul H. Levesque MD : Nothing to Disclose, Liane Elizabeth Philpotts MD : Nothing to Disclose

PURPOSE

Tomosynthesis (tomo) has been shown to reduce recalls from screening mammography and be equivalent or superior to conventional (2D) spot views. The value of spot tomo views has not yet been assessed. The purpose of our study is to determine in what lesions is additional diagnostic mammographic imaging beneficial.

METHOD AND MATERIALS

A retrospective review of the breast imaging database was performed to identify all BIRADS 0 cases in patients undergoing tomosynthesis screening in a 6 month period, July 1, 2013 to December 31, 2013. Of 295 BIRADS 0 lesions, 137 lesions in 138 patients who had tomo spot views and US as part of the diagnostic work-up were included. Cases were retrospectively blindly reviewed on a dedicated workstation by 4 readers. Two readers evaluated each lesion for a total of 314 lesion assessments. Readers evaluated the screening tomosynthesis exam, followed by the US images and finally the additional diagnostic spot tomo views. The type of lesion (asymmetry, mass, architectural distortion), breast density, forced BIRADS and likelihood of malignancy were assessed at each stage. The outcome of cases in terms of final BIRADS assessment and biopsy results, when appropriate, was assessed.

RESULTS

The mammographic findings consisted of 182 asymmetries, 83 masses, and 49 architectural distortions. In 226 (72%), additional spot tomo views were assessed as not helpful to screening tomosynthesis. Spot views were reported helpful in assessing 57% (28/49) architectural distortions, 25% (45/182) asymmetries and 18% (15/83) masses. Spot views were considered more helpful in assessing lesions noted on one view only (41%), the majority of which were asymmetries (75%) and architectural distortions (20%), compared with two views (17%). Readers identified all 9 cancers with tomo and US. No additional cancers were detected with spot tomo views.
CONCLUSION

Spot tomosynthesis views did not add to the diagnostic evaluation in the majority of non-calcification cases recalled from tomosynthesis screening but were useful in many cases of questioned architectural distortion. The overall sensitivity of screening tomo and US alone was equivalent to that with spot images.

CLINICAL RELEVANCE/APPLICATION

Routine screening tomosynthesis views allow adequate assessment of most mammographic findings such that US alone is required in the work up of the majority of cases recalled from screening which can save costs, radiation, exposure and time.

SSG01

Breast Imaging (Diagnostics and Treatment Monitoring)

Scientific Papers

MR BR

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 10:30 AM - 12:00 PM   Location: E451A

Participants

Moderator
Elizabeth A. Morris MD : Nothing to Disclose

Moderator
Linda Moy MD : Nothing to Disclose

Sub-Events

SSG01-01

Pathologic Response to Neoadjuvant Chemotherapy in Triple-negative Breast Cancer: Association with Pretreatment Breast MRI Features

Min Sun Bae MD, PhD (Presenter): Nothing to Disclose, Sung Ui Shin MD : Nothing to Disclose, A Jung Chu MD : Nothing to Disclose, Won Hwa Kim MD, PhD : Nothing to Disclose, Su Hyun Lee MD : Nothing to Disclose, Woo Kyung Moon : Nothing to Disclose, Nariya Cho MD : Nothing to Disclose, Sung Eun Song MD : Nothing to Disclose

PURPOSE

To evaluate whether pretreatment MRI findings were distinguishable between responders and non-responders in triple-negative (ER-/PR-/HER2-) breast cancer (TNBC) patients who received neoadjuvant chemotherapy.

METHOD AND MATERIALS

IRB-approved retrospective review of our database identified 113 TNBC patients who underwent pretreatment breast MRI and neoadjuvant chemotherapy between January 2005 and December 2009. Two experienced breast radiologists reviewed MRI and mammograms without knowledge of clinicopathologic findings based on BI-RADS lexicon. All interpretations were agreed upon prior to being recorded. Pathologic complete response (pCR) was defined as the absence of invasive tumor cells in the resected breast specimen. Twenty-two (19.5%) patients achieved pCR and 91 (80.5%) showed non-pCR. Association of pCR status with imaging features was assessed using Fisher’s exact test or the chi-squared test.

RESULTS

Median age was 43 years for both pCR and non-pCR groups. Breast cancer stage at presentation was not significantly different between the groups (p = 0.065). Irregular-shaped masses (p < 0.001, 96.7% vs 31.8% [non-pCR vs pCR]), irregular-marginated masses (p < 0.001, 93.4% vs 63.6%), presence of intratumoral high signal intensity on T2-weighted image (p = 0.002, 68.1% vs 31.8%), multifocality or multicentricity (p = 0.002, 39.6% vs 4.5%), and masses with calcifications seen on mammography (p = 0.043, 34.1% vs 13.6%) were significantly associated with non-pCR in TNBC patients. Features not statistically associated with pCR status included an internal enhancement pattern (p = 0.614), fibroglandular tissue on MRI (p = 0.651), background parenchymal enhancement (p = 0.319), and lymph node enlargement (p = 0.182).

CONCLUSION

Pretreatment MRI features in TNBC patients were shown to differ between responders and non-responders to neoadjuvant chemotherapy.

CLINICAL RELEVANCE/APPLICATION

This study demonstrates that TNBC response to neoadjuvant chemotherapy could be predicted using pretreatment MRI features.

SSG01-02

Role of T2 Mapping in Diagnosis and Neoadjuvant Chemotherapy of Breast Cancer
PURPOSE

To investigate 1) use of quantitative analysis of T2 relaxation time in differentiating malignant from benign breast lesions and therefore increase the diagnostic accuracy of breast MRI; 2) change in T2 relaxation time of breast cancer before and after neoadjuvant chemotherapy (NAC).

METHOD AND MATERIALS

Of the total 67 patients, 46 have malignant tumors while 21 have benign pathology. Twenty-six of the 47 malignant cases underwent NAC. MRI T2 mapping was performed in all patients. In patients with NAC, T2-mapping was performed before and after NAC. T2 relaxation times were obtained by using Funtool software on AW 43 workstation. Pathological response to NAC was assessed according to Miller-Payne response score. Statistical analysis was performed on T2 relaxation times of malignant and benign lesions, before and after NAC.

RESULTS

The mean T2 relaxation time in the malignant cases was 82.69 ±15.37 ms, whereas the T2 relaxation time in benign cases was 95.48±26.51 ms. Difference in T2 relaxation time between malignant and benign cases is statistically significant (P=0.015 <0.05). In 26 cases with NAC, the mean T2 relaxation time was 81.34±13.68 ms and 64.50±8.71 ms before and after NAC, respectively. Difference in T2 relaxation time between the pre- and post- NAC is significant (P=0.00 <0.05). Based on the MP response score, the mean post-NAC T2 relaxation time in 23 responders out of 26 NAC cases (63.18±8.37 ms) was significantly shorter than that in non-responders (74.62±2.32 ms) (P=0.029).

CONCLUSION

T2 relaxation time in benign lesions was found to be significantly longer than that in malignant lesions. Quantitative measurement of T2 relaxation time might provide new diagnostic parameter to breast MRI. T2 relaxation time in breast cancer was reduced after NAC, particularly in the responders. Measurement of T2 relaxation time change is a potential new tool to assess the response to NAC.

CLINICAL RELEVANCE/APPLICATION

Measurement of T2 relaxation time change is a potential new tool to assess the response to NAC and diagnosis breast cancer.
CLINICAL RELEVANCE/APPLICATION

Only tumor T2 hyperintensity may have utility in predicting tumor recurrence and response to chemotherapy in patients diagnosed with ER positive breast cancer.

SSG01-04

Breast Imaging Changes of Invasive Cancers on Dynamic Contrast-enhanced and Diffusion-weighted MR Imaging: Correlation with Molecular Subtypes

Li Na  Zhang MD (Presenter):  Nothing to Disclose , Song  Chen :  Nothing to Disclose , Shao Wu  Wang MD :  Nothing to Disclose , Qingwei  Song BS, BEng :  Nothing to Disclose , Ailian  Liu MD :  Nothing to Disclose

PURPOSE

To evaluate the breast characteristics of invasive cancers on dynamic contrast-enhanced MR imaging (DCE-MRI) and diffusion-weighted MR imaging (DWI) assessed as parameters in comparison with different molecular subtypes.

METHOD AND MATERIALS

This retrospective study was approved by the institutional review board and requirement for informed consent was waived. A total of 164 lesions in 161 women who underwent preoperative breast imagings both DCE-MRI and DWI were reviewed. According to the receptor status, tumour subtype was categorized as triple-negative breast cancer (TNBC), luminal A, luminalB, and Her2 +. The following lesion characteristics were recorded: DCE morphology and maximum lesion size, initial phase peak enhancement, delayed phase enhancement categorized by a single type of kinetics comprising the largest percentage of enhancement (washout, plateau, or persistent) with CAD analysis, apparent diffusion coefficient (ADC) values, and contrast-to-noise ratio (CNR) at DWI with b values of 0 and 800 s/mm2. Discriminative abilities of models were compared by using the area under the receiver operating characteristic curve (AUC).

RESULTS

Compared with other three subtypes (69 luminal A, 40 luminal B, and 21 Her2 +), TNBC lesions exhibited smooth mass margin, larger maximum lesion size and rim enhancement (n=34, P<0.005). Significant differences in delayed phase enhancement (P<0.005) and CNR (P<0.001) were observed among four subtypes, while no differences in lesion shape (p=0.09), initial phase peak enhancement parameters (P=0.07) or mean ADC value (P=0.099). A multivariate model combining maximum diameter, CNR with b values of 800 s/mm2 and delayed phase enhancement most significantly discriminated TNBC from other three subtypes (AUC=0.84).

CONCLUSION

In addition to the morphological features, DCE-MRI and DWI could provide novel quantitative information reflecting invasive cancers microenvironment changes, with a potential role in the differentiation of molecular subtypes and to facilitate lesion-specific targeted therapies.

CLINICAL RELEVANCE/APPLICATION

In addition to the morphological features, DCE-MRI and DWI could provide novel quantitative information reflecting invasive cancers microenvironment changes, with a potential role in the differentiation of molecular subtypes and to facilitate lesion-specific targeted therapies.

SSG01-05

Role of MRI Diffusion, as an Adjunct to Contrast Enhanced MRI of The Breast, for the Evaluation of Patients with Locally Advanced Breast Cancer Receiving Neoadjuvant Chemotherapy

Hebatalla H. Elkassas MD (Presenter):  Nothing to Disclose , Maha Hussein Helal MD :  Nothing to Disclose , Asmaa Abdelkhalek Abouraiba MD :  Nothing to Disclose , Naglaa  Abdel Razek MD :  Nothing to Disclose , Ola  Khorsid MD, MSc :  Nothing to Disclose , Ahmed  Farahat MD, MSc :  Nothing to Disclose , Mohamed  Zedan MSc, MRCS :  Nothing to Disclose , Ehab  Mansour MD :  Nothing to Disclose

PURPOSE

To assess the role of MRI diffusion in predicting further responders and non responders, early during the course of neoadjuvant chemotherapy given to patients with advanced breast cancer. Another objective was to depict the role of diffusion imaging in the evaluation of residual disease at the end of treatment.

METHOD AND MATERIALS

Thirty five patients with advanced breast cancer scheduled to receive neoadjuvant chemotherapy (NAC), between January 2013 and January 2014, were enrolled in this prospective study. MRI with diffusion weighted (DW) and contrast enhanced images were performed and parameters including number, size and apparent diffusion coefficient (ADC) values of lesions were recorded at 4 stages: before starting NAC, during (after the 1st and 2nd cycles) and after completion of NAC. The percentage changes in ADC values and tumor size, before and after the 1st and 2nd cycles were then calculated. Diagnostic performance of MRI (morphological and functional imaging) in predicting early response and assessing residual disease was then compared to the histopathological results.

RESULTS

The percentage increase in the ADC values, measured before and after the first cycle of NAC in responder patients, was significant, while the change in tumor diameter found after the 2nd cycle was only of border line significance. Following the first cycle of therapy, DWI had a sensitivity of 79% and a specificity up to 95% in differentiating responders from non responders. The sensitivity and specificity for depicting residual tumor was 94% and 92% respectively for DW MR imaging, with a 89% and 94% results for contrast enhanced MR
CONCLUSION
Diffusion weighted MRI is a valuable tool in identifying responders and non responders to NAC, in patients with advanced breast cancer early during their treatment course, hence selecting only patients that will benefit from NAC and avoiding non responders any unnecessary toxicity. The overall accuracy of DWI in detecting residual disease is almost similar to that of contrast enhanced MRI and can act as a substitute in patients that cannot be given contrast.

CLINICAL RELEVANCE/APPLICATION
Early prediction of non responder by DWI to neoadjuvant chemotherapy could potentially spare them unnecessary toxicity. Accurate delineation of the residual tumor could enhance surgical outcomes.

Diffuse Non-mass Enhancement (NME) May Safely Be Categorized as Background Parenchymal Enhancement
Adrienne Rebecca Newburg MD (Presenter): Nothing to Disclose, Chloe Muy-Chou Chhor MD: Nothing to Disclose, Leng Leng Young Lin BA, MD: Nothing to Disclose, Jennifer Gillman: Nothing to Disclose, Jin Ah Kim MD: Nothing to Disclose, Hildegarde B. Toth MD: Nothing to Disclose, Linda Moy MD: Nothing to Disclose

PURPOSE
Determination of physiologic versus pathologic enhancement on breast MRI can present a diagnostic challenge. Background parenchymal enhancement (BPE) was recently incorporated into the 5th edition BI-RADS lexicon, defined as the volume and intensity of fibroglandular tissue enhancement. However, physiologic enhancement may be non-uniform or asymmetric, and pathologic NME can be diffuse. We have observed that NME described as “diffuse” did not yield malignancy at follow-up or biopsy. Therefore, the purpose of the study was to determine frequency of subsequent malignancy on follow-up for NME described as diffuse.

METHOD AND MATERIALS
An IRB-approved, retrospective review of 5,837 consecutive breast MRIs performed from 2005-2011 identified 928 NME lesions for which follow-up or biopsy was recommended. We queried our database for the following terms: “diffuse NME” “scattered” “patchy areas” “bilateral stippled enhancement” or “likely benign fibrocystic change” in the MRI report impression. For purposes of this study these terms were categorized as diffuse. We identified 94/928 (10%) cases which were evaluated by 2 fellowship-trained breast radiologists using 5th edition BI-RADS lexicon. We sought to determine if enhancement pattern was benign and could be assigned one of 4 BPE categories. Final BI-RADS assessment, BPE category and follow-up exams were recorded.

RESULTS
Mean age of patients with NME described as diffuse was 44 years, range 22-73. Of the 94 NME described as diffuse, 21/94 (22%) had no further breast imaging at our institution. Of the remaining 73, 4 (5%) underwent biopsy with benign results. No subsequent cancers were identified for 73/73 (100%) of diffuse NME at follow-up (mean 2.6 yrs, range 0.1 to 4.8). 1/73 (1.4%) patients developed an interval malignancy after 2.5 yrs of follow-up, which was biopsy-proven DCIS manifesting as a new linear focal area of NME distinct from the background enhancement. BPE categories for the 73 cases were 7/73 (10%) minimal, 32/73 (44%) mild, 29/73 (40%) moderate, 5/73 (7%) marked.

CONCLUSION
Diffuse NME had a 0% PPV for malignancy.

CLINICAL RELEVANCE/APPLICATION
Diffuse breast tissue enhancement may be classified as BPE, with no additional follow-up or biopsy required. The introduction of the term BPE into the BI-RADS lexicon is useful.

Is the Predictive Value of BI-RADS 3, 4, and 5 Findings Detected on Screening and Diagnostic Breast MRI affected by Study Indication?
Sona Ajit Chikarmane MD: Nothing to Disclose, Catherine Streeto Giess MD (Presenter): Nothing to Disclose, Dorothy Amy Sippo MD: Nothing to Disclose, Robyn L. Birdwell MD: Nothing to Disclose

PURPOSE
To determine (1) the prevalence and predictive value of BI-RADS 3, 4, and 5 findings on breast MRI; and (2) the impact of study indication (screening versus diagnostic) and patient risk factors (personal or family history of breast cancer) on the predictive value of BI-RADS categories.

METHOD AND MATERIALS
An IRB approved, retrospective review of our breast MRI database from 2009-2011 (5778 contrast enhanced studies in 3360 patients) was performed. At our institution each breast receives an individual BI-RADS assessment. Breast MRI reports and electronic medical record were reviewed to obtain BI-RADS assessment, imaging features, patient demographics, and outcome data.

RESULTS
Overall, there were 9216 BI-RADS assessments assigned during the study period: 7879 (85.5%) BI-RADS 1/2,
567 (6.1%) BI-RADS 3, 715 (7.8%) BI-RADS 4, and 55 (0.6%) BI-RADS 5. The prevalence of BI-RADS 3, 4, and 5 was higher in studies performed for diagnostic (7.8%, 14.6%, 1.5%, respectively) than screening (5.2%, 4.0%, 0.07%) indications (p < 0.0001). A total of 734 biopsies were performed with 219 (29.8%) malignant and 515 (70.2%) benign outcomes. The overall negative predictive value (NPV) for BI-RADS 3 findings was 98.0% (11/567) with no difference observed by study indication (diagnostic, 98.4%; screening, 97.7%, p = 0.76). In patients without a personal or family history of breast cancer, the NPV of BI-RADS 3 was 100% (0/177). The overall malignancy rate of BI-RADS 4 and 5 was 22.5% (161/715) and 85.5% (47/55), respectively. Malignancy rates for BI-RADS 4 subcategories were 7.9% (4a), 23.5% (4b), and 59.7% (4c). A trend toward higher malignancy rate was observed in BI-RADS 4/5 in diagnostic versus screening indications (49.6% vs 22.9%, p = 0.09). The highest cancer rate for BI-RADS 4 and 5 categories was in patients undergoing screening for personal history of breast cancer (26.3%, 100%).

CONCLUSION

Inclusion of clinical indications and patient demographics in assessing the likelihood of malignancy may potentially lead to fewer benign biopsies and false negatives in certain populations, improving the predictive value of BI-RADS assessments in breast MRI.

CLINICAL RELEVANCE/APPLICATION

Clinical indication and personal / family history should be considered when assessing likelihood of malignancy in findings detected on breast MRI, particularly in BI-RADS 3 category.

Breast MRI Reliably Excludes Malignancy in Conventional BI-RADS 0 Cases

Claudio Spick MD (Presenter): Nothing to Disclose, Dieter H. M. Szolar MD : Nothing to Disclose, Klaus Werner Preidler MD : Nothing to Disclose, Pia Reittner : Nothing to Disclose, Manfred Tillich : Nothing to Disclose, Pascal Andreas Thomas Baltzer MD : Nothing to Disclose

PURPOSE

The use of breast MRI as a problem-solving tool in BI-RADS 0 cases has been the subject of controversy. The purpose of this study was to provide empirical data about the diagnostic use of breast MRI for problem-solving in BI-RADS 0 cases.

METHOD AND MATERIALS

In this IRB-approved, single-center study, 687 women prospectively underwent high-resolution, 3D, dynamic contrast-enhanced breast MRI between January 2012 and December 2012. We analyzed 111 consecutive patients (mean age, 51±12 years; range, 20-83 years) categorized as BI-RADS 0. Breast MRI findings were stratified by clinical presentations, conventional imaging findings, and breast density. MRI results were compared to the reference standard, defined as histopathology or an imaging follow-up of at least one year.

RESULTS

One-hundred-eleven patients with BI-RADS 0 conventional imaging findings revealed 30 (27%) mammographic masses, 57 (51.4%) mammographic architectural distortions, 5 (4.5%) mammographic microcalcifications, 17 (15.3%) ultrasound only findings, and two palpable findings without imaging correlates. No cancers were detected in breast cancer ACR category I. There were 15 true-positive, 85 true-negative, 11 false-positive, and zero false-negative breast MRI findings, resulting in a sensitivity, specificity, PPV, and NPV of 100% (95% CI: 78.2-100%), 88.5% (95% CI: 80.4%-94.1%), 57.7% (95% CI: 36.9%-76.7%), and 100% (95% CI: 95.8%-100%). The general rate of malignancy was higher in mass lesions (22.6%, 12 of 53) compared to non-mass lesions (5.2%, 3 of 58). Lesions presenting as mammographic mass or microcalcification had the highest probability for malignancy, followed by architectural distortions. Lesions presenting without mammographic correlate showed the lowest probability of malignancy. Breast density and reasons for referral had no significant influence on diagnostic performance of breast MRI (p>0.05). ROC-analysis revealed an area under the ROC-curve of 0.966 (95% CI 0.913-0.991).

CONCLUSION

Breast MRI reliably excludes malignancy in conventional BI-RADS 0 cases.

CLINICAL RELEVANCE/APPLICATION

Due to its high negative predictive value, breast MRI is suitable as a problem-solving tool for conventional BI-RADS 0 findings.

Are Incidental Hepatic Lesions on Breast MRI Clinically Significant?


PURPOSE

Incidental hepatic lesions identified on breast MR can be a diagnostic dilemma due to concern for liver metastases or other significant hepatic lesions. The purpose of this study was to identify the incidence and nature of liver lesions seen on breast MR, and determine whether additional imaging or follow up may be necessary.

METHOD AND MATERIALS
From 1/1/10–12/31/11, 1,664 breast MR studies were performed. The medical records and imaging of all patients were reviewed for the presence of liver lesions, if an accurate diagnosis was made on breast MRI, how often further imaging was recommended, and the final diagnosis upon additional imaging.

RESULTS

Of 1,664 breast MRs, incidental hepatic lesions were seen in 207 (12.4%). In 162 MRs (78%) these were reported as circumscribed T2 hyperintense lesions consistent with cysts or hemangiomas. No diagnosis was made on breast MR in 43 cases (21%) and lesions were described as suspicious for metastases in 2 cases (1.0%). Further imaging was recommended in 50/162 patients (31%) with lesions described as cysts or hemangiomas and 29/43 patients (67%) with lesions for which no diagnosis was made. Of these 79 patients, further imaging was performed in 60 patients (76%). 19 patients (24%) did not have subsequent imaging or were lost to follow-up. Further imaging confirmed the diagnosis of a cyst or hemangioma in 53/60 patients (88%), with no lesion identified in 5/60 patients (8%). 2 patients (3%) had lesions that were categorized as indeterminate on MRI but were stable at 1-year follow-up. The 2 patients with hepatic lesions suspicious for metastases both had mildly T2 hyperintense hepatic lesions confirmed as metastases at subsequent imaging. Both patients had locally advanced breast cancer on MR.

CONCLUSION

The majority of incidental liver lesions on breast MR can be classified as cysts or hemangiomas without further imaging. Of patients undergoing further imaging, 96% of patients had benign findings and 3% had lesions characterized as indeterminate but stable on follow-up. In 2 cases (1%), T2 mildly hyperintense hepatic lesions were correctly identified as metastases on breast MR. Our series suggests further imaging may not be necessary for incidental benign appearing lesions seen on breast MR.

CLINICAL RELEVANCE/APPLICATION

Breast MR detects incidental liver lesions in 12% of patients, the majority of which are benign. This suggests that additional dedicated hepatic imaging may not be necessary.

BRS-TUA

Breast Tuesday Poster Discussions

Scientific Posters

BR

AMA PRA Category 1 Credits™: .50

Tue, Dec 2 12:15 PM - 12:45 PM  Location: BR Community, Learning Center

Participants
Moderator
Emily F. Conant MD: Scientific Advisory Board, Hologic, Inc

Sub-Events

BRS257 How Sensitive is Contrast-enhanced Spectral Mammography (CESM) versus Breast MRI?—Initial Retrospective Comparison in 50 Malignant Breasts (Station #1)

Luna Li MD, PhD: Nothing to Disclose, Lydia Liao MD, PhD: Nothing to Disclose, Pauline Germaine DO: Nothing to Disclose, Elizabeth Tinney RRA (Presenter): Nothing to Disclose

PURPOSE

To compare contrast-enhanced spectral mammography (CESM) with breast MRI (BMRI) in a retrospective study in breast cancer detection. To further understand the features and benefits of CESM as a diagnostic tool.

METHOD AND MATERIALS

This study involved 50 malignant breasts in 48 women retrospectively chosen from of 960 patients in our institution. Both CESM and BMRI were done for each patient within 30 days. The positive findings were confirmed by pathology. The enhancement intensity of enhancement and malignant lesions was quantified. The size of lesions was classified into three categories based on standard of breast cancer stages. The enhancement intensity on both studies has been quantified based on a scale of 0-3. The scores of each case were calculated for average size of index lesion and statistical analysis. Sensitivity and positive predictive value (PPV) were calculated for each study. Morphology consistence was evaluated by the percentage of the consistent findings between CESM and BMRI.

RESULTS

Our retrospective study analyzed the sensitivity and PPV of CESM by comparing to BMRI. Of the 50 breasts, there was one false-positive finding at CESM mammography, and four false-positive findings at MR imaging. The average size of index lesion examined was 3.7 cm by CESM and 3.8 cm by BMRI. The smallest cancer can be detected by both CESM and BMRI is less than 0.5 cm. The average staging was 2 for both CESM and BMRI.
The score for cancer enhancement intensity is 1.8 for CESM and 2.2 for BMRI. Both CESM and BMRI have a sensitivity of 100% to detect breast cancer in our study. CESM has a PPV of 98% versus 93% for BMRI which reflects a better specificity. Morphology consistence was 46/50 (92%).

CONCLUSION

CESM and BMRI are consistent on morphology and equal sensitivity for detection of breast cancer lesions. CESM has less enhancement intensity than BMRI and higher PPV (reflecting a higher specificity) than BMRI.

CLINICAL RELEVANCE/APPLICATION

With its low cost, increased accessibility, feasibility, and short test duration, CESM can be used as a triage method before BMRI is applied.

BI-RADS Classification before and after Contrast Enhanced Spectral Mammography. Possible Indications and Usefulness as a Complementary Tool in Management of Breast Lesions (Station #2)

Juan Jose Cordones (Presenter): Nothing to Disclose, Carolina Ramirez Lozano MD: Nothing to Disclose, Jose Luis Cardenas: Nothing to Disclose, Johanna Marisol Silva MD: Nothing to Disclose, Carmen Bermejo: Nothing to Disclose, Angeles Cruz Diaz MD: Nothing to Disclose

PURPOSE

To describe how CESM changed BI-RADS category of lesions previously evaluated with conventional imaging modalities reviewing the cases performed in our institution from March 2011 to February 2013.

METHOD AND MATERIALS

We reviewed the indications of 95 patients with CESM performed at our institution and we analyzed how the BI-RADS category was modified according to the lack, presence and degree of enhancement on CESM in a total of 108 lesions, comparing it with the BI-RADS obtained in mammography and/or ultrasound. We correlated radiologic findings with histopathological findings (80) or radiologic follow-up of at least one year when no biopsy was performed (28).

RESULTS

We consider the performance of CESM indicated in the following situations: lack of conclusive findings on mammography and/or ultrasound (33), mismatch between different imaging modalities or between histologic and radiologic diagnosis (30), post-surgical changes making it difficult to rule out local recurrence on conventional tests (13), planning interventional procedures in cases of multiple lesions (18), and dense breasts with suspicious lesions (14). In 29 of 108 lesions, CESM determined a change in the BI-RADS category previously obtained with other radiological modalities. 80 lesions were biopsied and 28 went into radiological follow-up. 95% of non-enhancing lesions and 67% of those with low intensity enhancement were benign. Presence of malignant cells was confirmed in 93% of high intensity enhancing lesions.

CONCLUSION

Although studies with significant samples are needed to establish clear indications of CESM, our experience proves it is useful in various diagnostic scenarios as a complementary tool, determining in a significant number of cases a change in the diagnostic management of injuries. Accessibility is a remarkable advantage of this modality.

CLINICAL RELEVANCE/APPLICATION

CESM could be a useful tool in the assessment of lesions of questionable findings, evaluation of dense breast and as a complementary tool to mammography and ultrasound in the study of scars. Accessibility is a remarkable advantage of this exploration since we can use it in the same diagnostic act and requires little room occupancy time.

Preoperative Breast Cancer Staging with Contrast Enhanced Spectral Mammography (CESM) in Comparison to Breast Ultrasound: Preliminary Results (Station #3)

Katrin S. Blum MD (Presenter): Nothing to Disclose, Christian Rubbert MD: Fellowship funded, Koninklijke Philips NV, Britta Mathys MD: Nothing to Disclose, Gerald Antoch MD: Speaker, Siemens Medical AG, Speaker, Bayer AG Speaker, BTG International Ltd, Svjetlana Mohrmann MD: Nothing to Disclose, Silvia Obenauer MD: Nothing to Disclose

PURPOSE

To prospectively evaluate and compare the accuracy of CESM and ultrasound in size measurement of breast cancer with histologic tumor sizes as gold standard. Artifacts impeding tumor size measurements in CESM were assessed in addition.

METHOD AND MATERIALS

21 women aged between 40-73 years (mean age 56 y +/-9y) with histologically proven ductal carcinoma in situ (DCIS) alone, invasive ductal/lobular carcinomas with or without additional DCIS were included in the study.
Breast density of patients was classified by the standardized classification system of the American College of Radiology (ACR)'s Breast Imaging Reporting and Data System ACR1-4. Largest tumor diameter in each method was taken as tumor size in each patient. Agreement of imaging tumor size and histopathologic tumor size was evaluated with Bland-Altman analysis.

RESULTS

Motion artifacts did not occur in the study. CESM specific artifacts caused by scattered radiation did not cause any problems in tumor size measurement. In four patients additional enhancement caused most likely by hormone proliferation of breast tissue was seen. Ultrasound in general underestimated tumor size while CESM tumor size measurements lead to a slightly overestimation of tumor size. Mean differences of tumor sizes measurement with CESM was 0.14mm (5.33%) compared to -3.05mm (-11.99%) with ultrasound. Limits of agreement ranged from -18.6 to 18.9mm for CESM, and -19.5 to 13mm in CESM. Especially tumors with size smaller than 23mm were measured more precise with CESM, than tumors with larger size. Ultrasound underestimated tumor size in women with ACR4 breast tissue density.

CONCLUSION

Similar to MRI CESM leads to a small overestimation of tumor size whereas ultrasound tends to underestimate tumor size. Motion artifacts do not affect CESM images due to strong compression and fixation of the breast. Hormone proliferation causes enhancement of healthy breast and scattered radiation artifact is a special artifact of CESM, which did not affect tumor size measurement in this study.

CLINICAL RELEVANCE/APPLICATION

Breast cancer tumor size and distribution in the breast is important to plan the most adequate therapy. Initial results with CESM show that tumor size measurement with CESM is superior to tumor size measurements with breast ultrasound.

BRS260

Effect of Gadolinium Injection on Diffusion-weighted Imaging with Background Body Signal Suppression (DWIBS) Imaging of Breast Lesions (Station #4)

Marco Moschetta MD (Presenter): Nothing to Disclose, Michele Telegrafo: Nothing to Disclose, Leonardo Rella: Nothing to Disclose, Davide Antonio Carluccio: Nothing to Disclose, Amato Antonio Stabile Ianora: Nothing to Disclose, Giuseppe Angelelli: Nothing to Disclose

PURPOSE

Diffusion-weighted imaging with background body signal suppression (DWIBS) has improved DWI potential by using a short TI inversion recovery (STIR)-echo planar imaging (EPI) sequence and free breathing to screen for breast lesions. DWIBS MR sequences provide both qualitative and quantitative imaging of breast lesions and are usually performed before contrast material injection (CMI) in the course of breast MR scan protocol. This study aims to assess whether the administration of gadolinium significantly affects DWIBS imaging.

METHOD AND MATERIALS

200 patients were prospectively evaluated by MRI with STIR, TSE-T2, pre-CMI DWIBS, contrast enhanced THRIVE-T1 and post-CMI DWIBS sequences. Pre and post-CMI DWIBS were analyzed searching for the presence of breast lesions and calculating the ADC value. ADC values of ≤1.44x10-3 mm2/s were considered suspicious for malignancy. This analysis was then compared with the histological findings. Sensitivity, specificity, diagnostic accuracy (DA), positive predictive value (PPV) and negative (NPV) were calculated for both sequences for malignancy. This analysis was then compared with the histological findings. Sensitivity, specificity, diagnostic accuracy (DA), positive predictive value (PPV) and negative (NPV) were calculated for both sequences and represented by ROC analysis. Pre and post-CMI ADC values were compared by using the paired t test.

RESULTS

In 150/200 (59%) patients, pre and post-CMI DWIBS indicated the presence of breast lesions, 53 (35%) with ADC values of >1.44 and 97 (65%) with ADC ≤ 1.44. Both pre-CMI and post-DWIBS sequences obtained sensitivity, specificity, DA, PPV and NPV values of 97%, 83%, 89%, 79% and 98%, respectively. The mean ADC value of benign lesions was 1.831 ± 0.18 × 10-3 mm2/s before and 1.828 ± 0.18 ×10-3 mm2/s after CMI. The mean ADC value of the malignant lesions was 1.146 ± 0.16 × 10-3 mm2/s before and 1.144 ± 0.16 × 10-3 mm2/s after CMI. No significant difference was found between pre and post CMI ADC values (p > 0.05).

CONCLUSION

DWIBS imaging represent a useful diagnostic complement for characterizing breast lesions and its diagnostic accuracy is not influenced by CMI. Breast MR protocol could be modified by placing DWIBS after dynamic contrast enhanced sequences in order to maximize patient cooperation and preserve the diagnostic accuracy of breast MRI.

CLINICAL RELEVANCE/APPLICATION

DWIBS sequences are not influenced by gadolinium injection. Breast MR protocol could be modified by placing DWIBS after dynamic contrast enhanced sequences in order to maximize patient cooperation and preserve the diagnostic accuracy of breast MRI.

BRS261

The Predictive Value of BI-RADS Descriptors and Genetic Variants in Women Undergoing Breast Biopsy (Station #5)

Elizabeth S. Burnside MD, MPH (Presenter): Stockholder, Cellectar Biosciences, Inc Stockholder, NeuWave Medical Inc, Jie Liu : Nothing to Disclose, Charles David Page PhD : Nothing to Disclose, Catherine A McCarty PhD : Nothing to Disclose, Adedaoy A Onitilo MD,PhD : Nothing to Disclose, Peggy L. Peissig PhD : Nothing to Disclose, Terrie Kitchner : Nothing to Disclose, Amy Trentham-Dietz : Nothing to Disclose,

Breast density of patients was classified by the standardized classification system of the American College of Radiology (ACR)’s Breast Imaging Reporting and Data System ACR1-4. Largest tumor diameter in each method was taken as tumor size in each patient. Agreement of imaging tumor size and histopathologic tumor size was evaluated with Bland-Altman analysis.

RESULTS

Motion artifacts did not occur in the study. CESM specific artifacts caused by scattered radiation did not cause any problems in tumor size measurement. In four patients additional enhancement caused most likely by hormone proliferation of breast tissue was seen. Ultrasound in general underestimated tumor size while CESM tumor size measurements lead to a slightly overestimation of tumor size. Mean differences of tumor sizes measurement with CESM was 0.14mm (5.33%) compared to -3.05mm (-11.99%) with ultrasound. Limits of agreement ranged from -18.6 to 18.9mm for CESM, and -19.5 to 13mm in CESM. Especially tumors with size smaller than 23mm were measured more precise with CESM, than tumors with larger size. Ultrasound underestimated tumor size in women with ACR4 breast tissue density.

CONCLUSION

Similar to MRI CESM leads to a small overestimation of tumor size whereas ultrasound tends to underestimate tumor size. Motion artifacts do not affect CESM images due to strong compression and fixation of the breast. Hormone proliferation causes enhancement of healthy breast and scattered radiation artifact is a special artifact of CESM, which did not affect tumor size measurement in this study.

CLINICAL RELEVANCE/APPLICATION

Breast cancer tumor size and distribution in the breast is important to plan the most adequate therapy. Initial results with CESM show that tumor size measurement with CESM is superior to tumor size measurements with breast ultrasound.
Purpose

Recent large-scale genome-wide association studies (GWAS) have identified new genetic variants that predict breast cancer. However, the predictive ability of genetic variants compared to mammography (BI-RADS) features has not been evaluated. We conducted a retrospective case/control study to determine the predictive value of demographic risk factors (from the Gail model), germline genetic variants, and BI-RADS abnormality features in women undergoing image-guided breast biopsy.

Method and Materials

We collected age-matched cases and controls from a population-based Personalized Medicine Research Project (PMRP), including women of Western European heritage with a plasma sample, a mammogram, and a breast biopsy within 12 months after the mammogram. We used Gail model risk factors from surveys and the EMR, mammographic findings according to BI-RADS extracted from free text reports, and 10 germline genetic variants (single nucleotide polymorphisms-SNPs). We built conditional logistic regression models to determine the predictive ability of single data types: 1) Gail, 2) SNPs and 3) BI-RADS as well as combined data types: 1) Gail + SNPs, 2) Gail + BI-RADS and 3) Gail + SNPs + BI-RADS. We evaluated each model in turn by calculating a risk score for each patient (using 10-fold cross validation); used this risk estimate to construct ROC curves; and compared the AUC of each model using the DeLong method.

Results

With 373 cases and 395 controls, we found that models developed using a single data type, BI-RADS (AUC = 0.681) was superior to the Gail (AUC = 0.579; p < 0.001) and SNPs (AUC = 0.601; p < 0.001). Each data type augmented the baseline Gail model: Gail + SNPs (AUC = 0.622; p < 0.02), Gail + BI-RADS (AUC = 0.700; p < 0.001) and Gail + SNPs + BI-RADS (AUC = 0.718; p < 0.001).

Conclusion

Using a single data type, BI-RADS features were most predictive of breast cancer in this population. When combined, each data type augmented discriminative performance.

Clinical Relevance/Application

As genetic disease prediction gains momentum, we show that BI-RADS abnormality features alone outperform and together augment demographic and genetic risk factors in the prediction of breast cancer.

Purpose

Spectral CT is a recently introduced scan technique. The purpose of this survey was to discover whether spectral CT has an additional value in the diagnosis and staging of malignant breast lesions and in the follow-up during treatment.

Method and Materials

Spectral CT was performed in two groups of patients: patients with no suspicion for underlying breast malignancy who had a chest CT for pulmonary or pleural pathology and patients with a chest CT for staging of a suspected or biopsy proven breast malignancy. Spectral CT was also used in the follow-up of patients during treatment for breast malignancy. Spectral CT images were viewed both qualitatively as quantitative. Qualitative analysis was done by looking both at grayscale and color coded images, quantitative analysis was performed by measuring iodine content and using spectral attenuation curves. Results were compared to other imaging techniques as MRI and to pathology findings.

Results

Between September 2012 and March 2014 26 patients with biopsy proven breast cancer were staged with a spectral chest CT. Results were compared to MRI and postoperative pathology findings. All lesions (single or multifocal) were found on spectral CT, due to the higher iodine content in the malignant lesion compared to the surrounding breast tissue. Analysis of axillary lymph node involvement was done by comparing iodine content of the nodes with that of the primary lesion and the contralateral nodes. Spectral CT was also helpful in patients with suspected breast pathology with negative mammography and ultrasound when MRI could not be performed and was also able to detect several unsuspected breast malignancies on routine chest CT. Spectral CT was also used in the follow-up of patients during treatment to evaluate not only tumor size but also iodine concentration as a measure for residual tumor activity.

Conclusion

Spectral CT has a clear advantage over conventional CT in detecting breast cancer and can be an important additional tool in selected cases when breast MRI cannot be performed. After treatment of breast cancer spectral CT can evaluate tumor response to treatment both by measuring tumor size and iodine content as a measure for tumor activity.

Clinical Relevance/Application

Spectral CT is a new technique which is used in abdominal and thoracic oncologic imaging. The aim of our survey was to explore the possible use of spectral CT in breast imaging.
Can We Use the Manufacturer Reported Mammography Dose to Inform Patients? (Station #7)

Stamatia V. Destounis MD (Presenter): Investigator, FUJIFILM Holdings Corporation Investigator, Seno Medical Instruments, Inc., Ralph Philip Highnam PhD: CEO, Matakina Technology Limited CEO, Volpara Solutions Limited, Arianne Chan PhD: Employee, Matakina Technology Limited, Andrea Lynn Arieno BS: Nothing to Disclose, Renee Morgan RT: Nothing to Disclose

PURPOSE

To evaluate the radiation doses reported by manufacturers for women undergoing mammographic screening over time, in the context of dose reporting to patients.

METHOD AND MATERIALS

Mammographic images of women undergoing yearly mammography screening at our facility were retrospectively analyzed. We identified 30 women who had 4 or 5 temporal studies complete with 4-view mammograms taken from a mix of three manufacturers (System 1, System 2, and System 3) digital mammography systems. Raw digital images were used in this evaluation. The manufacturer reported mean glandular dose (MGD) was extracted from the image headers and compared over time, considering also the technical factors and volumetric information generated by VolparaDensity (algorithm version 1.5.0). All MGD values presented were taken as the average (mean) per image across a 4-view study.

RESULTS

The manufacturer-reported radiation doses for the same patient were highly variable over time. The absolute mean change (between sequential studies) in MGD was 0.72 mGy, with changes ranging from -2.87 to +4.31 mGy. For instances where dose increased compared to the previous year, the average increase in MGD and average percentage increase, were 0.8 mGy and 62.1%, respectively. For instances where dose decreased compared to the previous year, the average decrease in MGD and average percentage decrease, were -0.6 mGy and -21.7%, respectively. Changes in MGD were not significantly influenced by changes in breast density (quantitative volumetric or BI-RADS scores); however, the manufacturer did significantly influence changes in MGD as a significantly higher average MGD was found when comparing System 1 and System 2 (3.5 and 1.4 mGy, respectively; p < 0.001).

CONCLUSION

Manufacturer-reported radiation doses vary considerably over time and between manufacturer, due to differences in technology, as well as differences in how they compute dose. This is important as patients are becoming increasingly concerned about radiation dose.

CLINICAL RELEVANCE/APPLICATION

Radiation dose is becoming a major concern, not only for general radiology, but also for mammography. The delivery of meaningful dose reports to patients is hindered by the wide variation in manufacturer reported doses.

Introductions of Current and New Breast Diffusion MRI Techniques: Potential Alternative to Contrast-enhanced MRI Technique (Station #8)

Ken Yamaguchi MD (Presenter): Nothing to Disclose, Takahiko Nakazono MD, PhD: Nothing to Disclose, Tomoyuki Noguchi: Nothing to Disclose, Ryoko Egashira MD: Nothing to Disclose, Hiroyuki Abe MD: Consultant, Seno Medical Instruments, Inc, HIroyuki Irie MD, PhD: Nothing to Disclose, Yukiko Hara MD: Nothing to Disclose, Tetsuyoshi Hirai MD: Nothing to Disclose

TEACHING POINTS

1: To review the current breast diffusion MRI (principles including image acquisition, b factor, ADC value, fat suppression and current clinical value) 2: To introduce new breast diffusion MRI techniques including diffusion tensor imaging (principles and comparison with standard diffusion techniques), readout-segmented echo-planar imaging (principles and comparison with standard diffusion techniques) and diffusion weighted imaging of axillary lymph node 3: To demonstrate the clinical value of these new breast diffusion MRI techniques

TABLE OF CONTENTS/OUTLINE

Content Organization 1: The principle and clinical value of current breast diffusion MRI 2: Introductions and prospects of new breast diffusion MRI techniques 2-1: Breast diffusion tensor imaging 2-2: Breast diffusion MRI based on readout-segmented echo-planar imaging 2-3: Diffusion MRI of the axillary lymph node

Diagnosis, Treatment, and Follow-Up of Radiation Associated Angiosarcoma (RAA) of the Breast – What Radiologists Need to Know (Station #9)

Sona Ajit Chikarmane MD (Presenter): Nothing to Disclose, Eva Csilla Gombos MD: Royalties, Amirsys, Inc, Angela A. Giardino MD: Nothing to Disclose

TEACHING POINTS

RAA is an aggressive malignancy that can develop years after breast irradiation and may be difficult to detect clinically in a background of radiation-induced skin changes; RAA may also be obscured by expected post-treatment changes (e.g. architectural distortion, skin thickening) on conventional imaging (mammogram...
Earlier detection and treatment has been shown to improve survival. The purpose of this exhibit is to 1) review the pathology and demographics of RAA, 2) demonstrate the role of imaging in the diagnosis and management of RAA and 3) illustrate challenging cases with emphasis on multimodality imaging.

**TABLE OF CONTENTS/OUTLINE**

1. Review demographics, clinical presentation, and pathology of patients with RAA
2. Illustrate how imaging (mammography, US, and breast/chest wall magnetic resonance imaging [MRI]) is used in diagnosing RAA, with emphasis on MRI
3. Highlight role of imaging in staging, surgical planning, treatment response, and detecting recurrences/metastases
4. Discuss a multidisciplinary approach to treatment and management, focusing on conventional chemotherapies, new molecular targeted therapies and surgical options
5. Review challenging cases of RAA on mammography, US, and MRI, ranging from initial diagnosis to metastatic patterns, and draw examples from our tertiary care cancer center’s radiology and pathology database

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**BRS-TUB**

**Breast Tuesday Poster Discussions**

*Scientific Posters*

**BRS264**

**Histopathological Verification of BI-RADS Scoring Accuracy in Breast Ultrasound, Conventional Mammography and Contrast Enhanced Digital Mammography (Station #1)**

Elzbieta Luczynska MD (Presenter): Nothing to Disclose, Sylwia Heinz-Paluchowska PhD: Nothing to Disclose, Sonia Dyczek MD: Nothing to Disclose, Paweł Blecharz: Nothing to Disclose, Jerzy Jakubowicz MD: Nothing to Disclose

**PURPOSE**

The main goal of this study was to compare the accuracy in BI-RADS scoring in breast ultrasound (US), conventional mammography (MG) and contrast enhanced spectral mammography (CESM) of histologically proven breast cancers.

**METHOD AND MATERIALS**

US, MG and CESM examinations were performed in 137 patients (mean age 58.3, range 26-82 years) who were referred from screening program. The study was approved by health authorities and institutional review board and all patients enrolled provided written informed consent. For obtaining the ultrasound images we used a Hitachi Preirus Hi Vision (Hitachi Medical, Tokyo, Japan) ultrasound system. Conventional mammography (MG) (Mammomat 3000, Siemens; Senographe Essential, GE Healthcare) was performed in all patients either within the institution or in other imaging centres. CESM examinations (GE SenoBright) were bi-lateral, craniocaudal and mediolateral views with dual-energy acquisition technique starting 2 minutes after IV injection of 1.5ml iodinated contrast agent per kg of bodyweight with a flow of 3ml/sec. Achieved images were assessed using BI-RADS classification (scale 1-5). All lesions visible in these examination methods were evaluated by two independent, experienced radiologists.

**RESULTS**

The highest accuracy of BI-RADS scoring was observed in CESM examinations - 100% lesions classified as malignant appeared to be a cancer. In US breast imaging correct BI-RADS scoring was assigned in 92% of patients. The lowest accuracy was noticed in MG - only 90% of described lesions were classified correctly. Tab.1

**CONCLUSION**

The sensitivity of mammographic detection is reduced in women with dense breast and the presence of a non-calcified tumor might be undetectable especially if the mass is within a fibroglandular area. Although screening ultrasound could enable the detection of mammographically occult cancers and can be well visualized against a background tissue, our results showed, that CESM is a valuable diagnostic method that enables the most accurate BI-RADS classification of malignant breast lesions.

**CLINICAL RELEVANCE/APPLICATION**

Contrast Enhanced Spectral Mammography may provide higher BI-RADS scoring precision and greater diagnostic accuracy than conventional mammography and ultrasound.

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**BRS265**

**Diagnostic Usefulness of Digital Breast Tomosynthesis (DBT) for Invasive Lobular Carcinoma (ILC) (Station #2)**

Mari Kikuchi MD (Presenter): Nothing to Disclose, Nachiko Uchiyama MD: Nothing to Disclose, Minoru Machida MD, PhD: Nothing to Disclose, Hitomi Tani: Nothing to Disclose, Takayuki Kinoshita: Nothing to Disclose, Yasuaki Arai: Nothing to Disclose

**PURPOSE**

The mammographic detection is reduced in women with dense breast and the presence of a non-calcified tumor might be undetectable especially if the mass is within a fibroglandular area. Although screening ultrasound could enable the detection of mammographically occult cancers and can be well visualized against a background tissue, our results showed, that CESM is a valuable diagnostic method that enables the most accurate BI-RADS classification of malignant breast lesions.
Invasive Lobular Carcinoma (ILC) is difficult to detect and to evaluate the extent of the lesion in comparison with Invasive Ductal Carcinoma among breast cancer subtypes because of its diffuse growth. Digital breast tomosynthesis (DBT) is a useful diagnostic procedure compared to 2D mammography (MMG) because overlap of breast tissue is reduced by DBT. In this study, we evaluated the diagnostic usefulness of DBT for ILC in comparison with the other diagnostic modalities; 2D MMG and contrast-enhanced MRI (CE-MRI).

METHOD AND MATERIALS
Images from 32 patients (age 34-78yrs, mean 54.3yrs) who underwent 2D MMG, DBT and MRI from October 2009 to July 2013 and who were diagnosed with ILC based on surgical pathology specimens were retrospectively assessed. Items for imaging assessment were: 1. Comparison of detection capability according to 2D MMG and DBT. 2. The extent of the lesion according to 2D MMG, DBT, and MRI was compared to surgical pathology specimens, and statistical analysis was performed.

RESULTS
The rate of detection was 81.3% for 2D MMG and 100% for 2D MMG+DBT. Statistical analysis (using a paired t-test) revealed that adding DBT to 2D MMG significantly improved the ability to accurately diagnose the extent of the lesion compared to 2D MMG only (p<0.001, 95%CI -3.9 - -1.6). In addition, comparison of 2D MMG+DBT and MRI revealed no significant differences (p: 0.217, 95%CI -0.4-1.5), but extent of the lesion according to 2D MMG+DBT did deviate slightly from the extent of the lesion in surgical pathology specimens.

CONCLUSION
In diagnosing for ILC, adding DBT to 2D MMG resulted in improved ability to visualize tumor density, tumor margins, and architectural distortion in comparison to 2D MMG alone. Adjunction of DBT to 2D MMG is useful to detect and evaluate its extension in connection with ILC.

CLINICAL RELEVANCE/APPLICATION
Adjunction of DBT to 2D MMG improves capability both to detect and assess the extent of disease for ILC and helps to reduce false-negative and to determine the treatment planning.

System-Wide Monitoring of Mammographic Radiation Dose for Quality Assurance (Station #3)
Marcela Bohm-Velez MD : Consultant, Koninklijke Philips NV Consultant, Matakina Technology Limited
Ralph Philip Highnam PhD (Presenter): CEO, Matakina Technology Limited CEO, Volpara Solutions Limited
Ariane Chan PhD : Employee, Matakina Technology Limited, Thomas S. Chang MD : Nothing to Disclose

PURPOSE
Interpreting large volumes of mammographic site data for quality assurance is complicated by differences in imaging systems and population characteristics. In this study, we used a novel system-wide approach to determine whether GE and Hologic mammographic units under- or over-estimated mean glandular dose (MGD) compared to a personalized estimate.

METHOD AND MATERIALS
Mammographic images (11,254 images; 2864 studies) from December 2006 to March 2014 were retrospectively analyzed in our practice using automated quality assurance software (VolpraAnalyticsTM). Volumetric breast density (VBD) characteristics and a personalized estimate of MGD (P-MGD) were obtained from the raw images. Facility and image data were automatically extracted from the image headers (e.g. manufacturer-reported MGD (M-MGD), detector ID and vendor). Average MGD values were compiled across individual mammography units (3 GE and 2 Hologic). Differences between P-MGD and M-MGD were assessed by mammography unit, vendor and patients’ VBD characteristics.

RESULTS
Overall, M-MGD significantly underestimated dose compared to the P-MGD (1.47 and 1.58 mGy, respectively; p=0.014). When stratified by vendor, the difference between M-MGD versus P-MGD estimates were 0.03 mGy (p<0.05) and 0.24 mGy (p<0.001) for the GE and Hologic units respectively. Subanalysis of one GE and one Hologic unit found that M-MGD and P-MGD estimates were very similar for the GE unit (1.44 and 1.46 mGy; p=0.381), but significantly different for the Hologic unit (1.60 and 1.84 mGy, respectively; p<0.001) despite similar VBD and breast volumes for both patient groups. The differences in vendor dose algorithms effectively masked some of the variation in dose between mammography units, albeit other influencing factors, such as compression, were also present.

CONCLUSION
Stratification of radiation dose data by mammography unit highlighted significant differences in MGD estimates between GE and Hologic units which can be attributed, in part, to the different dose algorithms used by each manufacturer. P-MGD estimates, which incorporate both individual breast densities and a manufacturer-independent dose algorithm, are essential for standardizing the assessment of radiation dose.

CLINICAL RELEVANCE/APPLICATION
In monitoring radiation dose, a system-wide approach incorporating breast density characteristics allows standardization of MGD between mammographic units, for improved breast imaging safety.
Diagnostic Accuracy of Breast MRI in the Evaluation of Patients with Suspicious Nipple Discharge. (Station #4)

Valeria Casali (Presenter): Nothing to Disclose, Marianna Teleca MD: Nothing to Disclose, Simone Liberali: Nothing to Disclose, Elena Miglio: Nothing to Disclose, Ilaria Mussetto: Nothing to Disclose, Federica Pediconi MD: Nothing to Disclose, David Cannata MD: Nothing to Disclose, Rossella Di Miscio: Nothing to Disclose

PURPOSE

To investigate the role and the diagnostic accuracy of Breast Magnetic Resonance Imaging (MRI) in the evaluation of patients with suspicious discharge from the nipple.

METHOD AND MATERIALS

68 patients with suspicious nipple discharge underwent MRI using a 1,5T scan with the following protocol: pre-contrast T2-weighted TIRM sequences, T1 weighted 3D sequences acquired before and after dimeglumine administration (Multihance 0.1 mml/Kg). MRI findings were divided according to BIRADS criteria into two groups: benignes (BIRADS 1-2-3) and maligns (BIRADS 4-5). 42 patients underwent surgery. 26 patients were clinically and instrumentally followed-up during 24 months. Histological and clinical findings after 24 month were compared to MRI findings.

RESULTS

MRI identified 28 cases of BIRADS 4-5, 12 of which were found to be malignant at histological examination. In the 40 cases classified as BIRADS 1-2-3, 14 lesions were confirmed as benign by definitive histological examination, 2 lesions were found to be a malignant tumor and 24 patients had negative follow-up at 24 months. Sensitivity, specificity and diagnostic accuracy of MRI were respectively 93%, 92% and 92% with a positive predictive value of 87% and negative predictive value of 96%.

CONCLUSION

Breast MRI is an accurate method in the evaluation of patients with suspicious nipple secretion. A negative MRI can direct patients to follow-up rather than surgery.

CLINICAL RELEVANCE/APPLICATION

Breast MRI can be considered a diagnostic leader in patients with unexplained nipple discharge to distinguish malignant from benign lesion.

Using Computer-extracted Features from Tumors on Breast MRI to Predict Stage (Station #5)


PURPOSE

One of the most important roles of imaging in women with breast cancer is to accurately predict stage in order to direct patients to appropriate treatment. Our goal in this study was to demonstrate that computer extracted features of biopsy-proven breast cancer (computer-extracted tumor phenotype-CETP) on MRI can accurately predict breast cancer stage.

METHOD AND MATERIALS

We used a retrospectively collected dataset of de-identified breast MRIs from multiple institutions organized by the National Cancer Institute (NCI) in a centralized repository called The Cancer Imaging Archive (TCIA) which includes outcomes collected from cancer center tumor registries. For each case, we characterized tumors on MRI by (a) qualitative semantic features from multiple radiologists’ interpretations and (b) automated computerized image analyses (CTEP) including volumetrics, texture (homogeneity), and kinetics. We built a linear discriminant analysis model (LDA) to predict tumor stage and lymph nodes involvement on pathology. We evaluated each LDA model in turn by calculating a risk score for each patient (using cross validation); used this risk score to construct ROC curves; and compared the AUC of each model to baseline chance (AUC=0.5) using the DeLong method.

RESULTS

We analyzed a total of 98 biopsy proven breast cancer cases. Pathologic outcomes revealed: negative nodes (n=49), >1 positive node (n=48; 1 missing), stage I (n=23), stage II (n=62) and stage III (n=13). Use of CTEP to distinguish between tumors at stage I (N=23) and stage III (N=13) demonstrated an AUC = 0.7, significantly better than chance (p = 0.017). We also found that CTEP could distinguish between tumor without
(N=49) and with (N=48) positive lymph nodes AUC = 0.59.

CONCLUSION

The results from this study indicate that quantitative MRI analysis shows promise as a means for predicting breast cancer stage and lymph node status.

CLINICAL RELEVANCE/APPLICATION

In an era of personalized treatment based on genetics, demonstrating that image based (MRI) phenotyping can contribute to prediction of cancer stage is important.

Clinical Validation of Combined X-ray and Optical Breast Imaging with 215 Lesion Cases (Station #6)

Qianqian Fang PhD, Research Grant, Koninklijke Philips NV, Bin Deng PhD (Presenter): Research Grant, Koninklijke Philips NV, Dana H. Brooks: Nothing to Disclose, Stefan Carp PhD: Nothing to Disclose, Richard H. Moore: Research support, General Electric Company Research support, Siemens AG Research support, Astrophysics Inc Research support, SAP AG, Daniel B. Kopans MD: Research Grant, General Electric Company Royalties, Cook Group Incorporated Consultant, Siemens AG, David Boas PhD: Research Grant, Koninklijke Philips NV Research Grant, Canon Inc

PURPOSE

Combining the structural information from x-ray mammography with the functional information from tomographic optical breast imaging (TOBI) represents a promising direction towards further enhancement of imaging sensitivity and specificity for clinical breast cancer diagnosis. Over the past 8 years, we have conducted a clinical study, including 307 subjects with breast lesions and 118 healthy volunteers, to validate the clinical efficacy of this new dual-modality approach.

METHOD AND MATERIALS

A total of 307 subjects with breast lesions were recruited between 2006 and 2013 under a HIPAA compliant protocol approved by the IRB. Among them, 215 subjects were found to have valid reconstructions and x-ray discernible lesions, including 99 malignant, 83 solid benign and 33 cystic lesions. All recruited subjects were scanned by a combined TOBI and tomosynthesis (DBT) system developed by our group. To utilize the spatially co-registered imaging information, we have developed a joint x-ray/TOBI reconstruction algorithm. Paired and two-sample t-tests are then used to find significant differences between different tissue types in the same breast as well as between lesion groups.

RESULTS

The reconstructed optical images with the structural-priors show more spatial details in the lesion region compared to those from the non-prior-guided reconstructions. One-tailed paired t-tests reveal significance differences in scattering coefficients (μs) at 830 nm between all pairs in adipose, fibroglandular tissues and lesions for all lesion groups. Significant difference in total hemoglobin concentration (Hbt) between fibroglandular tissue and malignant tumors was also found (p=0.0009). Two sampled t-tests demonstrate significant differences in Hbt (p=0.0139) and μs (p=0.0108) between malignant and solid benign lesions. The μs difference between solid benign and cystic lesions is nearly significant (p=0.0509).

CONCLUSION

The improved image quality achieved by fusing structural information in the optical reconstructions and the enhanced statistical power provided by a large study population has provided further evidence to support a combined x-ray/TOBI system as a clinically feasible approach for assisting breast cancer diagnosis.

CLINICAL RELEVANCE/APPLICATION

Combining optical imaging with x-ray mammography brings valuable functional assessment to the clinical evaluation of breast cancer, thus, leading to reduced unnecessary biopisies and missed cancers.

Evaluation of Image Quality and Diagnostic Performance of Breast Tomosynthesis at Reduced Exposure Dose (Station #7)

Arpad Bischof MD (Presenter): Employee, IMAGE Information Systems, Thobias Muller: Nothing to Disclose, Joerg Barkhausen MD: Nothing to Disclose

PURPOSE

To analyse the impact of radiation dose, number of projections and projection angle on image quality and accuracy in digital breast tomosynthesis (DBT).

METHOD AND MATERIALS

57 DBT data sets (25 projections, angle 50°) with malignant and benign mass lesions were included into the study. Off-line image reconstruction was performed using all projections, every second (13 projections, angle...
50°) and every third (9 projections, 50°) projection as well as 13 central projections (angle 25°) and 9 central projections only (angle 16°). The DBT images with a slice thickness of 1 mm where independently evaluated by five radiologists. The readers evaluated the subjective image quality and assigned each reconstruction to a BI-RADS category. Both, image quality and discriminatory power, where compared for benign and malignant lesions for each reconstruction.

RESULTS

Compared to the standard of reference (full number of projections) DBT images based on every second projection showed a comparable discriminatory power between benign and malignant lesions; positive-predictive value of 45,7% versus 44,3%, negative-predictive value 91,1 % versus 92,7%. Despite good diagnostic performance, the subjective image quality of DBT image with reduced number of projections was rated lower compared to the reference. All other reconstructions using either 13 central projections with an angle of 25° or only 9 projections were inferior to the reference with regard to the diagnostic accuracy and the subjective image quality was rated lower compared to the approach using 13 projections with an angle of 50°.

CONCLUSION

For the detection and characterization of mass lesions DBT data sets using 13 projections with an angle of 50° can reduce the radiation exposure without decreasing the diagnostic accuracy.

CLINICAL RELEVANCE/APPLICATION

New reconstruction schemes can further reduce the radiation dose in digital breast tomosynthesis.

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**BRE117**

**Tomosynthesis Guided Needle Localization: An Instructional Guide with Examples (Station #8)**

Nelly Salem MD (Presenter): Nothing to Disclose, Donna M. Plecha MD: Advisory Board, Hologic, Inc Research Grant, SuperSonic Imagine

**TEACHING POINTS**

To review indication, imaging appearance, and procedural methods of tomosynthesis-guided needle localization. The imaging and final pathology results from a series of 9 tomosynthesis-guided-needle localizations performed at our institution since the implementation of tomosynthesis in 2011 will be included.

**TABLE OF CONTENTS/OUTLINE**

- Introduction
- Indication
- How to do it: A Step-by-step guide
- Example with pictorial review of procedure
- Pathology
- Series of 8 additional cases demonstrating the findings on both 2D mammography and digital breast tomosynthesis and including the final pathology for each case
- Outcome
- Conclusion

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**BRE174**

**Breast Cancer In Women Under 40 Years: Frequency, Clinicopathologic and Imaging Features – 10 Years Of Experience (Station #9)**

Tatiana Cardoso de Mello Tucunduva MD: Nothing to Disclose, Giselle Guedes Mello PhD (Presenter): Nothing to Disclose, Adriana Helena Padovan Grassmann Ferreira MD, PhD: Nothing to Disclose, Luciano F. Chala MD: Nothing to Disclose, Monica M.A. Stiepich MD, PhD: Nothing to Disclose, Joao Luiz Marin Casagrande MD: Nothing to Disclose, Andrea Maciel MD: Nothing to Disclose

**PURPOSE**

Breast cancer in young women are not common and it is widely believed that is characterized by a relatively unfavorable prognosis and pathological features. The aim of this study is to investigate frequency, clinicopathological and imaging features of breast cancer in women younger than 40 years in a specialised breast diagnostic center.

**METHOD AND MATERIALS**

Cases were retrospectively selected from our database of 8889 consecutive breast biopsies performed between February of 2003 and September 2013. There were 2284 (25,7%) patients under 40 years in this group. Frequency, clinicopathological and imaging features of breast cancer diagnosed in this group of women were determined.

**RESULTS**

Of 1820 malignant tumors, 212 were detected in women younger than 40 years, resulting in an overall frequency of 11,6% (212/1820) in this age group. The most common imaging presentation was irregular mass (34%), followed by mass with microcalcifications (19,7%). The most frequently histologic type was invasive
ductal carcinoma (60.3%), manifesting as histological grade 1 (12%), grade 2 (46%) e grade 3 (42%), followed by in situ ductal carcinoma (28.7%). The immune profile showed 28% of HER2 overexpression cases and 23% of triple negative tumors.

CONCLUSION

In this study, the frequency of malignant breast lesions in patients under the age of 40 years was 11.6%, with a predominance of histological grade 2 and 3 ductal carcinomas and which manifests primarily as masses in imaging methods.

CLINICAL RELEVANCE/APPLICATION

The study of frequency and phenotypic features of the tumors in patients younger than 40 years generates epidemiological information and comparative basis of tumor behavior in different population groups.

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**BRE015-b**

**The Uprooted Implant: A Multimodality Review of Breast Implant Rupture and Associated Complications**

Nancy Anne Resteghini DO, MS (Presenter): Nothing to Disclose, Carolynn M. Debenedectis MD: Nothing to Disclose, Glenn Allen Hoots MD: Nothing to Disclose

**TEACHING POINTS**

1. To review normal breast implant anatomy, including both implant location as well as different types of implants commonly encountered. 2. To discuss abnormal presentations of implant devices on mammography and MRI including classic signs of intracapsular and extracapsular rupture. 3. To highlight the importance of detecting implant complications, including post-operative peri-implant fluid collections, infection, and implant associated tumors. 4. To present various imaging modalities for evaluation of breast implant rupture with emphasis on which modalities are optimal.

**TABLE OF CONTENTS/OUTLINE**

1. Overview of normal breast implant anatomy. Prepectoral vs. Rectropectoral and their appearance on various imaging modalities. 2. Review types of breast implants and their normal imaging characteristics. Saline implant vs. Silicone implant and their appearance on various imaging modalities. 3. Discussion and examples of breast implant ruptures and their classic radiologic features. 4. Present examples of additional implant complications, including post-operative peri-implant fluid collections, infection, and implant associated tumors. 5. Provide examples of breast implant ruptures with Mammography/ MRI/Ultrasound while discussing the sensitivity/specificity of implant rupture detection for each modality.

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**SSJ01**

**Breast Imaging (Quantitative Imaging)**

_Paper Topic: 3D Computer-Aided Detection (CAD) System for Breast Tomosynthesis in the Detection of Microcalcifications: Initial Experience_

A Jung Chu MD (Presenter): Nothing to Disclose, Nariya Cho MD: Nothing to Disclose, Jung Min Chang MD: Nothing to Disclose, Won Hwa Kim MD, PhD: Nothing to Disclose, Min Sun Bae MD, PhD: Nothing to Disclose, Su Hyun Lee MD: Nothing to Disclose, Woo Kyung Moon: Nothing to Disclose, Sung Ui Shin MD: Nothing to Disclose, Sung Eun Song MD: Nothing to Disclose

**PURPOSE**

To evaluate the performance of a 3D computer-aided detection (CAD) system for breast tomosynthesis (DBT) in the detection of microcalcifications in comparison with 2D CAD for digital mammography.

**METHOD AND MATERIALS**

3D CAD (ImageChecker 1.0, Hologic) and 2D CAD systems (R2 ImageChecker CAD 9.3, Hologic) were retrospectively applied to combined DBT-digital mammograms of 68 women (mean age, 51 years; range, 30-77 years) with 68 microcalcifications (31 malignant [14 invasive, 17 DCIS], 37 benign; BI-RADS category 2 in 19, 3 in 29, 4 in 19 cases).
category 3 in 2, category 4 in 31, and category 5 in 16). Number of DBT reconstructed slices obtained per breast ranged from 36 to 76 (mean, 56.7). CAD marks were considered positive if the location of the corresponding lesions were correctly identified on at least one slice of DBT or one view of digital mammograms. Sensitivities for malignancy and for recalled lesions were defined as the number of lesions correctly marked divided by the total number of malignant lesions and by the number of the BI-RADS category 3, 4, or 5 lesions, respectively. To evaluate the false-positive mark rate, 20 mammograms with no clinical or radiologic abnormalities during 2-year follow-up in 20 women were used. Differences between 3D and 2D CAD systems were compared by using McNemar test and Wilcoxon signed rank test.

RESULTS

Sensitivities of 3D CAD were similar to those of 2D CAD for both malignancies (97% [30/31] vs. 100% [31/31], P = 1.0) and recalled lesions (97% [48/49] vs. 100% [49/49], P = 1.0). 2D CAD correctly marked one additional cancer at one view, which was missed by 3D CAD. For the 20 normal mammograms, mean false-positive marks per view with 3D CAD was similar to that of 2D CAD (0.13 vs. 0.14, P = 0.48).

CONCLUSION

3D CAD for DBT achieved 97% sensitivities for both malignant and recalled microcalcifications with 0.13 false-positive marks per view, which was comparable to those of 2D CAD.

CLINICAL RELEVANCE/APPLICATION

3D CAD is expected to reduce the interpretation time for radiologists in the detection of suspicious microcalcifications in reconstructed DBT slices with high sensitivity and an acceptable false positive rate.

SSJ01-02

Prediction of False-positive Recall from Screening Mammography Using Computer-extracted Breast Tissue Complexity Features: Data from the ACRIN 4006 trial

Shonket Ray PhD (Presenter): Nothing to Disclose, Brad M. Keller PhD: Nothing to Disclose, Jae Young Choi DPhil: Nothing to Disclose, Jinbo Chen PhD: Nothing to Disclose, Emily F. Conant MD: Scientific Advisory Board, Hologic, Inc, Despina Kontos PhD: Nothing to Disclose

PURPOSE

To investigate the feasibility to predict risk of false-positive recall from breast cancer screening with digital mammography based on computer-extracted parenchymal pattern features of breast tissue complexity.

METHOD AND MATERIALS

Digital mammography (DM) images from the ACRIN 4006 trial were retrospectively analyzed. The trial was a reader study to compare screening call-back rates from 2D DM versus a combination of 2D/digital breast tomosynthesis (DBT) in an enriched cohort of women. From a total of 550 women imaged, 76 were recalled on the basis of DM alone, from which 11 were true-positives. Images were acquired using a full-field digital mammography (FFDM) unit. All DM images sets consisted of bilateral CC and MLO views and were vendor post-processed (“For Presentation”, Selenia Hologic Inc.). To characterize breast tissue complexity, breast percent density (PD) was estimated on a per-woman basis using previously validated automated software. In addition, thirteen texture features were extracted using a locally adaptive computerized parenchymal texture analysis algorithm. Logistic regression was performed to identify significant predictors of overall recall and false-positive recall respectively, adjusting for age and number of previous benign biopsies. The area under the curve (AUC) of the receiver operating characteristic (ROC) was used to evaluate model performance.

RESULTS

The logistic regression model has AUC=0.75 (95% CI 0.69-0.81) for predicting overall recall from DM and AUC=0.94 (95% CI 0.87-0.99) for predicting risk of false-positive recall; outperforming prediction based on age and number of previous benign biopsies alone that have AUC=0.64 (95% CI 0.57-0.70) and AUC=0.73 (95% CI 0.51-0.94) respectively. Significant predictors (p<0.05) are energy, inertia, inverse difference moment, sum average, sum variance, difference average, difference variance and difference entropy. Sensitivity for predicting false-positive recalls is 80% at a 100% cancer detection ROC operating point.

CONCLUSION

Prediction of false-positive recall from DM screening mammography could be improved with the inclusion of computer-extracted features of breast tissue complexity.

CLINICAL RELEVANCE/APPLICATION

Prediction models could identify women at high-risk for false-positive DM screening due to their breast tissue complexity, who may be offered supplemental modalities for breast cancer screening.

SSJ01-03

Fully Automated Volumetric Breast Density Estimation from Digital Breast Tomosynthesis Images: Multi-modality Comparison with Digital Mammography and Breast MRI

Said Pertuz PhD (Presenter): Nothing to Disclose, Elizabeth McDonald MD, PhD: Nothing to Disclose, Susan Weinstein MD: Nothing to Disclose, Emily F. Conant MD: Scientific Advisory Board, Hologic, Inc, Despina Kontos PhD: Nothing to Disclose

PURPOSE
Accurate breast density estimation is important for breast cancer risk assessment and guiding personalized breast screening recommendations. We investigate the feasibility of fully-automated volumetric breast density estimation (VBD) from digital breast tomosynthesis (DBT), and compare to VBD estimates from digital mammography (DM) and breast MRI. Compared to 2D mammography, DBT visualizes the 3D distribution of fibroglandular tissue, having the potential to allow for more accurate VBD estimation.

**METHOD AND MATERIALS**

Bilateral DBT images, DM images (Selenia, Hologic Inc.) and sagittal MRI scans (GE LX echo speed, Siemens) were retrospectively collected from 63 women undergoing breast cancer screening within the course of one year (2010-11). A fully-automated algorithm was developed to segment the fibroglandular tissue and measure VBD from all DBT images. The proposed algorithm exploits the geometry of the acquisition of DBT sequences as well as the relationship between image intensity and tissue density and achieves 3D segmentation of the fibroglandular tissue by analyzing both the projection images and reconstructed DBT slices. For comparison, the DM images were processed with FDA-cleared software (Volpara 1.5, Matakina) and the MR images were processed with previously validated automated software to obtain corresponding VBD estimates. The Pearson’s correlation and linear regression were used to compare the obtained multi-modality VBD estimates.

**RESULTS**

Substantial agreement is observed between bilateral VBD estimates from DBT images ($r = 0.89, 95\% \text{ CI: 0.83-0.93, } p<0.001$). Estimates of the total breast volume and percent volumetric breast density from DBT are highly correlated with DM with $r = 0.99 (95\% \text{ CI: 0.98-0.99})$ and $r = 0.88 (95\% \text{ CI: 0.81-0.93})$; as well as with the MR-based estimates with $r = 0.95 (95\% \text{ CI: 0.91-0.96})$ and $r = 0.76 (95\% \text{ CI: 0.63-0.85})$, respectively ($p<0.001$). Corresponding correlations between DM and MRI are $r = 0.95 (95\% \text{ CI: 0.92-0.97})$ and $r = 0.73 (95\% \text{ CI: 0.59-0.83})$.

**CONCLUSION**

Fully-automated 3D fibroglandular tissue segmentation and VBD estimation from DBT images is feasible and shows strong agreement with existing volumetric techniques based on DM and MRI images.

**CLINICAL RELEVANCE/APPLICATION**

Fully-automated quantitative VBD estimation from DBT could result into more accurate measures of the fibroglandular tissue in the breast and ultimately more accurate measure of breast cancer risk.

**Three-Compartment Breast Imaging and Quantitative Mammographic Image Analysis: Synergy for Improved Diagnosis**


**PURPOSE**

To investigate whether knowledge of the biologic composition of breast lesions and the embedding parenchyma, derived through three-compartment breast (3CB) imaging, can improve upon existing mammographic quantitative image analysis (QIA) in estimating the probability of malignancy.

**METHOD AND MATERIALS**

3CB imaging is a novel imaging technique that derived biologic tissue composition measures from dual-energy mammography and a thickness phantom at about 110% of the dose of a regular mammogram. The study population consisted of 96 patients with 102 breast lesions imaged with dual-energy mammography prior to breast biopsy with final diagnosis resulting in 16 invasive ductal carcinomas, 10 ductal carcinoma in situ (DCIS), and 76 benign diagnoses. Analysis was three-fold: 1) The raw low-energy mammographic images were analyzed with an established in-house QIA method, ‘QIA alone’, 2) the 3-compartment breast (3CB) composition measure - derived from the dual-energy mammography - of water, lipid, and protein thickness were assessed, ‘3CB alone’), and 3) information from QIA and 3CB was combined, ‘QIA+3CB’. Analysis was initiated from radiologist-indicated lesion centers and was otherwise fully automated. Steps of the QIA and 3CB methods were lesion segmentation, characterization, and subsequent classification for malignancy in leave-one-case-out cross-validation. Performance was assessed using Receiver Operating Characteristic (ROC) analysis with the area under the ROC curve (AUC) as figure of merit.

**RESULTS**

The AUC for distinguishing between benign and malignant lesions (invasive and DCIS) was 0.78 (standard error 0.06) for the ‘QIA alone’ method, 0.66 (0.06) for ‘3CB alone’ method, and improved to 0.85 (0.05) for ‘QIA+3CB’ combined ($p=0.05$ with respect to ‘QIA alone’).

**CONCLUSION**

Combining knowledge of the composition of breast lesions and their periphery with an existing mammographic QIA method improved the distinction between benign and malignant lesions, which could help prevent...
Classification of Breast Cancer Subtypes Using MRI Texture Features

Elizabeth J. Sutton MD (Presenter): Nothing to Disclose, Brittany Dashevsky MD, DPhil: Nothing to Disclose, Jung Hun Oh PhD: Nothing to Disclose, Harini Veeraraghavan: Nothing to Disclose, Elizabeth A. Morris MD: Nothing to Disclose, Joseph Owen Doisy PhD: Nothing to Disclose, Aditya Prakash Apte PhD: Nothing to Disclose, Girard Gibbons BA: Nothing to Disclose

PURPOSE

Breast cancer subtypes have been classified based on tumor genotype variation and are indicators of disease free and overall survival. Using texture features extracted from magnetic resonance imaging (MRI) and a machine learning method, we investigated whether imaging characteristics could differentiate breast cancer subtypes.

METHOD AND MATERIALS

This retrospective study received institutional review board approval and need for informed consent waived. 178 women with invasive ductal carcinoma (IDC) and preoperative breast MRI were identified. Immunohistochemistry surrogates defined subtypes, and the distribution was: estrogen and progesterone receptor positive (ERPR+; n=95, 53.4%), HER2 receptor positive (HER2+; n=35, 19.6%) and triple negative (TN; n=48, 27.0%). Clinical and pathologic data were collected. Tumors were contoured on the fat-suppressed T1-weight pre- and three post-contrast images. Shape-, texture- and histogram-based features were extracted using in-house software (Computational Environment for Radiological Research). Support vector machine (SVM), a frequently used machine learning technique for classification problems, was used to identify significant image features and build a robust model to predict each IDC subtype.

RESULTS

SVM identified significant clinical, pathologic and imaging features. When the top 9 features were incorporated, the predictive model distinguished IDC subtypes with an overall accuracy of 83.4%. The model’s accuracy for each subtype was 89.2% (ERPR+), 63.6% (HER2+) and 82.5% (TN). The nine features were: nuclear grade, tumor volume, presence of multi-centric disease, three texture features, and three histogram-based features. For these features, statistical analysis was performed using Kruskal-Wallis test. For all the 9 features, there was a statistically significant difference between ERPR+, HER2+ and TN subtypes with p < 0.0001.

CONCLUSION

We have developed a machine learning-based predictive model using texture features extracted from MRI that can distinguish IDC subtypes with significant predictive power.

CLINICAL RELEVANCE/APPLICATION

We were able to leverage computer-derived MRI phenotypic image-based biomarkers that reflect the genetic variability of different breast cancer subtypes, which are associated with different outcomes.
image-based phenotyping included: 1) 3D lesion segmentation based on a fuzzy c-means clustering algorithm; 2) computerized feature extraction; 3) leave-one-out linear stepwise feature selection; and 4) Linear Discriminant Analysis (LDA) as the prognostic predictive classifier. The performance of the classifier model for molecular subtyping was evaluated using jackknifing ROC analysis with area under the ROC curve (AUC) as the figure of merit.

RESULTS

Use of computer-extracted tumor phenotypes in for the task of distinguishing between molecular prognostic indicators, yielded AUC values of 0.79 (p-value < 0.0001), 0.68 (p-value = 0.0066), and 0.61 (p-value =0.126) in the tasks of distinguishing ER- vs ER+, PR- vs PR+, and HER2- vs HER2+, respectively. Features selected for the predictive tasks included volumetrics, texture (entropy), and kinetics for the predictive tasks.

CONCLUSION

The results from this study indicate that quantitative MRI analysis shows promise as a means for high-throughput image-based phenotyping in the discrimination of breast cancer subtypes, and potential. Merging imaging phenotypes with genomic data may lead to improved prognostic predictors.

CLINICAL RELEVANCE/APPLICATION

Computerized image-based phenotyping may yield quantitative predictive models of breast cancer for precision medicine.
CONCLUSION

DE-CESM provides additional information of associate enhancement in diagnosing the impalpable breast microcalcifications, not-perfectly with acceptable sensitivity or negative predictive value. The sizes of enhanced cancers closely related to microscopic size that would help for pre-operative planning.

CLINICAL RELEVANCE/APPLICATION

DE-CESM can evaluate if the concern microcalcifications associating with enhancement and this information helps for diagnosis or surgery planning.

SSJ02-04

Contrast-Enhanced Spectral Mammography: Is the Low Energy Image Comparable to Standard Digital Mammography?

Eva Maria Fallenberg MD (Presenter): Research Grant, Bayer AG Research Grant, Siemens AG Research Grant, General Electric Company Speaker, Siemens AG Speaker, General Electric Company Speaker, Bayer AG , Clarisse Dromain MD : Nothing to Disclose, Diane Miriam Renz MD : Nothing to Disclose, Florian Engelken MD, MBBCh : Nothing to Disclose, Felix Diekmann MD : Research Grant, Bayer AG Research Grant, Koninklijke Philips NV , Héba Ahmed Ámér : Nothing to Disclose, Corinne Balleyguier MD : Nothing to Disclose

PURPOSE

To compare the low energy image (LE) of CESM only to mammography (MG) regarding diagnostic accuracy of histologically proven breast lesions.

METHOD AND MATERIALS

The study was approved by Health Authorities and Ethics Committee. 90 consenting patients diagnosed with breast cancer were imaged with MG and CESM and underwent surgery. 136 malignant and 15 benign lesions could be assessed. CESM was performed as a bi-lateral examination starting 2 minutes after injection of an iodinated contrast agent. LE and MG images were interpreted by three blinded independent radiologists with an interval of minimum 4 weeks for memory wash-out. Sensitivity and specificity were evaluated across readers. BI-RADS 4 was defined as threshold for true positives. Gold standard was post-surgical histology.

RESULTS

Sensitivity with LE was 47.0% for reader1, 43.7% for reader2 and 33.8% for reader 3 (average 41.5%) and 47%, 45% and 39.7% (average 43.9%) with MG, respectively. Specificity was 86.7% (readers 1 and 3) and 80% (reader 2) for LE in average 84.4%, 100% (readers 1 and 2) and 97.8% (reader3) in average 94.8% for MG. The differences were not significant. There was no significant difference in sensitivity and a slightly higher average specificity in MG (p=.03).

CONCLUSION

The LE-image of CESM and MG showed similar sensitivity and MG had a slightly higher specificity than the LE only.

CLINICAL RELEVANCE/APPLICATION

CESM is a reliable imaging technique with superior diagnostic accuracy, which may replace MG in symptomatic patients to avoid unnecessary radiation. To do so it is important to know, if the diagnostic information of the LE images is comparable to MG.

SSJ02-05

Dose Evaluation of Contrast-enhanced Spectral Mammography in a National Cancer Centre

Jennifer Murphy MBBCh, MRCPI (Presenter): Nothing to Disclose, Siobhan O’Neill MBBCh : Nothing to Disclose, Fiachra Gerard Moloney MBBCh, MRCPi : Nothing to Disclose, Lorna Duddy MD : Nothing to Disclose, Nina Louise Marshall MBBS : Nothing to Disclose, Josephine Barry MBBCh, FRCR : Nothing to Disclose, Max Frederick Ryan MBBCh : Nothing to Disclose

PURPOSE

The aim of this study is to evaluate the dose associated with contrast-enhanced spectral mammography (CESM) compared with full field digital mammography (FFDM) in a national breast cancer centre using web-based radiation dose tracking software and to investigate factors that affect this.

METHOD AND MATERIALS

Fifty patients attending the Symptomatic Breast Clinic who underwent FFDM and CESM within a short interval were retrospectively identified. Average glandular dose (AGD) was calculated for FFDM, low energy CESM (LE-CESM) and high-energy CESM (HE-CESM). Compressed breast thickness was recorded. Breast density was measured using the American College of Radiology (ACR) Breast Imaging-Reporting and Data System (BI-RADS) by two independent radiologists.

RESULTS

Fifty patients were included in the study (all female, mean age 54.3 ±13.2 years). The mean AGD for FFDM, LE-CESM and HE-CESM was 5.39 mGy, 7.78 mGy and 1.87 mGy respectively. LE-CESM was associated with a significantly higher dose than FFDM (mean difference 2.39 mGy, CI 1.82 - 2.96, p
CESM is a relatively novel technique. Studies have shown that it has a higher sensitivity for breast cancer than FFDM and better specificity than MRI. It is associated with increased dose when compared to FFDM however remains within accepted limits set out in ACR guidelines.

**CLINICAL RELEVANCE/APPLICATION**

As LE-CESM is technically equivalent to FFDM, CESM could be used instead of FFDM to reduce overall dose in selected patients.

**Challenges in Dual-energy Contrast Enhanced Spectral Mammography: Artifacts**

Yael Yagil MD (Presenter): Employee, Neopharm Group, Annat Shalmon MD: Nothing to Disclose, Arie Rudnstein MD: Nothing to Disclose, Yael Servadio MD: Nothing to Disclose, Osnat Halshtok MD: Nothing to Disclose, Michael Gotlieb MD: Nothing to Disclose, Miriam Sklair-Levy MD: Nothing to Disclose

**PURPOSE**

The use of contrast-enhanced spectral mammography (CESM) is on the rise, however the literature on image artifacts is sparse. The goal is to review and describe the incidence of commonly encountered artifacts in CESM.

**METHOD AND MATERIALS**

Included in this retrospective study were women who underwent CESM for screening and diagnostic purposes. Data recorded included patient age, medical history and relevant clinical information. CESM was performed using a full-field digital mammography system with software and hardware modifications enabling acquisition and image post processing of dual-energy exposures. Acquisition parameters collected included mAS, kV, compression force, breast thickness, compression plate size. Images were reviewed with focus on the presence of artifacts on recombined images: rim enhancement (breast within breast), skin line enhancement, ripple-like appearance, focal dot enhancement, linear horizontal line through the axilla, and silhouette sign. Statistical analysis was performed using Chi-Square Test and T-Test.

**RESULTS**

Included in the study were 105 women, average age 50 years (27-74 yrs), 13 (12%) with familial predisposition and 28 (27%) with prior history of breast malignancy. Indications for the CESM were screening in 53 (50%) cases, breast tenderness or palpable lesion in 29 (28%), disease extent evaluation in 11 (10%), and pre-op FNL in 3 (3%). Average CESM parameters were 85 mAS, 79 kV, compression and 58 mm breast thickness. 99% of women had at least one artifact detected on recombined images: 103 (98%) rim enhancement, 44 (42%) skin line enhancement, 93 (89%) ripple-like appearance, 4 (4%) dot enhancement, 62 (59%) axillary horizontal line and 11 (10.5%) silhouette sign. Statistical significance was found between skin line enhancement and silhouette sign, and Silhouette sign with 42 mAS on low-energy images (p-value < 0.001). Axillary line was detected bilaterally in all cases, and associated in 98% with the use of a small compression plate (1914x2294x12mm).

**CONCLUSION**

Image artifacts are common on CESM studies. Therefore it is crucial to interpret them correctly and prevent misinterpretation of the artifacts as real breast pathology.

**CLINICAL RELEVANCE/APPLICATION**

Recognition and identification of artifacts seen on CESM are crucial for improved quality of mammographic interpretation and prevent characterization of artifacts as real breast pathology.

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**MSES34**

**Essentials of Breast Imaging**

**Multisession Courses**

**SSJ02-06**

**Asymmetries and Architectural Distortion - Challenging Mammographic Signs of Malignancy**

Jessica Wai Ting Leung MD (Presenter): Speakers Bureau, Hologic, Inc Scientific Advisory Board, Hologic, Inc

**LEARNING OBJECTIVES**

1) Understand the definitions and types of asymmetries and architectural distortion identified at mammography.
2) Understand the imaging evaluation and clinical significance of asymmetries and architectural distortion...
identified at mammography. 3) Know the pathology correlation of asymmetries and architectural distortion identified at mammography.

**ABSTRACT**

Asymmetries and architectural distortion are challenging signs of malignancy at mammography.

**MSES34B**  
**Image Guided Interventions**

Thomas Hans Helbich MD (Presenter): Research Grant, Medicor, Inc Research Grant, Siemens AG Research Grant, C. R. Bard, Inc

**LEARNING OBJECTIVES**

1) Identify the application of different image guided interventions in breast lesions. 2) Analyze image guided techniques and apply the knowledge to protocol development, patient management / safety, and costs. 3) Compare the indications, advantages, and controversies of imaging-guided interventions.

**MSES34C**  
**Breast MRI: Non Mass Enhancement**

Steven P. Poplack MD (Presenter): Research Grant, Hologic, Inc

**LEARNING OBJECTIVES**

1) Become acquainted with the changes to the BIRADS lexicon that involve Non-Mass Enhancement in the BIRADS™ 5th edition. 2) Appreciate the range of appearances of Non-Mass Enhancement and the associated likelihood of malignancy of these different NME finding types. 3) Become familiar with the differential diagnosis of various types of Non-Mass Enhancement.

**ABSTRACT**

This presentation is intended to familiarize the audience with the range of appearances, differential diagnosis and likelihood of malignancy of the various forms of non-mass enhancement of the breast.

**RC415**

**Clinical Breast MR Imaging (An Interactive Session)**

*Refresher/Informatics*

**MR BR MR**

AMAPRA Category 1 Credits ™: 1.50  
ARRT Category A+ Credits: 1.50  
**Tue, Dec 2 4:30 PM - 6:00 PM Location: E450A**

**Sub-Events**

**RC415A**  
**Tips on Interpretation**

Constance D. Lehman MD, PhD (Presenter): Consultant, Bayer AG Consultant, General Electric Company Research Grant, General Electric Company

**LEARNING OBJECTIVES**

1) Develop skills in distinguishing suspicious lesions from background enhancement. 2) Use the BI-RADS lexicon to accurately assess breast lesions and provide final interpretation.

**RC415B**

**MR BI-RADS 3**

Christopher E. Comstock MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand appropriate use of the ACR BI-RADS 3 in MR Interpretation. 2) Review case examples of when and when not to use BI-RADS 3 classification.

**RC415C**

**Challenging Cases**

Gillian Macaline Newstead MD (Presenter): Medical Advisory Board, Bayer AG Consultant, Three Palm Software LLC Consultant, VuCOMP, Inc Medical Advisor, Quantitative Insights, Inc

**LEARNING OBJECTIVES**
1) To review the analysis of enhancing lesions on breast MRI. 2) To identify features useful in distinguishing benign from malignant. 3) To discuss common pitfalls in breast MRI interpretation.

**SPSC40**

**Controversy Session: Breast Density Notification Legislation: Pros and Cons**

**Special Courses**

AMA PRA Category 1 Credits™: 1.00  
ARRT Category A+ Credit: 1.00  
Wed, Dec 3 7:15 AM - 8:15 AM  Location: N226

**Participants**

Moderator  
Christopher E. Comstock MD: Nothing to Disclose  
Barbara S. Monsees MD (Presenter): Nothing to Disclose  
Stephen Albert Feig MD (Presenter): Medical Advisory Board, Hologic, Inc

**LEARNING OBJECTIVES**

1) Review the current state of breast density legislation in the U.S. 2) Understand the rationale for passage of laws stipulating dense breast notification, and review the language and requirements of such laws. 3) Review the effects of breast density notification on use of supplemental screening, followup, biopsy and cancer yield.

**RC515**

**The New BI-RADS (An Interactive Session)**

**Refresher/Informatics**

AMA PRA Category 1 Credits™: 1.50  
ARRT Category A+ Credits: 1.50  
Wed, Dec 3 8:30 AM - 10:00 AM  Location: E450A

**Sub-Events**

**Mammography**

Murray Rebner MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To educate the attendees with the use of the audience response system regarding the changes to the mammography section in the new 5th edition of the BI-RADS atlas.

**ABSTRACT**

The new edition of the BI-Rads atlas contains changes in the various sections. The purpose of this presentation is to highlight the major additions and revisions to the mammography section of the document. These points will be made with slides and with illustrations. Theey will be emphasized with the use of the audience response system. The participants should obtain an understanding of the major changes and this will enable them to incorporate these modifications in their practice.

**Ultrasound**

Mary C. Mahoney MD (Presenter): Scientific Advisory Board, Hologic, Inc Research support, Hologic, Inc Consultant, Devicor Medical Products, Inc

**LEARNING OBJECTIVES**

1) To review the BI-RADS lexicon for breast US. 2) To identify recent changes to the US BI-RADS lexicon. 3) To discuss the incorporation of BI-RADS into breast US interpretation.

**MRI**

Carol H. Lee MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To review the BI-RADS lexicon for breast MRI. 2) To identify recent changes to the MR BI-RADS lexicon. 3)
To discuss the incorporation of BI-RADS into breast MRI interpretation.

**RC517**

**Emerging Breast Imaging Strategies**

*Refresher/Informatics*

- **MR**
- **DM**
- **BR**

AMA PRA Category 1 Credits™: 1.50  
ARRT Category A+ Credits: 1.50  

**Participants**

**Moderator:**  
Brian A. Hargreaves PhD  
Research support, General Electric Company Royalties, General Electric Company Royalties, Koninklijke Philips NV Royalties, Siemens AG

**Sub-Events**

**RC517A**  
**Diffuse Optical Spectroscopy of Breast Cancer**

David R. Busch PhD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To understand principles of light transport in tissue and the biological origins of DOSI functional contrast. 2) To review applications of DOSI in breast cancer and evaluate its utility in the context of conventional imaging.

**RC517B**  
**Contrast Enhanced Mammography and Tomosynthesis**

John Morton Lewin MD (Presenter): Research Consultant, Hologic, Inc Scientific Advisory Board, Hologic, Inc Research Grant, Hologic, Inc

**LEARNING OBJECTIVES**

1) To discuss the indications and utility of contrast-enhanced mammography (CEM) and contrast-enhanced tomosynthesis (CET). 2) To understand the feasibility, limitations, and technical issues of CEM / CET. 3) To compare the utility of CEM and CET against non-contrast techniques and discuss future directions.

**RC517C**  
**High Resolution Dynamic Contrast Enhanced Breast MRI**

Brian A. Hargreaves PhD (Presenter): Research support, General Electric Company Royalties, General Electric Company Royalties, Koninklijke Philips NV Royalties, Siemens AG

**LEARNING OBJECTIVES**

1) Be able to select appropriate spatial and temporal resolution parameters to run a dynamic contrast-enhanced (DCE) breast MRI sequence. 2) Explain to colleagues the difference between temporal resolution and temporal footprint for fast DCE scans. 3) List 3 different approaches to fat suppression, and be able to set up a scan protocol using at least one of these on the learner's scanner.

**ABSTRACT**

This talk will provide an overview of high-resolution breast MRI techniques. Initially, MRI concepts including parameter tradeoffs, contrast mechanisms, and parallel imaging will be reviewed. Fat suppression techniques are essential for high-quality breast MRI, and include further tradeoffs. Finally, techniques for high spatiotemporal resolution sampling to resolve rapid contrast kinetics while also offering sharp images will be described.

**URL’s**


**RC553**

**Computer Aided Diagnosis (Development and Clinical Applications)**

*Refresher/Informatics*

- **IN**
- **OI**
- **CT**
- **BR**

AMA PRA Category 1 Credits™: 1.50  
ARRT Category A+ Credits: 1.50

**Participants**

**REMOTE ROADSIDE LEGAL ASSISTANCE**

**Sub-Events**

**RC551A**

**Computer Aided Diagnosis**

**RC551B**

**Computer Aided Diagnosis**

**RC551C**

**Computer Aided Diagnosis**
LEARNING OBJECTIVES

1) Understand needs of CAD in radiologic image interpretation. 2) Understand basic concept of CAD in assisting radiologists’ image reading. 3) Understand the usefulness of CAD in improving radiologists’ performance. 4) Learn historical review of CAD developments. 5) Learn CAD for detection and differential diagnosis of common cancers. 6) Learn ROC analysis of radiologists’ performance without and with CAD in observer studies.

ABSTRACT

Computer-aided diagnosis (CAD) has become one of the major research subjects in medical imaging and diagnostic radiology. In this refresher course, the principles of CAD will be presented together with current development and clinical applications.

The CAD is aimed at improving the radiologists diagnostic accuracy, and can be used as primary, concurrent or second reader. The latter is the recommended paradigm. In principle the CAD performs a morphological recognition of the pathology; (nodule, focal lesion, polyp, etc) combined with quantitative information (MR signal intensity, CT density, contrast enhancement, volume, etc.)

Many different types of CAD schemes are being developed for detection and/or characterization of various lesions in different imaging modalities, including conventional projection radiography, CT, MRI, and ultrasound imaging. Organs that are subjected to research for CAD include the breast, lung, colon, brain, liver, kidney, and the vascular and skeletal systems.

For detection of breast cancer on mammograms, many commercial CAD systems have been used clinically in assisting radiologists worldwide.

For detection of lung cancer, CAD schemes have been developed for detection of pulmonary nodules on chest radiographs and CT images. In addition, CAD schemes have been developed for differential diagnosis of distinction between malignant and benign lesions.

For colon cancer, CAD schemes have been developed for detection of polyps in CT colonography. Observer performance studies with use of ROC analysis indicated an improved performance in radiologists.

URL’s

www.rad.unipi.it www.massgeneral3dimaging.org

Sub-Events

**Development of a CAD: From Benchtop to Clinic**

**Ronald M. Summers MD, PhD (Presenter):** Royalties, iCAD, Inc Research funded, iCAD, Inc Stockholder, Johnson & Johnson Grant, Viatronix, Inc

**LEARNING OBJECTIVES**

1) To understand what radiology problems are amenable to computer aided detection. 2) To understand the steps required to develop and validate a radiology computer-aided detection product. 3) To understand the current performance and future trends in computer-aided detection with respect to indications, algorithms, sensitivity, false positive rates and pitfalls.

**CAD for CT Colonography: Where Do We Stand?**

**Daniele Regge MD (Presenter): Nothing to Disclose**

**LEARNING OBJECTIVES**

1) Review interpretation pitfalls of CT colonography that could be overcome with CAD. 2) Present different reading paradigms of CAD for CT colonography and analyze their performances. 3) Summarize advantages and limitations of the use of CAD for CT colonography in different clinical settings.

**CAD for Breast Cancer Detection: Where Do We Stand?**

**Ulrich Bick MD (Presenter):** Equipment support, Hologic, Inc License agreement, Hologic, Inc Royalties, Hologic, Inc Equipment support, Toshiba Corporation Institutional research collaboration, Siemens AG

**LEARNING OBJECTIVES**

1) To learn about different applications of computer-aided diagnosis (CAD) in breast imaging. 2) To understand the potential and risks of using CAD in mammography screening. 3) To realize the impact of CAD on soft-copy reading and work-flow.

**CAD for Lung Cancer Detection: Where Do We Stand?**

**Kunio Doi PhD (Presenter):** Shareholder, Hologic, Inc License agreement, Hologic, Inc License agreement, Deus Technologies, LLC License agreement, Riverain Technologies, LLC License agreement, Mitsubishi Corporation License agreement, MEDIAN Technologies License agreement, General Electric Company License agreement, Toshiba Corporation Research support, Deus Technologies, LLC Research support, E. I. du Pont de Nemours & Company Research support, Elcint Medical Imaging Ltd Research support, FUJIFILM Holdings Corporation Research support, General Electric Company Research support, Hitachi, Ltd Research support, Eastman Kodak Company Research support, Konica Minolta Group Research support, Mitaya Manufacturing Co,
LEARNING OBJECTIVES

View learning objectives under main course title.

SSK01

Breast Imaging (Tomosynthesis Screening)

Scientific Papers

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Wed, Dec 3 10:30 AM - 12:00 PM  Location: Arie Crown Theater

Participants

Moderator
Sarah Maier Friedewald MD : Consultant, Hologic, Inc Research Grant, Hologic, Inc
Moderator
Emily F. Conant MD : Scientific Advisory Board, Hologic, Inc
Moderator
Steven P. Poplack MD : Research Grant, Hologic, Inc

Sub-Events

SSK01-01
Abnormalities Seen on Screening 3D Digital Breast Tomosynthesis: Is Additional Diagnostic Mammography Always Necessary?


PURPOSE

3D Digital breast tomosynthesis (DBT) has been introduced into breast cancer screening programs. A subset of patients screened with DBT often subsequently undergo additional imaging workup. This study seeks to determine whether additional diagnostic mammographic (MG) evaluation is clinically helpful for abnormalities detected on screening DBT images.

METHOD AND MATERIALS

DBT was introduced in our department for screening on 12/15/12. All screening MGs performed with DBT and interpreted as BI-RADS 0 from 12/15/2012 - 2/15/14 at our institution were included in this prospective study. When patients returned for diagnostic work-up (including MG and/or ultrasound), the interpreting radiologist prospectively indicated whether additional MG imaging of screen-detected abnormalities (mass, asymmetry, architectural distortion, and microcalcifications), provided clinically useful information beyond that available from 2D-DBT screening. The overall utility of the additional MG views, as well as utility by type of abnormality, was evaluated and differences were analyzed using a Chi squared test.

RESULTS

There were 5,342 screening DBT exams performed during the study period. 323 (6.0%) patients had a BI-RADS 0 designation with 351 total findings at screening mammography. Abnormalities included 183 masses (52.1%), 75 asymmetries (21.4%), 75 calcifications (21.4%), and 18 architectural distortion (5.1%). Additional MG views were helpful in the evaluation of 170/351 (48.4%) findings, including 45/183 (24.6%) masses, 46/74 (62.2%) asymmetries, 10/18 (55.6%) areas of architectural distortion, and 69/75 (92.0%) calcifications. Additional MG images evaluated calcifications significantly better than other lesions (masses, asymmetries, architectural distortion) seen on screening DBT (p<0.0001).

CONCLUSION

The utility of additional diagnostic MG evaluation varies with lesion type. Our study suggests additional diagnostic MG should be performed in evaluating microcalcifications but may not be necessary for evaluation of masses, asymmetries, and architectural distortion seen on screening DBT. If diagnostic MG could be avoided, there is potential to increase patient satisfaction, decrease patient radiation exposure, lower costs, and improve operational efficiency.

CLINICAL RELEVANCE/APPLICATION

Not all patients recalled from screening mammography with DBT may benefit from additional mammographic diagnostic evaluation.
Comparison of Detection Rates from Screen Film to CR to Digital Breast Tomosynthesis—A 7 Year Review

Dipa Harish Patel MD (Presenter): Nothing to Disclose

PURPOSE

Canadian researchers performing digital mammography using computed radiography (CR) technology noticed lower breast cancer detection rates than traditional film-screen mammography published a study in Radiology on May 14, 2013. The study comprised of 403,688 women screened with CR technology vs 220,520 using DR technology. To corroborate this study, a retrospective review of cases performed at a single breast center using CR technology for 3 years was compared to detection rates using film screen methodology for 2 prior years. The results were then compared to detection rates using Digital Breast Tomosynthesis in an effort to chronicle detection rates.

METHOD AND MATERIALS

An analysis was performed for a single fellowship trained breast imaging reader (16 years breast imaging experience) at a dedicated breast imaging center using three different mammography techniques. Breast cancer detection rates were compared for two years from 2008-2009 (13,228 screening mammograms) for film screen mammography. Breast cancer detection rates were compared for two years from 2010-2012 (14,106 screening mammograms) using CR technology. Breast cancer detection rates for one year using digital breast tomosynthesis (DBT) was used (2835 screening mammograms) for comparison with film screen and CR technology.

RESULTS

Breast cancer detection rate for film screen mammogram: 2008 was 3.2 (6604 exams), in 2009 was 2.0 (6624 exams). Breast cancer detection rate for CR digital mammogram: 2010 was 2.8 (6384 exams), in 2011 was 1.7 (7722 exams). Breast cancer detection rate for DBT/tomosynthesis: 2013 was 6.0 (2835 screening exams). The detection rates fell from 2008 to 2010 by 12.5% and 46.9% from 2008 to 2011 (max and min change) with CR. Tomosynthesis (DBT) detection rates increased from CR by 114% from 2010 to 252% from 2011. Tomosynthesis (DBT) detection rates increased from film screen by 87.5% in 2008 to 200% from 2009.

CONCLUSION

There is significant increase in breast cancer detection rates using digital breast tomosynthesis (DBT) on multiyear comparison with both film screen technique and CR technique. There is significant decrease in detection rates with CR technique from both film screen technique and DBT/tomosynthesis imaging.

CLINICAL RELEVANCE/APPLICATION

We can expect significant increased breast cancer detection rates with DBT/tomosynthesis from screen film and CR technique.

Effect of Experience on Tomosynthesis Screening Recall Patterns: Is there a Learning Curve?

Melissa Angeline Durand MD (Presenter): Nothing to Disclose, Regina J. Hooley MD : Nothing to Disclose, Madhavi Raghu MD : Nothing to Disclose, Jaime Lynn Geisel MD : Consultant, Siemens AG, Liva Andrejeva-Wright MD : Nothing to Disclose, Reni Simov Butler MD : Nothing to Disclose, Laura Jean Horvath MD : Consultant, Siemens AG, Liane Elizabeth Philpotts MD : Nothing to Disclose

PURPOSE

The purpose of this study was to determine if screening recall patterns change as tomosynthesis experience increases.

METHOD AND MATERIALS

An IRB approved retrospective chart review of screening mammograms with tomosynthesis was performed from 10/1/2011-10/1/2013. The number of screening recalls, types of recalled mammographic abnormalities, recalled abnormality resulting in a cancer diagnosis and numbers of invasive and in situ cancers were recorded over four 6-month periods.

RESULTS

8441 screening mammograms with tomosynthesis were performed over two years at a single tertiary breast center. The overall recall rate was 8.7% (735/8441). Over the four 6-month periods, the recall rates for masses and calcifications did not significantly change (masses: 46/1900, 2.4%; 71/2091, 3.4%; 52/1959, 2.7%; 58/2491, 2.3%; calcifications: 48/1900, 2.5%, 67/2091, 3.2%, 61/1959, 3.1%, 75/2491, 3.0%). The recall rates for architectural distortion (AD) and asymmetries steadily increased over the four periods, and comparing the first and last periods, a statistically significant increase in screening recalls for AD and asymmetries was seen. (AD 5/1900, 0.26%; 15/2091, 0.72%; 20/1959, 1.0%; 25/2491, 1.0%, P=0.0027; asymmetries 66/1900, 3.5%; 78/2091, 3.7%; 84/1959, 4.3%; 123/2491, 4.9%, P=0.0198). The overall cancer detection rate was 5.9/1000 and did not significantly change over the four periods. 6 of 65 recalled architectural distortions resulted in a cancer diagnosis, which at 9.2% was the mammographic abnormality yielding the highest proportion of cancer diagnoses (12/351, 3.4% asymmetries; 11/227, 4.9% masses; 21/272, 7.7% calcifications).

CONCLUSION

Recalls for architectural distortion at screening mammography with tomosynthesis significantly increase with radiologist experience. Architectural distortion is the mammographic abnormality resulting in the highest proportion of cancer diagnoses. Therefore, radiologists new to interpreting tomosynthesis exams should be aware of the significance of this finding.
**CLINICAL RELEVANCE/APPLICATION**

Practice habits may change as experience with tomosynthesis is gained.

**Impact of Availability of PRIOR Examinations and DBT Individually and Jointly on the Interpretation of Non-recalled, Clinically Recalled and Cancer-verified Mammograms**

Christiane Mary Hakim MD (Presenter): Nothing to Disclose, David Gur PhD: Nothing to Disclose, Jules Henry Sumkin DO: Scientific Advisory Board, Hologic, Inc, Marie Adele Ganott MD: Nothing to Disclose, Denise Chough MD: Nothing to Disclose, Victor J. Catullo MD: Nothing to Disclose, Amy Elizabeth Kelly MD: Nothing to Disclose, Dilip Digambar Shinde MD: Nothing to Disclose, Luisa Paula Wallace MD: Nothing to Disclose

**PURPOSE**

To assess the impact of the availability of PRIOR examinations and digital breast tomosynthesis (DBT), individually and jointly, on decisions to recall a woman during mammographic interpretations.

**METHOD AND MATERIALS**

Under an IRB approved HIPAA compliant protocol eight radiologists independently interpreted 153 FFDM, PRIOR and DBT examinations in a paired design, fully crossed, mode balanced study. During one mode three sequential ratings were provided using FFDM only, followed by FFDM+DBT, followed by FFDM+DBT+PRIORS. During the second mode FFDM only, then FFDM+PRIORS, then FFDM+PRIORS+DBT were viewed and rated. The enriched dataset of 153 verified (two year follow up) examinations included 43 benign cases clinically recalled, 60 negative cases, and 50 verified cancer cases. Recall recommendations under each mode and interaction between the effect of PRIORS and DBT on decisions were assessed at a 0.05 significance level using generalized linear model (proc glimmix, SAS. V.9.3) accounting for case and reader variability.

**RESULTS**

Regardless of the order of presentation, there were no statistically significant differences between the multiplicative effects of the availability of DBT and PRIORS on assessment of cancer-free cases (p=0.71, interaction term in logit-link model). Average recall rates in all non-cancer cases were significantly reduced (25%; from 0.51 to 0.38, p=0.03) with the addition of DBT first and with addition of PRIORS first (35%, from 0.51 to 0.33 p<0.01). For a combination of FFDM with PRIORS, addition of DBT reduced recall rate by 30% (from 0.33 to 0.23, p=0.02) and addition of PRIORS to FFDM+DBT reduced the recall rate by 34% (from 0.38 to 0.25, p<0.01). Availability of DBT did not have significant effects on sensitivity whether added to FFDM only (p=0.38) or to FFDM+PRIORS (p=0.13). Notably, availability of PRIORS reduced sensitivity when added to FFDM only (p<0.01) or to FFDM+DBT (p=0.09).

**CONCLUSION**

PRIORS and DBT are independent, primary contributing factors in reducing recall recommendations during mammographic interpretations.

**CLINICAL RELEVANCE/APPLICATION**

Comparison with prior imaging and review of DBT are primary, independent contributing factors in decision making. Each lead independently to a significant decrease in unnecessary recalls.

**Utilization of MRI as a Problem Solving Tool Prior to and Following the Implementation of Screening DBT**

Amy Chudgar MD: Nothing to Disclose, Susan Weinstein MD (Presenter): Nothing to Disclose, Elizabeth McDonald MD, PhD: Nothing to Disclose, Phillip Andrew Yamartino BS: Nothing to Disclose, Marie Synnestvedt: Nothing to Disclose, Emily F. Conant MD: Scientific Advisory Board, Hologic, Inc

**PURPOSE**

Imaging with digital breast tomosynthesis (DBT) improves lesion conspicuity for both benign and malignant lesions. MRI may be used to "problem solve" inconclusive mammographic findings. We compare the utilization of MRI as a problem solving tool prior to and following the implementation of screening DBT.

**METHOD AND MATERIALS**

This retrospective analysis was IRB approved and HIPAA compliant. Results of screening DM cases from 8/2010 to 9/2011 were compared to DBT cases from 10/2011 to 11/2013. Lesions for which MR was recommended for further evaluation were categorized as architectural distortions, asymmetries, and masses. If the MRI was requested to evaluate two findings, both findings were included separately in the analysis (3 cases). Differences between groups were compared using Wilcoxon Rank Sum test.

**RESULTS**

A total of 10,751 DM cases were compared to 24,563 DBT cases. There were 24 DM (0.22%) and 60 DBT (0.24%) cases that utilized MRI for problem solving. The DM detected lesions were architectural distortion (4/24, 16%), asymmetry (13/24, 54%), and mass(es) (7/24, 29%). For DBT cases, the lesions evaluated with MRI were architectural distortion (21/60, 35%), asymmetry (36/60, 60%), and mass(es) (6/60, 10%). In the DBT cohort, there was significantly decreased utilization of MRI to evaluate for masses (p=0.03). There was a trend toward increased utilization of MRI for architectural distortion in the DBT cohort, but this difference was not significant (p=0.1). There was no difference in the utilization of MRI for asymmetries between the two
groups (p=0.6).

**CONCLUSION**

The overall utilization rate of MRI as a problem solving tool did not change for patients screened with DBT compared to DM. However, the types of lesions prompting MR evaluation differed. With DBT detected lesions, utilization of MRI to evaluate masses significantly decreased, but this was offset by a trend toward increased utilization for architectural distortion.

**CLINICAL RELEVANCE/APPLICATION**

The overall utilization rate of MRI as a problem solving tool did not differ with DM vs DBT screening, however the types of lesions that prompted further evaluation with MRI differed.

**Analysis of Cancers Missed on Digital Breast Tomosynthesis**


**PURPOSE**

To determine the imaging and breast tissue characteristics associated with false negative tomosynthesis studies.

**METHOD AND MATERIALS**

IRB approval was obtained. 339 tomosynthesis examinations with verified cancer performed at 3 institutions either at the time of diagnosis or up to 12 months prior to the cancer diagnosis were retrospectively reviewed. Tissue density, tomosynthesis views obtained and pathology cell type were collected. One of 6 experienced breast imaging radiologists recorded lesion location on each view, shortest distance to skin and reason for non-visualization (obscured, not included on the view, looks like normal tissue, motion/blur). Lesion location and cancer cell type were known to the reader to assure the correct lesion was evaluated.

**RESULTS**

Cell type distribution was 24% IDC (82/339), 16% DCIS (53/339), 48% (164/339) mixed IDC/DCIS, 10% (33/339) ILC, and <1% each (3/339) mucinous and (1/339) invasive papillary. Of the 339 cancers detected within 12 months of tomosynthesis acquisition, 54 (16%) were not visible on both views. A substantially larger number of cancers were visible on the CC view (78%; 265/339) as compared to the MLO view (47%;165/339) (p<0.001). The majority of the non-visible cancers were recorded by the readers as not visible because the cancer looked like normal tissue. There was no significant difference in visibility as a function of breast density (p=0.13) but fractionally, visibility was better in lower breast densities. There was no significant difference in visibility by cancer type (p>0.6). On the CC view, better visibility was associated with being located centrally (p<0.04) while there was no significant correlation between fraction of cancers rated not visible with respect to location or distance to skin on the MLO view.

**CONCLUSION**

Cancers of all cell types are missed on tomosynthesis on one or both views at all locations, primarily because they look like normal tissue. The CC view seems to depict substantially more cancers than the MLO view.

**CLINICAL RELEVANCE/APPLICATION**

Tomosynthesis has been shown to improve performance but still a substantial fraction of cancers of all types and at all locations may be missed primarily in non-fatty breasts because they look like normal tissue.

**Recall Costs in Breast Tomosynthesis: Age as a Variable Independent of Mammographic Density**

Xiao Wu : Nothing to Disclose , Vivek Bihari Kalra MD (Presenter): Nothing to Disclose , Brian Haas MD : Nothing to Disclose , Liane Elizabeth Philpotts MD : Nothing to Disclose

**PURPOSE**

To determine if age is a variable independent of mammographic density in recall costs of breast tomosynthesis compared to 2D mammography.

**METHOD AND MATERIALS**

Diagnostic workups resulting from screening recalls performed with tomosynthesis and 2D mammography were tabulated from a one year period at a single institution in a HIPAA compliant, IRB-waived study. Unnecessary diagnostic workups were defined as those that subsequently returned to screening or had biopsies with non-malignant pathology.

All imaging was performed on Selenia Dimensions units (Hologic, Bedford, MA). Patients were evaluated with tomosynthesis or 2D without preferential assignment. The direct costs of basic diagnostic mammographic imaging and biopsy procedures were calculated.
imaging, advanced diagnostic imaging, biopsy procedure costs, and pathology interpretation costs were assessed using 2013 regional facility Medicare payment values. Multiple linear regression analysis was performed to determine significance of age and density as independent variables.

RESULTS
During the one-year period, 13,174 patients underwent screening mammography, of which 6,116 had tomosynthesis and 7,058 had 2D mammograms. 516 (8.4%) of tomosynthesis patients were recalled and 826 (11.7%) of 2D mammography patients were recalled (p<0.0001). No significant difference in patient characteristics, including number of patients lost to followup, were seen between the two groups. Tomosynthesis demonstrates an 8.4% decrease in recall costs between each decade age group independent of density (p=0.01), leading to 27.4% more savings in the 40-49 age group compared to 70+. Tomosynthesis demonstrates a 4.0% decrease in recall costs for each stepwise increase in breast density independent of age (p=0.004), leading to 12.5% greater savings in the extremely dense group compared to predominantly fatty group. Overall cost reduction of 17.1% was seen, as previously presented.

CONCLUSION
Age, grouped by decade, independently is more than twice as significant as mammographic density in determining recall cost benefits in combined breast tomosynthesis compared to 2D mammography. There was an 8.4% decrease in recall costs between each decade age group independent of density, leading to 27.4% more savings in the 40-49 age group compared to 70+.

CLINICAL RELEVANCE/APPLICATION
Age is independently more than twice as significant as mammographic density in determining recall cost benefits in combined breast tomosynthesis compared to 2D mammography.

SSK01-08
Distortion and Its Significance at Screening with Digital Breast Tomosynthesis: Do We Call Back More Patients for Distortion After Screening with Tomosynthesis?
Nancy Ibrahim MD (Presenter): Nothing to Disclose, Debra Somers Copit MD: Scientific Advisory Board, Hologic, Inc, Caroline Ling MD: Nothing to Disclose, Meghan Boros MD: Nothing to Disclose

PURPOSE
Although there is increasing data that tomosynthesis reduces call-back rates and increases cancer detection, there is less information regarding specific abnormalities for which patients are assigned a BI-RADS 0. We have observed that distortion is more commonly seen with tomosynthesis. Having a screening population undergo routine digital mammography (DM) with and without tomosynthesis, we were able to compare these groups to determine how often they were recalled for possible distortion. Furthermore, we sought to determine the significance of distortion in these patients in terms of diagnosing invasive carcinoma vs radial scars.

METHOD AND MATERIALS
We performed a HIPAA compliant retrospective review of all screening studies (DM and DM with tomo) performed at our institution between 7/1/2011 and 12/31/2013. All screening studies assigned BI-RADS 0 were included. Data collected included lesion type for which the patient was recalled, BI-RADS category at diagnostic imaging and final pathology. Statistical analysis assessed differences in recall rates, lesion type and final pathology between the two groups.

RESULTS
45,850 patients had screening mammography; 24,159 receiving tomosynthesis. Recall rate was significantly decreased from 9.9% in the DM group to 8.5% in the tomo group (95%CI, -1.9 to -.09%, p<.0001). Recall rate for distortion was significantly increased from 3.0% in the DM group to 6.3% in the tomo group (95%CI, 2.0 to 4.6%, p<.0001). The percentage of patients who had suspicious findings (BI-RADS 4/5) on subsequent diagnostic exams was similar in the 2 groups, DM (n=17, 31%) and tomo (n=43, 35%). The percentage of patients diagnosed with cancer was similar in the 2 groups, DM (n=5, 33%) and tomo (n=12, 30%). There was a nonsignificant difference in the percentage of patients diagnosed with radial scar, DM (n=1, 7%) and tomo (n=13, 32%) (95%CI, 4.3 to 42%, p=.086).

CONCLUSION
The percentage of patients called back for distortion was significantly increased in the tomosynthesis group compared to the DM group. This resulted from an increase in radial scars in the tomosynthesis group, rather than an increase in cancer detection.

CLINICAL RELEVANCE/APPLICATION
Increasing data suggest cancer detection rate is increased in patients undergoing digital breast tomosynthesis but the additional cancers diagnosed may not be solely attributed to increased detection of distortion.

SSK01-09
Recall Rate Reduction with Tomosynthesis during Baseline Screening Examinations – Assessment from a Prospective Screening Trial

PURPOSE
In a stable clinical practice women undergoing baseline examinations constitute a small fraction of the screening
population that is not routinely assessed as a special group. We report results from a prospective clinical study designed to specifically evaluate the impact of using digital breast tomosynthesis (DBT) during baseline screening.

**METHOD AND MATERIALS**

Under an institutional review board approved protocol, consenting women between 40 and 55 years of age scheduled for their initial/baseline screening mammogram underwent both digital mammography (FFDM) and DBT. The FFDM images (mode 1) and the FFDM+DBT images (mode 2) were interpreted independently in a balanced design by two experienced radiologists (out of 14 participating radiologists) under the standard clinical screening protocol. A woman was recalled for a diagnostic workup if either radiologist recommended recall. This analysis reports the results from the first 957 participants in this single institution prospective study. We assessed the proportion of recommended recalls (BIRADS 0 ratings) from clinical interpretations of FFDM alone and FFDM+DBT, as well as their diagnostic outcome.

**RESULTS**

Density distribution (BIRADS 1-4) of all participants was 4.6%, 40.3%, 51.3% and 3.8%, respectively. The fractions of women recommended for recall by either or both modalities (FFDM alone and FFDM+DBT) were 366/957 (38%) and 250/957 (26%). This represents a 32% reduction in recall rate (p<0.01). The vast majority of the reduction was in density BIRADS 2 and 3. Recall rates varied substantially among radiologists (range 21% to 51% for FFDM alone and 11% to 41% for FFDM+DBT) and so did the reduction in recall rates (from -2% to 60%). Our clinical baseline recall rate is 37% range (18% to 55%) and 28% for FFDM+DBT. One DCIS was found on FFDM alone and one IDC on FFDM+DBT alone. PPV3 was substantially higher in women recalled as a result of FFDM+DBT (5/25=0.20 versus 5/16=0.31). There was no "learning" effect or "study knowledge" effect in our study.

**CONCLUSION**

Performance during baseline should be assessed carefully. FFDM+DBT resulted in a significant decrease in recall rates during baseline screening of young women.

**CLINICAL RELEVANCE/APPLICATION**

Recall rates during baseline screening need special attention and the use of DBT in our practice results in a significant, albeit not sufficient, reduction in recall rates.
survival while controlling for the effects of age, breast tissue density (BTD), adjuvant hormonal therapy (AHT), radiation therapy (XRT), and surgical margins. Stratified log-rank tests were used to investigate whether the effectiveness of XRT varied by MC morphology, distribution, or age.

RESULTS

Of 1911 patients with pure DCIS, 255 patients with negative M and noncalcified lesions were excluded, leaving 1656 patients for final analysis (mean age 55 years, SD 11.0). The lesion mean size was 2.9 cm (SD, 2.9). The contralateral breast cancer 66 (4%), locoregional recurrence 49 (2.5%), and distant metastasis 7(0.5%). Event rates increased with patient age (p<0.001), positive surgical margins (p<0.02) and decreased in patients with XRT (p<0.004). The data failed to show significant evidence that survival was impacted by MC morphology and BTD in multiple regression analysis. There was tendency to decreased survival for patients with linear/segmental distribution of DCIS MC (p=0.06). XRT was associated with improved survival among older (>55) patients (p<0.001), DCIS with amorphous and pleomorphic/heterogeneous morphology (p<0.05) and grouped distribution of MC (p<0.001). XRT didn't improve survival for DCIS MC with fine linear/branching morphology (p=0.4) and regional/diffuse or linear/segmental distribution in stratified analysis.

CONCLUSION

When controlled for the effects of interventions MC morphology did not identify subgroups prognostic for survival. There is some evidence that MC distribution may be prognostic with diminished survival for linear/segmental patterns. XRT was associated with improved survival for subgroups of DCIS MC.

CLINICAL RELEVANCE/APPLICATION

Both MC morphology and distribution may provide predictive markers for XRT with enhanced benefit for amorphous and heterogeneous/pleomorphic morphology and grouped distribution.

Digital Mammography Screening: Does Age Influence the Detection Rates of Low, Intermediate and High Grade Ductal Carcinoma in Situ?

Stefanie Bettina Weigel (Presenter): Nothing to Disclose, Oliver Heidinger : Nothing to Disclose, Jan Heidrich : Nothing to Disclose, Shoma Berkemeyer : Nothing to Disclose, Walter Leonhard Heindel MD : Nothing to Disclose, Hans Werner Hense : Nothing to Disclose

PURPOSE

To investigate the association between age and detection rates of ductal carcinoma in situ (DCIS), separately for different nuclear grades, after introduction of a population-based digital mammography screening program (MSP).

METHOD AND MATERIALS

740,200 women participating for the first time in the MSP between 2005 and 2008 were examined in 17 screening units. We calculated DCIS detection rates (DetR; per 1,000 women screened) in 5-years age groups distinguishing DetR for low (n=189), intermediate (n=405) and high grade (n=436) DCIS. Likewise, the relative contribution of each nuclear grade was calculated as a proportion of the overall DetR. Data analyses accounted for variation between screening units using multivariate regression techniques.

RESULTS

The DetR for total DCIS increased from younger to older age groups (50-54 yrs.: 1.22; 55-59 yrs.: 1.27; 60-64 yrs.: 1.37; 65-69 yrs.: 1.74; p=0.0008). The DetR for high grade DCIS showed a significant trend with age (+0.09 per 5 years; p=0.0017); the trend for intermediate grade DCIS was of borderline significance (+0.05 per 5 years; p=0.055). Of note, the DetR for low grade DCIS did not significantly differ between the age groups (+0.02 per 5 years; p=0.18). In terms of DCIS proportions, 42.3% were on average high grade, 39.3% intermediate grade and 18.3% low grade DCIS and there was no significant influence of age.

CONCLUSION

Overall DCIS detection rates increase with age groups which is mostly due to a rise of detection rates of DCIS high and intermediate grade, i.e., precursor lesions that carry a higher risk for transition to invasive breast cancer than DCIS low grade.

CLINICAL RELEVANCE/APPLICATION

Increasing detection rates of more progressive DCIS subtypes in increasing age groups with highest rates in the age group 65-69 years rise questions to extend the upper age limit for organized mammography screening programs.

Clinical Utility of Short-term Follow-up After Benign Concordant Stereotactic Breast Biopsy

Cathleen Clare Heffernan MD : Nothing to Disclose, Kathryn Iwata (Presenter): Nothing to Disclose, Cecilia Luz Mercado MD : Nothing to Disclose

PURPOSE

The purpose of this project is to determine the utility of short interval follow-up after benign concordant stereotactic core biopsy.
**METHOD AND MATERIALS**

This study is an IRB approved, HIPAA compliant retrospective review of stereotactic core biopsies performed between 2004 and 2011 using a 9 or 11-gauge vacuum assisted biopsy device yielding benign concordant pathology results. Excluded from the study were high-risk lesions, lesions with discordant results and technically unsuccessful biopsies. Radiologic-pathologic concordance was evaluated by the radiologist who performed the biopsy. Benign concordant cases were evaluated for outcomes at short term and long term follow-up, re-biopsy rates and false negatives.

**RESULTS**

A total of 1532 stereotactic core biopsies were performed at our institution during a 7-year time period. Pathology results yielded 842 (55%) benign, 259 (17%) high-risk or atypical and 383 (25%) malignant lesions. Of the benign cases, 81% (686/842) returned for imaging follow-up: 54% (372/686) returned for short interval follow-up (<8 months), 34% (230/686) returned for annual exam (between 8 and 15 months) and 12% (84/686) returned after 15 months. The mean age was 54 years, mean length of subsequent follow-up time was 33 months after biopsy and mean number of samples taken was nine. Five cases were re-biopsied (< 1%) within the next year. Of those re-biopsied, none were malignant. Four cases revealed benign pathology while one revealed flat epithelial atypia and radial scar requiring excision.

**CONCLUSION**

No false negatives were identified on short-interval and long term follow-up after 9 gauge and 11 gauge stereotactic core biopsies at our institution. Prior studies of benign stereotactic core biopsies have recommended 6 month follow-up mammogram to evaluate for false negatives. Our data support the elimination of the short interval follow-up mammogram for benign concordant results.

**CLINICAL RELEVANCE/APPLICATION**

By reducing the number of follow-up imaging studies needed after benign concordant biopsies, we can reduce health care costs as well as reduce emotional stress from extra unnecessary tests for our patients.

**SSK02-06**

*Correlation of Axillary Ultrasound Features after Neoadjuvant Chemotherapy with Final Pathology in Patients Presenting with Node-Positive Breast Cancer (T0-T4, N1-2, M0): Results from a Multi-institutional Collaborative Clinical Trial (Alliance)*

H. Carisa Le-Petross MD (Presenter): Nothing to Disclose , Linda M. McCall MS : Nothing to Disclose , Kelly K. Hunt MD : Nothing to Disclose , Elizabeth Mittendorf MD : Nothing to Disclose , Gretchen M. Ahrendt MD : Nothing to Disclose , Lee G. Wilke MD : Nothing to Disclose , Karla Ballman PhD : Nothing to Disclose , Judy Boughey MD : Nothing to Disclose

**PURPOSE**

ACOSOG Z1071 was a prospective multicenter trial evaluating axillary surgery in patients with biopsy proven node positive breast cancer (T0-4, N1-2, M0) receiving neoadjuvant chemotherapy (NAC). The role of post chemotherapy/preoperative axillary ultrasound (AUS) to assess for residual nodal disease remains unclear. Here we report the correlation of lymph node (LN) features on AUS after NAC with final nodal pathology.

**METHOD AND MATERIALS**

All patients had AUS performed after NAC (within 4 weeks prior to axillary surgery). AUS images were centrally reviewed for LN cortical thickness (in mm), LN size, and cortical morphologic features defined as: type I- no visible cortex, type II- < 3 mm hypoechoic cortex, type III- > 3mm hypoechoic cortex, type IV- generalized lobulated hypoechoic cortex, type V- focal hypoechoic cortical lobulation, and type VI- totally hypoechoic node with no hilum. We compared LN features on AUS after NAC with final nodal pathology.

**RESULTS**

Surgical pathology and post NAC AUS images were available on 611(87.2%) patients. Median age was 50 years (range 23-93 years). 370 patients (60.6%) had residual nodal disease (N+) on final pathology and 241 (39.4%) had a complete pathologic nodal response (N0). The cortical thickness correlated with residual nodal response (mean 3.6mm vs. 2.5mm; p <0.0001). Neither LN size (p=0.40) nor long-axis diameter to short-axis-diameter ratio (LSR) (p=0.39) was significantly different between patients with pathological N+ vs N0 cases. Cortical morphologic type I and II had the lowest risk of residual nodal disease while type VI had the highest (p = 0.0002). The visualization of a fatty hilum in a lymph node was associated with response to chemotherapy or N0 disease (p = 0.0007).

**CONCLUSION**

AUS after NAC is useful to assess for nodal response to NAC, with cortical thickness being the best predictor of residual nodal metastasis. LN size or LSR do not reliably exclude residual nodal metastasis in patients after NAC.

**CLINICAL RELEVANCE/APPLICATION**

Cortical thickness of axillary LN can be used instead of LN size to differentiate post-NAC responders from non-responders and may help triage patients who would be eligible for SLNB instead of ALND.

**SSK02-07**

*Radial Sclerosing Lesions without Atypia on Core Needle Biopsy: Excision or Observation*

Elizabeth Kalife MD : Nothing to Disclose , Ana P. Lourenco MD (Presenter): Nothing to Disclose , Murray Resnick MD : Nothing to Disclose , Martha Beretta Mainiero MD : Nothing to Disclose , Yihong Wang MD : SSK02-06

**METHOD AND MATERIALS**

Correlation of Axillary Ultrasound Features after Neoadjuvant Chemotherapy with Final Pathology in Patients Presenting with Node-Positive Breast Cancer (T0-T4, N1-2, M0): Results from a Multi-institutional Collaborative Clinical Trial (Alliance)
PURPOSE

To review malignancy rates of radial scars/radial sclerosing lesions without atypia (RSL) detected on core needle biopsy.

METHOD AND MATERIALS

An IRB approved, HIPAA compliant retrospective review of the pathology database from 1/2003 thru 7/2013 was conducted to identify all needle biopsies with diagnosis of RSL without atypia. Any cases associated with atypia (ductal, lobular, flat epithelial, columnar cell) or malignancy were excluded. Biopsy and excision specimens were reviewed by a breast pathologist and imaging follow-up was reviewed by a breast radiologist. Patient demographics, lesion size, all available excisional pathology and imaging follow-up were reviewed using the electronic medical record and results recorded in a database. Cases were categorized as incidental if the biopsy was for calcifications and targeted if the biopsy was for mass, architectural distortion or MRI enhancement.

RESULTS

100 cases were identified, 54 incidental and 46 targeted. Average patient age was 57 (incidental) and 52 (targeted), (p=.018). Average pathologic size was smaller for the incidental group (3mm) than for the targeted group (6mm), p<.001. Of the 54 incidental lesions, 14 had surgical excision, 30 had imaging follow-up and 10 were lost to follow-up. Of the 46 targeted lesions, 27 had excision, 11 had imaging follow-up and 8 were lost to follow-up. Of the 41 surgical excisions, 4 (10%) (3 incidental, 1 targeted) identified atypia; none were up-graded to malignancy. All 4 have negative imaging follow-up (range 1-7 years). There were no ipsilateral malignancies among the 41 patients with imaging follow-up (mean follow-up 4 years). One of the 30 patients with imaging follow-up after an incidental RSL biopsy developed a contralateral invasive ductal carcinoma 7 years after biopsy.

CONCLUSION

In this study, there were no associated ipsilateral malignancies with either incidental or targeted RSL needle biopsy results. This suggests that patients with RSL without atypia on needle biopsy may not require surgical excision.

CLINICAL RELEVANCE/APPLICATION

RSL are frequently encountered on needle biopsy and have commonly been recommended for surgical excision. These results suggest patients may be able to avoid surgery in this setting.

SSK02-08

Atypical Lobular Hyperplasia at MRI Guided Vacuum Assisted Biopsy: Is Surgery Necessary?

Sandra Brennan MBCh, MSc (Presenter): Nothing to Disclose, Manuela Durando: Nothing to Disclose, Adriana D. Corben MD: Nothing to Disclose, Elizabeth A. Morris MD: Nothing to Disclose

PURPOSE

To evaluate MRI characteristics and upgrade rate to cancer of atypical lobular hyperplasia (ALH) diagnosed at MRI guided vacuum-assisted biopsy (MRI-VAB).

METHOD AND MATERIALS

A HIPAA compliant retrospective study was performed by collecting consecutive MRI-VABs yielding ALH between January 2003-December 2012. ALH was divided into 2 groups 1) pure ALH and 2) ALH associated with other high risk lesions (atypical ductal hyperplasia (ADH), papilloma, radial scar or columnar cell changes)(noted ALH/HR). Patients with incomplete data or with synchronous ipsilateral cancer were excluded. ALH that yielded cancer at surgery was defined as upgrade. Statistical analysis was performed (p<0.05) and 95% CI were calculated.

RESULTS

196 consecutive MRI-VABs yielded atypical lesions; 54/196 (27.6%) were ALH. 2/54 cases were excluded for incomplete data and 7/54 for synchronous ipsilateral cancer, leaving 43 patients with 45 ALH (mean size 11.7 mm; range: 3-40). 33/45 (73%) were pure ALH and 12/45 (27%) were ALH/HR (5/45 (11%) associated with ADH. Patients (mean age 53 years; range: 34-72) were predominantly post-menopausal (51.2%), with previous history of breast cancer (41.9%) or high risk lesions (20.9%) and underwent MRI mostly for screening (69.8%). No difference in size, T2 appearance or type of enhancement was noted between pure ALH and ALH/HR. Patients with incomplete data or with synchronous ipsilateral cancer were excluded. ALH that yielded cancer at surgery was defined as upgrade. Statistical analysis was performed (p<0.05) and 95% CI were calculated.

CONCLUSION

ALH represented 27.6% of atypical lesions identified at MRI-guided VABs performed in our high risk population. Upgrade rate to cancer of MRI-VABs yielding ALH was low (2.6% and 2.2%) and was found with ALH associated with ADH only. Pure ALH without associated atypia may not necessitate surgical removal.
Upgrade rate to cancer of MRI-VABs yielding ALH was low (2.6% and 2.2%) in our study and was found with ALH associated with ADH only, therefore pure ALH without associated atypia may not necessitate surgical removal.

**Imaging Factors Influencing Surgical Margin Status Following Pre-operative I-125 Radioactive Seed Localization (RSL) of Breast Lesions: Comparative Analysis with Needle Localizations (NL)**

Mark Joseph Dryden MD (Presenter): Nothing to Disclose, Basak Erguvan Dogan MD: Nothing to Disclose, Cuiyan Wang MD, PhD: Nothing to Disclose, Patricia Sue Fox MS: Nothing to Disclose, Shon Black MD: Nothing to Disclose, Wei Tse Yang MD: Researcher, Hologic, Inc, Kelly K. Hunt MD: Nothing to Disclose

**PURPOSE**

Determine the impact of imaging lesion type, method of pre-operative localization (RSL vs. NL), multiple seeds vs needles for bracketing, on surgical margins

**METHOD AND MATERIALS**

660 lesions in 565 women were localized using RSL or NL between 05/16/2012 and 05/30/2013. Patient age, lesion type [mass; calcifications (calc), mass+calc, others (clips, architectural distortion, intraductal filling defect)], lesion size, imaging modality (US or Mammography-guided (USG or MG), NL versus bracketing (brac), number of seeds or needles (1 versus >1 per lesion) were recorded. Surgical margins [close-positive (PM) or negative (NM)], re-excision and mastectomy rates were surgical end points. Chi square test was used for univariate associations. Multivariate logistic regression was used to predict the odds of having a PM.

**RESULTS**

127 (19%) patients underwent RSL, 533 (81%) underwent NL pre-operatively. Mean lesion size was 1.80 cm (std=1.25) for RSL and 1.83 cm (std=1.66) for NL (p=0.37). Of the NL, 405(76%) were performed MG, 128(24%) USG. Of the RSLs, 58 (46%) were MG, 69(54%) USG. In NL group,48% were mass, 35% [(calc) or mass+calc] and 16% other lesion types. In RSL group, 52%mass, 33%[calc or mass+calc] and 14% other lesion types were localized. Loc with a single seed per lesion was used in 105(83%) RSL compared to single NL 350 (66%) (p=0.0002). PM was similar between the two groups at 26(20%) RSL and 104(21%) NL (p= 0.81). No significant differences were observed between the groups for re-excision (20% RSL vs. 16% NL, p=0.36) or mastectomy (6% each, p=0.96). [Calc and mass+calc] were more likely (OR 4.4, 95%CI 2.8-7, p<.0001) to require >1 needle or >1 seed (OR 7.0 95%CI 1.6-30, p=0.0088) compared to masses after accounting lesion size. In multivariate analysis, increasing lesion size and [calc or mass+calc] lesion types were significant predictors of PM regardless of localization type, while use of >1 needle or seed was not (OR 0.9, 95%CI 0.6-1.5) (p=0.75).

**CONCLUSION**

Single seed RSL was more commonly performed for equivalent sized lesions that required multiple needles (NL) in our series, while PM, re-excision and mastectomy rates remained similar. Presence of calc increased odds of PM.

**CLINICAL RELEVANCE/APPLICATION**

RSL is equally effective to NL in the pre-operative localization/ bracketing of malignancy. Similar surgical outcomes using a single seed vs. multiple needles may impact procedure time with potential downstream cost reduction.
**SSK23-02**

The Role of Pretreatment Maximum Standardized Uptake Value of 18 F-FDG (PET/CT) in Predicting Treatment Outcome in Breast Cancer Patients Presenting with Multiple or Oligometastatic Disease

Hala Ahmed El-Lathy MD, MSc (Presenter): Nothing to Disclose, SAMY EL BADAWAY: Nothing to Disclose, Yasser Alassiri MD, PhD: Nothing to Disclose, YASSER ALMALKI: Nothing to Disclose, Ahlam Dohal: Nothing to Disclose, EHAB IBRAHIM: Nothing to Disclose

**PURPOSE**

This study aimed to evaluate the role of pretreatment 18-fluorodeoxyglucose positron emission tomography (18F-FDG-PET) as a predictor of progression free survival (PFS), and overall survival (OS) in breast cancer patients presenting with multiple or oligometastatic disease.

**METHOD AND MATERIALS**

After obtaining the institutional review board approval, we conducted a retrospective analysis of metastatic breast cancer patients (MBC) with >=1 metastatic lesion on pretreatment PET/CT from 01/01/2010-12/31/2013. We examined the association between the highest pretreatment (SUVmax) in metastatic sites (bone, liver, lung and lymph nodes) and the treatment outcomes. The (PFS), and (OS) were calculated by the Kaplan-Meier method, and the differences were evaluated on log rank test. The prognostic significance was assessed by univariate and multivariate analyses.

**RESULTS**

We identified 130 MBC patients with median age of 50.4 years who had pretreatment PET/CT (64.3% ER+ and 21.4% HER2+). Median OS was 34 months. Oligometastasis mainly to bone was observed in 30 patients while multiple metastases was noticed in 100 patients. The receiver-operating characteristic curve (ROC) demonstrated a SUVmax of 7.7 to be the optimal cutoff in patients with multiple metastases for predicting PFS which is significantly higher in patients with pretreatment PET-CT SUVmax 7.7 (P 4.4 (P =0.001). Similarly, On multivariate analysis, the SUVmax category was the only factor associated with PFS (HR) = 7.4, 95% CI 3.2-56.8, P

**CONCLUSION**

This study shows that the pretreatment SUVmax is a potential independent prognostic predictor of clinical outcomes in metastatic breast cancer patients.

**CLINICAL RELEVANCE/APPLICATION**

The 18- FDG PET CT is feasible, relatively safe imaging with satisfactory sensitivity and specificity in breast cancer patients.

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**SSK23-03**

Solid Modulated Accelerated Radiation Therapy (SMART) for Early Stage Breast Cancer Conservation: Final Results

Theodore Edward Yaeger MD (Presenter): Nothing to Disclose

**PURPOSE**

Accelerated radiation is being studied as an alternative to conventional radiation for early stage breast cancers. This report is to finalize the results of a technique to accelerate the radiotherapy course consistent with the American Society Radiation Oncology (ASTRO) ‘Choose Wisely’ recommendations. Intensity modulated radiation therapy (IMRT) using concurrent seroma radiation with conventional whole breast prophylaxis is studied.

**METHOD AND MATERIALS**

Patients older than 50 years with stage 0, 1, or early 2 breast cancers were planned for both conventional 3-D tangents versus accelerated IMRT. Plans that developed improved dose homogeneity were treated with accelerated IMRT over 5 weeks. Patients without plan improvements were treated with conventional technique (half-beam blocked tangents to boost) over 6.5 weeks. The populations are compared for demographics, treatment tolerance, cosmesis and local control. The original intent is to prove non-inferiority.

**RESULTS**

During 6 years of accrual for conservation radiation to early stage breast cancers 73 patients were treated with either conventional or IMRT techniques. The beam-modulation technique offered shorter course IMRT if improved dosing was assured. All 73 patients were evaluated with dosimetry planning and 38 were eligible for IMRT. 35 patients had no improvement in their plans (thus treated conventionally). All patients were judged for treatment tolerance and local control, prospectively. No patient in either group experienced a local or global failure with 3.5 years average follow-up. However nearly 50% of patients treated with tangent fields developed treatment required skin reactions. Only one in the IMRT group required skin care. No patient in the IMRT group developed global breast edema or any cosmetic defect. Pain scores and cosmetic results consistently favored the IMRT group as judged by the patients. Both groups had similar demographics, stage distributions, and prescribed doses.

**CONCLUSION**

Beam-modulated accelerated radiotherapy delivers tumor control probabilities similar to conventional radiation for breast conservation. For all, but especially larger volume women, IMRT significantly enhances treatment tolerances and yields improved cosmetic outcomes.

**CLINICAL RELEVANCE/APPLICATION**

Beam-modulated accelerated radiation therapy is a shortened-course, non-inferior alternative for larger volume, low nodal risk early stage breast cancer patients seeking a breast conservation choice.
Assessing Intraoperative Radiotherapy Combined with Second Breast-conserving Surgery after Local Recurrence of Breast Carcinoma

Claire Lemanski (Presenter): Nothing to Disclose

ABSTRACT

After 20 years of breast-conserving surgery (BCS) and radiotherapy, the rate of ipsilateral breast tumor recurrence (IBTR) remains between 10 and 15%. IBTR is an independent predictor of poor survival with a 3 to 46 increased risk of cancer-related death. Local control remains a major challenge for these relapsed patients. Therapeutic de-escalation would avoid a mastectomy. However, second BCSs are associated with a high rate of local relapse (19-50% at 5 yrs). Indeed, it may not be combined with a conventional re-irradiation, given the local tolerance issue. Purpose/Objective(s): As numerous patients still undergo a mutilating mastectomy, we aimed to evaluate the feasibility of a conservative alternative. Partial breast irradiation is an interesting method, as studies in adjuvant setting report promising results, both in terms of tolerance and local control (74-100% at 5 yrs). Among the available techniques, intraoperative radiotherapy (IORT) is highly precise and preserves healthy tissue. Materials/Methods: We determined the design, objectives and outcomes that were the most appropriate for the evaluation of IORT in patients with IBTR. The targeted population was defined and all equipped centers in France were contacted. Results: A prospective, multicenter, single arm Phase II trial was developed in our institution. The primary objective is to evaluate the tolerance of IORT in terms of fibrosis rate. Secondary objectives are to evaluate the cosmetic outcome and quality of life, according to standardized scales, oncologic criteria (local relapse-free survival, metastasis relapse-free survival, disease-free survival and overall survival) and the mastectomy-free interval. Are eligible patients with local recurrences occurring more than 5 years after initial treatment, considered of good prognosis, non-metastatic, with a satisfactory predicted cosmetic result after a second BCS and presenting favorable pathological criteria (i.e. Grade I-II, non-lobular and unifocal disease, without vascular and lymphatic emboli, Estrogen Receptor +, erb2-). Lymphectomy is performed with safe margins, according to oncologic standards. Associated IORT is delivered at a single dose of 20 Gy with 50 kV photons. The experimental treatment will be considered unacceptable if we observe >= 6 patients, out of the 51 scheduled patients, with Grade >= 2 fibrosis within 12 months (CTC v4.0 grading). Conclusions: This trial is the first to prospectively evaluate the BCS-IORT combination which is a promising alternative in the treatment of IBTR. All the nine French centers equipped with a low-energy mobile accelerator are participating. Acknowledgments: This project is supported by a Grant from the French Ministry of Health. Authors thank the numerous participating teams.

VMAT(3Arc) Vs. 3D-CRT for Locally Advanced Breast Cancer: Volumetric Modulated Arc Therapy (VMAT) Improves Locoregional Control Compared to 3D Conformal Radiation Therapy (3D-CRT)

Yijun Kim (Presenter): Nothing to Disclose

ABSTRACT

Purpose/Objective(s): This study compared Volumetric modulated Arc therapy (VMAT, 3Arc) and 3D conformal radiation therapy (3D-CRT) for locally advanced breast cancer including internal mammary nodes based on clinical data and a dosimetric analysis. Materials/Methods: We compared VMAT (n=40), in women with locally advanced nonmetastatic breast cancer (stage III) treated with conservative breast surgery or modified radical mastectomy from January 2011 to July 2013. The median follow-up was 20.1 months (10.4 months for VMAT, 25.3 months for 3D-CRT). The primary endpoint was locoregional control. Kaplan-Meier method and log-rank test was used. The secondary endpoint was RT induced complications including RT induced pneumonitis. Pearson’s chi-squared test was used for the analysis of complications. For comparative dosimetric study, we compared 39 patients treated with VMAT and 26 patients treated with 3D-CRT with planning target volume (PTV) dose homogeneity and conformity. After Kolmogorov-Smirnov test and Shapiro-Wilk test for normality test, t-test was done. Among these patients, 10 patients previously treated with modified radical mastectomy (MRM) and postoperative radiotherapy using VMAT were randomly chosen and re-planned with 3D-CRT. PTV dose homogeneity, conformity and dose to surrounding structures were compared using Wilcoxon signed rank test. Results: During follow-up period patients treated with VMAT did not have locoregional recurrence. 3 patients with 3D-CRT died from distant metastasis and one of 3 recurred locally. The overall locoregional control was 100% for VMAT group. In 3D-CRT group 5 were locoregional recurrences. The primary endpoint was not reached in this analysis. The rate of RT induced pneumonitis was 0% for VMAT and 2% for 3D-CRT. Conclusions: VMAT improved locoregional control in locally advanced breast cancer compared to 3D-CRT by significantly improved PTV dose homogeneity and conformity but showed a tendency to increase mean heart dose and contralateral breast than that of 3D-CRT. Therefore, further long-term follow-up is recommended to observe RT induced side effects.

Low Incidence of Symptomatic Lymphedema Following Hypofractionated Radiation Therapy for Early-stage Breast Cancer

Maha S. Jawad MD (Presenter): Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Limited data exist regarding the development of breast cancer-related lymphedema (BCRL) following hypofractionated whole breast irradiation (h-WBI) for early-stage breast cancer. The purpose of this study was to evaluate the rate of symptomatic BCRL in patients treated with h-WBI and to attempt to correlate factors predictive for BCRL development. Materials/Methods: 289 patients with early-stage breast cancer were treated with h-WBI from 2007-2013. Fractionation was delivered to the whole breast utilizing a hypofractionated regimen of 4256 cGy in 16 fractions. No lumpectomy cavity boost or third (supracavitary) field was used. Toxicity was assessed at each follow-up. Upper extremity BCRL was scored loosely based on the CTC v3.0: 1 = no BCRL, 2 = mild BCRL, 3 = moderate BCRL, and 4 = severe BCRL. No formal arm measurements were performed. Results: Median follow-up was 7 yr (range 0-10). Median age at diagnosis was 68 yrs (31-89; 92% post-menopausal). Histology was DCIS in 24% (n=71), invasive ductal in 64% (n=186), invasive lobular in 6% (n=16), and other (medullary, colloid, tubular) in 6%. T-stage was Tis in 24%, T1 in 65%, and T2 in 11%, with a median tumor size of 11 mm (1-70 mm). The majority of patients had grade 1 (42%) or 2 (44%) histology. Of the 137 patients who had sentinel lymph node
(SLN) sampling, the median number of LN removed was 1 (0-6). 16% of patients who had SLN sampling underwent a completion axillary lymph node dissection, with a median of 2 nodes removed (0-24). Initial surgical margins were positive in 12% of patients (n=33) and close in 29% (n=80). 89 of the patients with inadequate margins underwent re-excision, resulting in a final margin clearance rate of 96%. Final margins were positive in only 1% of patients. ER/PR was positive in 92%/79%, and Her2/neu was negative in 97%. Toxicity data was available for 97% of patients (n=281). The incidence of symptomatic BCRL was < 1%. Given the very low number of events, further correlation for predictors was not possible. Conclusions: The incidence of symptomatic BRCL for patients undergoing h-WBI was very low in this cohort of patients, which could be due to our detection method or because of small numbers of LN removed. The development of BCRL typically occurs within the first 3 yrs post-treatment, indicating a sufficient follow-up length in our cohort. However, because ours was a gross assessment of symptomatic lymphedema with no formal extremity measurements, the accuracy of evaluating BCRL using this method is limited. Current practice in the lymphedema clinic at our institution involves bilateral measurements taken at 5 different points along the upper extremity, pre- and post-treatment. While the current study suggests that h-WBI is safe with regards to avoiding the development of BCRL, prospective evaluation utilizing a more thorough and systematic approach should be considered.

**SSK23-07**

**Standard Whole Breast Tangential Fields Provide Suboptimal Axillary Coverage and Whole Axilla Radiation Significantly Increase Lung Dose in Chinese Breast Cancer Patients Treated with Breast Conservative Surgery and Sentinel Node Biopsy**

Ran Peng BMBCh (Presenter): Nothing to Disclose

**ABSTRACT**

Purpose/Objective(s): Axilla dissection is not recommended for breast cancer patients with low tumor burden in sentinel lymph nodes if whole breast radiation is planned. The low rate of axillary recurrence was assumed to be attributed to effective systemic therapy and certain amount of axilla coverage by standard whole breast tangential fields (WBTF). This study was to evaluate the coverage of the Level I and II axilla with WBTF, and to what extent that whole axilla radiation could increase the dose to normal tissue

Materials/Methods: Fifteen consecutive left breast cancer patients treated with breast conservative surgery and sentinel node biopsy followed by whole breast radiation were studied. All had inverse IMRT plan using WBTF with prescription dose of 50Gy to 95% of the planning target volume (PTV) of the whole breast. Level I and II axilla was contoured according to the RTOG atlas. The dose distribution and coverage of Level I and II axilla with WBTF was calculated. Two plans delivering 50Gy to 95% of the PTV of the whole breast as well as Level I and II axilla (WB+AX) were designed. The homogeneity index (HI=D5/D95) of the whole breast and conformal index (CI=V95/TV, TV=target volume, V95=Volume of the Reference Isodose) of the PTV, the dose to the heart, lung, left anterior descending coronary artery (LAD) and contralateral breast were compared between WBTF and WB+AX. Paired T-test was used to compare the differences.

**Results:** The mean volume of Levels I and II axilla was 170.9cm² (range, 115-254 cm²) and 84.4cm² (range, 51-131 cm²), respectively. With WBTF, the average dose to Levels I and II axilla was 34.39Gy and 21.90Gy, respectively. The V50 and V40 were 22.57 % and 49.86 % for Level I axilla, 5.99% and 21.99% for Level II axilla. Data shown in the table indicated that WB+AX significantly increased the HI of the whole breast and CI of the PTV. WB+AX also significantly increased the dose to the ipsilateral lung and heart as compared with WBTF. There was no significant difference in mean dose to LAD between WBTF and WB+AX.

**Conclusion:** Standard whole breast tangential field doesn’t offer optimal coverage of Level I and II axilla. Patients who had high-risk relapse of axilla should be planned to adequately cover the whole axilla if axilla dissection is not performed. Given the compensated dose homogeneity of the whole breast and the significantly increased lung dose with WB+AX plan, axilla dissection and axilla radiation should be weighted and discussed with patients for those who need axilla treatment.

**Dosimetric Results**

<table>
<thead>
<tr>
<th></th>
<th>WBTF</th>
<th>WB+AX</th>
<th>p Value</th>
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<tr>
<td>Breast HI</td>
<td>1.068</td>
<td>1.082</td>
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<tr>
<td>PTV CI</td>
<td>1.196</td>
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<td>Heart V30</td>
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<td>Heart Dmean</td>
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<td>Lung V20</td>
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<td>Lung V5</td>
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<td>Lung Dmean</td>
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<td>LAD Dmean</td>
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<td>Contralateral Breast Dmean</td>
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**SSK23-08**

**Single Fraction HDR Brachytherapy Boost after Conservative Surgery and Whole Breast Radiotherapy: A Single Institution Experience**

Ana Díaz Gavela (Presenter): Nothing to Disclose, Elia del Cerrro Penalver: Nothing to Disclose, Felipe Counago: Nothing to Disclose, Francisco Marcos: Nothing to Disclose, Gines Hernandez Cortes: Nothing to Disclose, Lucia Gonzalez Cortijo: Nothing to Disclose, Juan Castro Novais: Nothing to Disclose

**ABSTRACT**

**INTRODUCTION:** The role of HDR brachytherapy boost in the management of breast cancer treated conservatively is more than consolidated, showing a significant decrease in local relapses in patients at risk.
OBJECTIVES: To evaluate the results of this technique in our department.

METHODS: We evaluated 500 breast cancer patients who received a HDR-BTB in our department from October 2008 to July 2013. All of them were treated with external radiotherapy to the whole breast before the boost. EBRT treatment: 27.6% of the patients were treated in classical fractionation (50Gy/25 fractions) and 72.4% in a hypofractionated schedule (START B scheme: 40,05Gy/15 fractions). HDR-BTB prescription dose was based on the modified Paris dosimetry treatment in all patients. Location: 49.4% of the patients had left breast tumors and in 35.4% the tumor bed was located in upper external quadrant. Boost dose: 69.2% of the patients received 8Gy, 29.2% received 7Gy%, 1.4% received 10Gy and 0.2% received 12Gy. The mean implant volume (isodose of the 90% of the prescribed dose) was 8.19cc. (1.65-29.5cc). Follow-up period: 27 months (6-63)

RESULTS: Acute toxicity: When finishing the treatment, 1.2% of the patients presented acute bleeding (none required corrective surgery) and 1.8% suffered from local infection (mastitis in the month following treatment). Two cases of chondritis were reported. Late toxicity: 3 patients presented telangiectasia and 2 patients skin hypochromia over the implant. Regarding to fibrosis, it was absent or mild in 77.4% of the patients. The remaining patients except one showed moderate fibrosis. The only case of severe fibrosis, which required surgery, was a patient with severe cardiovascular comorbidities. 7.2% of the patients presented visible in-quadrant edema and 3.4% suffered from local pain requiring first-step analgesia. Six patients presented distant metastasis, while we observed just one local failure.

CONCLUSION: HDR-BRT is a safe, fast, well tolerated and not much toxic way to administer the boost over the tumor bed in patients in indication.

The Role of Magnetic Resonance Imaging (MRI) in Selecting Patients Candidate for Partial Breast Irradiation (PBI). A Meta-analysis

Rubina Manuela Trimboli : Nothing to Disclose, Gianni Di Leo (Presenter): Nothing to Disclose, Barbara Jereczek-Fossa MD : Nothing to Disclose, Alessandro Poloni : Nothing to Disclose, Ileana Ioan : Nothing to Disclose, Francesco Sardanelli MD : Speakers Bureau, Bracco Group Research Grant, Bracco Group Research Grant, Bayer AG Research Grant, Bayer AG Research Grant, IMS International Medical Scientific

PURPOSE

There is no consensus regarding magnetic resonance imaging (MRI) when selecting patients for partial breast irradiation (PBI). This meta-analysis examines the effect of pre-treatment MRI on eligibility of women initially candidate for PBI on the basis of conventional imaging, mammography and US.

METHOD AND MATERIALS

A literature cross-referencing search, limited to articles written in English with no time limits, was performed on MEDLINE, EMBASE and the Cochrane Database of Systematic Reviews. Heterogeneity (I2) was evaluated using the Cochrane Q statistics: P-value <.100 were considered significant. Using random-effects model, we estimated the pooled proportion of women deemed not eligible for PBI given the MRI results. We also investigated the association between pre-treatment variables and ineligibility for PBI, reported as odds ratio.

RESULTS

Ninety-three citations were initially retrieved and finally 7 studies including 3369 cases met the eligibility criteria and entered the analysis. Heterogeneity was low, overall and for all subgroup analyses (I2<40%). 245/1432 women were found to be ineligible for PBI with a pooled overall ineligibility rate of 14% (95%CI 1.36-3.44) while rate of ineligibility was lower for DCIS (OR 0.64; 95%CI 0.42-0.97). Preoperative variables significantly associated to ineligibility for PBI included pT stage ≥2 (OR 7.0), premenopausal status (OR 2.7), palpable lesions (OR 2.2), Her2 amplification (OR 1.6), first degree relative with a history of breast cancer (OR 1.4) and dense breasts (OR 1.2).

CONCLUSION

This meta-analysis supports the evidence that breast MRI alters the PBI recommendations for 14% of women candidate based on standard assessment, with higher rates for invasive lobular carcinomas. Factors associated with ineligibility were found to be pT stage ≥2, premenopausal status, palpable lesions, Her2 amplification, first degree relative with a history of breast cancer and dense breasts.

CLINICAL RELEVANCE/APPLICATION

Women who are candidate for PBI on the basis of conventional imaging should undergo a pre-treatment MRI, revealing 14% to be not eligible to. This is especially true for women with invasive lobular carcinoma, pT stage ≥2, premenopausal status, palpable lesions, Her2 amplification, first degree relative with a history of breast cancer and dense breasts.
Diagnostic Performance of Shear-wave Elastography (SWE) in Complex Cystic Breast Lesions in Comparison with Conventional Ultrasound (Station #1)

Boeun Lee (Presenter): Nothing to Disclose, Eun-Suk Cha MD: Nothing to Disclose, Jin Chung MD: Nothing to Disclose, Jee Eun Lee MD: Nothing to Disclose, Jeoung Hyun Kim: Nothing to Disclose

PURPOSE

To evaluate the diagnostic performance and usefulness of SWE for differential diagnosis of complex cystic breast lesions, in comparison with conventional ultrasound (US).

METHOD AND MATERIALS

From January 2013 to November 2013, of 140 women who had been performed conventional US and SWE, 140 complex cystic breast lesions were included in this study. All patients underwent US-guided core biopsy or surgical excision. BI-RADS US final assessment and SWE parameters (qualitative maximum elasticity using a six-level visual color scale, homogeneity of elasticity, color pattern) were recorded for each lesion. Final assessment of SWE with US was based on BI-RADS US lexicon, however, the final assessment was downgraded for dark blue and light blue lesions and upgraded for orange and red lesions. Sensitivity and specificity were calculated, while category 4b, 4c or 5 indicated malignancy and category 3 or 4a was regarded as a benign interpretation. Histopathologic diagnosis was used as reference standard.

RESULTS

Of the 140 complex cystic lesions, 30 lesions (21.4%) were malignant. Large size (22.7mm vs. 14.8mm), old age (52.7 years vs. 43.6 years), symptomatic lesions (70% vs. 31.8%) and final assessments for US and SWE with US were significant with malignancy (P<0.05). Of group of 30~70% cystic portion, malignancy rate was significant as 37.8%. Mean maximum elasticity of malignant lesions (187.75kPa) was significantly higher than that of benign (46kPa) (P<0.001). Homogeneity of elasticity and color pattern were significantly different from malignancy and benign lesions (P<0.05). Sensitivity of US and SWE with US were 33.3% and 93.3% (P<0.001, Kappa =0.069) and specificity of US and SWE with US were 94.5% and 96.4% (P=0.687, kappa=0.373). Diagnostic accuracy was improved after adding SWE (21.4% to 86.4%). Using SWE with US, we could reduce benign biopsy rate from 100% to 16.4% (18/110) and 74.4 % (93/125) of category 4a lesions were downgraded to category 3.

CONCLUSION

For complex cystic breast lesions, SWE is able to increase in the accuracy and sensitivity in distinguishing benign from malignant lesions and to avoid unnecessary benign biopsy.

CLINICAL RELEVANCE/APPLICATION

The combination of US and SWE is useful in differential diagnosis of complex cystic breast lesions with reducing benign biopsy rate.

Management of Radial Scar/Radial Sclerosing Lesions Diagnosed on Image-guided Biopsy of the Breast (Station #2)

Beatriu Reig MD, MPH (Presenter): Nothing to Disclose, Tova C. Koenigsberg MD: Nothing to Disclose, Sanjita Ravishankar MD: Nothing to Disclose, Susan Fineberg MD: Nothing to Disclose

PURPOSE

Radial scars and radial sclerosing lesions (RSL) of the breast are benign lesions that may present with mammographic distortion or may be incidentally identified on core needle biopsy. Patients with RSL on core biopsy usually undergo excisional biopsy due to the concern for undersampling of an associated malignancy. There are conflicting data in the literature regarding the upgrade rate of radial scar found on core needle biopsy, with the upgrade to malignancy ranging from 0% to 40% of cases. We seek to expand on this literature with the largest case series to date that evaluates outcomes in patients with radial scar without atypia on core biopsy.

METHOD AND MATERIALS

The pathology database of breast core biopsy results was searched for words ‘radial scar,’ ‘complex sclerosing lesion’ or ‘radial sclerosing lesion’ for years 2003 through 2014. Inclusion criteria for this study were: (1) RSL diagnosed as the highest-grade lesion on imaging-guided core needle biopsy specimens; and (2) surgical excision, or, if excision was not recommended, two-year imaging or clinical follow without evidence of malignancy. Patients with any finding of malignancy or atypia (atypical ductal hyperplasia, atypical lobular hyperplasia, flat epithelial atypia, cytologic atypia or lobular carcinoma in situ) in the needle core biopsy specimen were excluded.

RESULTS

100 lesions in 100 patients met criteria for inclusion. Patients ranged in age from 25 to 89 years. 89 patients had surgical excision and 11 patients had imaging or clinical follow up for at least two years. Complete imaging information was available for 93 patients. Of these, 40 underwent stereotactic core needle biopsy, 50 underwent ultrasound-guided core biopsy, and 3 underwent MRI-guided core biopsy. In the 100 patients, there were two cases of upgrade to malignancy on the surgical excision specimen, both of which yielded low-grade DCIS (spanning 3 mm and 1 cm in each case). There were no cases upgraded to invasive carcinoma.
CONCLUSION

The cancer upgrade rate of RSL is 2%, with two cases that were low grade DCIS. There were no upgrades to invasive carcinoma. This suggests that surgical excision could be obviated in RSL cases without atypia on imaging-guided core needle biopsy.

CLINICAL RELEVANCE/APPLICATION

Careful radiologic-pathologic correlation of benign findings and close imaging follow up may be a safe alternative to surgery in patients with RSL without atypia diagnosed on needle core biopsy.

Almost a Wonder: Ultrasound-guided Sclerosis with Alcohol in Breast Fistulas; A New Treatment (Station #3)

Ana Maria Fernandez Martinez MD (Presenter): Nothing to Disclose, Laura Lopez: Nothing to Disclose, Iria Alvarez Silva: Nothing to Disclose, Jose Daniel Samper Wamba MD: Nothing to Disclose, Teresa Cuesta: Nothing to Disclose

PURPOSE

Breast fistulas are defined as communication between one or more ducts and the skin. The disease affects young women and it is an insidious clinical pathology, usually with long evolution and with a major impact on daily life. The treatment has traditionally been surgical with a high rate of recurrence. We propose to study the clinical utility of ultrasound-guided sclerosis with alcohol as an alternative treatment to surgery in breast fistulas.

METHOD AND MATERIALS

A retrospective study based on data collected during 3 years, from January 2011 to December 2013. All breast fistulas diagnosed and treated with ultrasound-guided sclerosis with alcohol were reviewed. The technique of ultrasound-guided sclerosis with alcohol consists of introducing a solution of pure alcohol reduced to 50% with an anesthetic agent. The result of the percutaneous treatment was recorded as bad (partial response, secretion persists), good (partial response, low discharge) or excellent (complete response, absence of secretion, complete closure).

RESULTS

Ten fistulas were identified in nine women. The median age was 35 years old (interquartile range was 18.5 years). The median time for the clinical evolution of the disease was 24 months. In five patients, fistulas were caused by recurrent mastitis (50%), in four patients fistulas were attributed to previous surgery (40%) and in one case to breastfeeding (10%). Patients reported clinical exacerbation in winter (78%), symptoms associated with menstruation (33%) and symptoms associated with stressful situations (22%). Nipple inversion existed in 45% of the patients. 78% of patients were smokers. No immediate complications were noted. The procedure was well tolerated in most cases (9 out of 10 patients scored 1 or 2 on the visual analogue scale of pain). During the follow-up time there has not been evidence of recurrence in any of them. The response to the treatment was excellent in eight fistulas (80%) and good in two of them (20%).

CONCLUSION

Ultrasound-guided sclerosis with alcohol is a therapeutic alternative to surgery that shows favorable clinical results in the treatment of breast fistulas.

CLINICAL RELEVANCE/APPLICATION

The biggest problem of fistulas breast is the high rate of recurrence after surgical treatment. We propose a new treatment, less aggressive, with favorable clinical results as a therapeutic alternative.

A Comparison of FFDM Screening Recall Rates Before and After the Addition of 2D/3D Digital Breast Tomosynthesis: Is there a “trickle-down” Effect? (Station #4)

Nicole Nakyung Lee MD (Presenter): Nothing to Disclose, Tracy Frazee: Nothing to Disclose, Zhongze Li: Nothing to Disclose, Steven P. Poplack MD: Research Grant, Hologic, Inc

PURPOSE

To determine if 2D (FFDM) screening recall rates have been impacted by the clinical implementation of 2D/3D digital breast tomosynthesis (DBT).

METHOD AND MATERIALS

Our institution initiated use of 2D/3D DBT as a screening modality in February 2012 in one of three screening mammography units. A retrospective review of screening mammography was performed for a two-year period before and after the introduction of tomosynthesis. Aggregate FFDM recall rates from February 2010-January 2012 were compared to aggregate FFDM recall rates from February 2012-January 2014 using a Chi-square test. Both sets of recall rates (before vs after DBT) were stratified by density and a three dimensional analysis was performed using a Cochran-Mantel-Haenszel test.
RESULTS
A total of 24,384 FFDM screening mammograms were performed in the two years before implementation of 2D/3D DBT; 17,210 FFDM screening mammograms were performed in the two years after the addition of 2D/3D DBT to the screening practice. The aggregate FFDM recall rate was significantly lower after implementation of 2D/3D DBT, decreasing from 8.75% to 7.76% (p=0.0003). When stratified by density, recall rates for each time period (before vs after, respectively), were: extremely dense 9.41% vs 9.47%; heterogeneously dense 10.64% vs 9.25%; scattered 8.49% vs 7.71%; fatty 4.67% vs 4.96%. The p-value from the Cochran-Mantel-Haenszel test was 0.008.

CONCLUSION
The recall rate of FFDM may be positively influenced by the partial implementation of 2D/3D DBT in screening mammography. The etiology of this effect is unclear, but may be related to a learning curve from experience with 2D/3D DBT.

CLINICAL RELEVANCE/APPLICATION
Addition of 2D/3D DBT to clinical screening practice may indirectly result in a reduction of 2D (FFDM) screening recall rates, which would contribute further to the beneficial effect of DBT implementation in a breast cancer screening program.

BRS275

Atypical Lobular Hyperplasia at MRI Guided Vacuum Assisted Biopsy: Is Surgery Necessary? (Station #5)

Sandra Brennan MBCh, MSc (Presenter): Nothing to Disclose, Manuela Durando: Nothing to Disclose, Adriana D. Corben MD: Nothing to Disclose, Elizabeth A. Morris MD: Nothing to Disclose

PURPOSE
To evaluate MRI characteristics and upgrade rate to cancer of atypical lobular hyperplasia (ALH) diagnosed at MRI guided vacuum-assisted biopsy (MRI-VAB).

METHOD AND MATERIALS
A HIPAA compliant retrospective study was performed by collecting consecutive MRI-VABs yielding ALH between January 2003-December 2012. ALH was divided into 2 groups 1) pure ALH and 2) ALH associated with other high risk lesions (atypical ductal hyperplasia (ADH), papilloma, radial scar or columnar cell changes)(noted ALH/HR). Patients with incomplete data or with synchronous ipsilateral cancer were excluded. ALH that yielded cancer at surgery was defined as upgrade. Statistical analysis was performed (p<0.05) and 95% CI were calculated.

RESULTS
196 consecutive MRI-VABs yielded atypical lesions; 54/196 (27.6%) were ALH. 2/54 cases were excluded for incomplete data and 7/54 for synchronous ipsilateral cancer, leaving 43 patients with 45 ALH (mean size 11.7 mm; range: 3-40). 33/45 (73%) were pure ALH and 12/45 (27%) were ALH/HR (5/45 (11%) associated with ADH. Patients (mean age 53 years; range: 34-72) were predominantly post-menopausal (51.2%), with previous history of breast cancer (41.9%) or high risk lesions (20.9%) and underwent MRI mostly for screening (69.8%). No difference in size, T2 appearance or type of enhancement was noted between pure ALH and ALH/HR. Both pure ALH 24/33 (73%) and ALH/HR 8/12 (67%) showed predominantly progressive kinetics (p=0.95). Surgical excision was performed on 39/45 ALH lesions. The remaining 6/45 lesions underwent imaging follow-up (mean 20 months (range: 12-48)). Malignancy (low grade DCIS) was found in 1/39 (2.6%; CI 95%: 0.1-13.5%) undergoing biopsy or 1/45 (2.2%; CI 95%: 0.1-11.8%) of all cases. The single upgrade occurred in the ALH/HR group associated with ADH. No pure ALH lesions were upgraded at surgery.

CONCLUSION
ALH represented 27.6% of atypical lesions identified at MRI-guided VABs performed in our high risk population. Upgrade rate to cancer of MRI-VABs yielding ALH was low (2.6% and 2.2%) and was found with ALH associated with ADH only. Pure ALH without associated atypia may not necessitate surgical removal.

CLINICAL RELEVANCE/APPLICATION
Upgrade rate to cancer of MRI-VABs yielding ALH was low (2.6% and 2.2%) in our study and was found with ALH associated with ADH only, therefore pure ALH without associated atypia may not necessitate surgical removal.

BRS276

Ultrasound Predicts Residual Disease in Triple Negative and ER+ Breast Cancer but not in HER2+ Breast Cancer (Station #6)


PURPOSE
The purpose of this study is to determine if ultrasound (US) tumor response measurements during neoadjuvant chemotherapy (NAC) predicts residual cancer burden (RCB), which is a significant predictor of distant relapse-free survival.

METHOD AND MATERIALS
Patients with primary invasive breast cancer, who had ultrasound performed before and after NAC, were included in this HIPAA-compliant retrospective study from a single institution. Patients were treated with paclitaxel followed by fluorouracil, doxorubicin and cyclophosphamide (FAC) or fluorouracil, epirubicin and cyclophosphamide (FEC). Human epidermal growth factor receptor 2 positive (HER2+) patients received concomitant trastuzumab. US measurements were obtained in three dimensions. All patients underwent mastectomy or segmentectomy and sentinel node biopsy or axillary node (AXLN) dissection. RCB was calculated based on area of primary tumor bed, overall cancer cellularity as percent (%) of area, % of in situ cancer, number of positive lymph nodes and diameter of largest metastasis. Regression analysis was performed for RCB versus % change in the following tumor measurements: 1) largest dimension, 2) bi-dimension and 3) volume.

RESULTS

160 breast cancer patients [69 triple receptor negative (TRN), 45 estrogen receptor positive (ER+) and 46 HER2+] were included. Median age at diagnosis was 50, range 30-76; median tumor size was 3.4 cm, range 0.9-10.4. 63% of patients were AXLN positive at diagnosis; 30% of this subset became node negative at surgery. TRN tumors showed 38% pCR (pathologic complete response), 9% RCB-I, 32% RCB-II and 22% RCB-III; ER+ 11% pCR, 13% RCB-I, 58% RCB-II and 18% RCB-III; HER2+ 57% pCR, 15% RCB-I, 26% RCB-II and 2% RCB-III. There were significant associations between RCB and % change in tumor largest dimension, bi-dimension and volume for TRN (p<0.001) and ER+ (p<0.05) but not in HER2+ breast cancer (p>0.05).

CONCLUSION

US tumor response measurements are significant predictors of RCB in TNBC and ER+ but not in HER2+ breast cancers. This may contribute to the monitoring of TNBC and ER+ breast cancer response to targeted therapies and drug development.

CLINICAL RELEVANCE/APPLICATION

US has differential capacities of measuring tumor response based on molecular phenotype; alternate imaging is needed to adequately measure response of HER2+ tumors to better identify chemoresistance.

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**BRS277**

Stereotactic Biopsy of Segmental Breast Calcifications: Is Sampling of Anterior and Posterior Components Necessary? (Station #7)

Sean D. Raj MD (Presenter): Nothing to Disclose, Emily Lorraine Sedgwick MD: Nothing to Disclose, Frederick Joseph Severs MD, MS: Nothing to Disclose, Karla A. Sepulveda MD: Nothing to Disclose

**PURPOSE**

Pathology from biopsy of a large area of segmental calcifications on mammography can have direct impact on surgical management. Although dependent on breast size, cancer spanning greater than 5 cm is usually treated with mastectomy and cancer less than 5 cm is managed with lumpectomy. There is insufficient data on whether a single central biopsy of calcifications that assumes homogeneity of disease in the imaging abnormality is adequate to establish need for mastectomy, or if pathologic proven cancer in the anterior and posterior components defining extent of disease is required. This study aims to evaluate concordance rates of paired biopsies of suspicious segmental mammographic calcifications.

**METHOD AND MATERIALS**

From a 5 year review of our imaging database, 66 subjects with BI-RADS® 4 or 5 segmental calcifications on mammography that underwent anterior and posterior stereotactic biopsies were identified. The paired biopsy results were analyzed for concordance in benign, high-risk and malignant pathology.

**RESULTS**

Of the 66 cases, there was strong agreement (Kappa=0.88, p<0.001) in anterior and posterior pairs in benign, high-risk and malignant findings with 92% concordance (61/66 cases; 95% CI=83-97%). In 3 cases of discordance involving high risk (ADH) and malignancy (DCIS), management did not change, as surgery was required at both sites. In 2 cases with discordant benign and high risk (few foci of ALH) management did not change as observation was performed rather than surgery.

**CONCLUSION**

The absence of data on pathologic concordance in anterior and posterior aspects of segmental calcifications has led to a varied clinical approach to biopsy. In our study, the sampling of 2 components of segmental calcifications spanning more than 5 cm on mammography yielded high concordance, and there was no change in surgical management in the discordant results. Although further prospective investigation is warranted, this data suggests that a single central biopsy of suspicious segmental calcifications would be adequate for diagnosis and representative of the whole imaging abnormality. This approach reduces potentially unnecessary biopsies, associated morbidity and health care costs.

**CLINICAL RELEVANCE/APPLICATION**

Greater than 90% concordance of pathology in biopsies of anterior and posterior aspects of segmental calcifications suggests a single central biopsy would be adequate to establish diagnosis of a large segmental mammographic abnormality.

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**BRE192**

Invasive Carcinoma of Special Subtypes: Rad-Path Correlation (Station #8)

Tomie Heldt Ichihara MD: Nothing to Disclose, Luciano F. Chala MD: Nothing to Disclose, Bruna Maria

**PURPOSE**

Pathology from biopsy of a large area of segmental calcifications on mammography can have direct impact on surgical management. Although dependent on breast size, cancer spanning greater than 5 cm is usually treated with mastectomy and cancer less than 5 cm is managed with lumpectomy. There is insufficient data on whether a single central biopsy of calcifications that assumes homogeneity of disease in the imaging abnormality is adequate to establish need for mastectomy, or if pathologic proven cancer in the anterior and posterior components defining extent of disease is required. This study aims to evaluate concordance rates of paired biopsies of suspicious segmental mammographic calcifications.

**METHOD AND MATERIALS**

From a 5 year review of our imaging database, 66 subjects with BI-RADS® 4 or 5 segmental calcifications on mammography that underwent anterior and posterior stereotactic biopsies were identified. The paired biopsy results were analyzed for concordance in benign, high risk and malignant pathology.

**RESULTS**

Of the 66 cases, there was strong agreement (Kappa=0.88, p<0.001) in anterior and posterior pairs in benign, high-risk and malignant findings with 92% concordance (61/66 cases; 95% CI=83-97%). In 3 cases of discordance involving high risk (ADH) and malignancy (DCIS), management did not change, as surgery was required at both sites. In 2 cases with discordant benign and high risk (few foci of ALH) management did not change as observation was performed rather than surgery.

**CONCLUSION**

The absence of data on pathologic concordance in anterior and posterior aspects of segmental calcifications has led to a varied clinical approach to biopsy. In our study, the sampling of 2 components of segmental calcifications spanning more than 5 cm on mammography yielded high concordance, and there was no change in surgical management in the discordant results. Although further prospective investigation is warranted, this data suggests that a single central biopsy of suspicious segmental calcifications would be adequate for diagnosis and representative of the whole imaging abnormality. This approach reduces potentially unnecessary biopsies, associated morbidity and health care costs.

**CLINICAL RELEVANCE/APPLICATION**

Greater than 90% concordance of pathology in biopsies of anterior and posterior aspects of segmental calcifications suggests a single central biopsy would be adequate to establish diagnosis of a large segmental mammographic abnormality.
TEACHING POINTS

To review WHO classification and molecular taxonomy of special subtypes invasive carcinomas To learn about imaging features particularities of special subtypes invasive carcinomas and their histological basis To identify differences and similarities in presentation of non special subtype and most common special subtypes of the invasive carcinoma

TABLE OF CONTENTS/OUTLINE

WHO classification of special type invasive carcinoma Associations between the molecular taxonomy of breast cancer and histological special types Frequency and epidemiology of special subtype invasive carcinoma Case based review illustrating: Imaging features and histological basis of special type invasive carcinoma Differences and similarities in presentation of non special subtype and most common special subtypes of the invasive carcinoma Special type invasive carcinomas that can mimic benign lesion Conclusion

BRE176

Breast Findings in Systemic Diseases: A Pictorial Review (Station #9)

Ivan Carrion MD (Presenter): Nothing to Disclose, Luis Martin MD: Nothing to Disclose, Luz Elena Guerrero MD: Nothing to Disclose, Lina K. Rojas MD: Nothing to Disclose

TEACHING POINTS

The objective of this educational exhibit is making a pictorial review of systemic diseases with findings in mammography and US breast studies emphasizing in the differential diagnosis with malignant and benign specific breast pathology.

TABLE OF CONTENTS/OUTLINE

The exhibit will be presented in an electronic slide quiz format. Spectrum of systemic diseases with breast findings with pathology images correlation will be exhibit and most important clinical features of each one and key differential diagnostic points will be highlighted in the discussion part. The exhibit will show the next cases: - Malignancies: o Metastases o Hematology malignancies - Cardiovascular: o Arterioesclerosis o Vascular congestion (agenesis of ICV, compression of SVC,…) - Endocrinology diseases: o Diabetic mastopathy o Hyperparathyroidism - Inflammatory disease: o Granulomatous diseases. o Rheumatoid arthitis o Systemic lupus erythematous o Scleroderma - Other entities: o Amyloidosis o Sarcoïdosis o Collagen vascular disease o Mondor disease o Poland syndrome - Infections diseases: o Widespread infections o Phylariais

BRE006-b

Imaging Features of Metastatic Lesions to the Breast: Pictorial Essay (hardcopy backboard)


TEACHING POINTS

The purpose of this exhibit is: 1. To review the incidence, epidemiology, diagnosis and treatment of metastatic lesions to the breast. 2. To present the imaging appearances of secondary breast tumors at mammography, ultrasound (US), magnetic resonance imaging (MRI), computed tomography (CT) and positron emission tomography (PET)/CT. 3. To evaluate the use of imaging methods, including PET/CT, on the staging and therapeutic evaluation of patients with metastatic lesions to the breast.

TABLE OF CONTENTS/OUTLINE

Metastatic lesions to the breast - Incidence - Epidemiology - Diagnosis - Treatment Imaging Features - Mammography - Ultrasound - MRI - CT - PET/CT
biopsy (CNB) are considered "high risk breast lesions" and surgical excision (SE) is routinely recommended to rule out an associated occult malignancy. However, this practice is controversial and is seen by many as unwarranted, especially with the improving ability to accurately discern lesions associated with premalignant atypical epithelial proliferation from those without. We performed a retrospective review to evaluate core needle biopsy diagnosed RS/CSL with and without associated atypia and the subsequent upgrade rate to malignancy on surgical excisional biopsy.

METHOD AND MATERIALS

The records of all CNB performed at our institution between 9/2009 and 2/2014 were analyzed. 112 patients were diagnosed with RS/CSL by CNB during this time. Patients were excluded who did not have definitive SE pathology reports at our institution or had a synchronous/prior diagnosis of breast cancer. 63 patients remained and the CNB pathology results were compared to SE biopsy results to assess the upgrade rate to malignancy.

RESULTS

15 of the 63 patients diagnosed with RS/CSL had associated atypia on CNB. None of the 48 patients without atypia were upgraded to malignancy at SE for a malignancy underestimation rate of 0%. If the patients with RS/CSL lesions without atypia were simply followed, 48 of the 63 patients (76.2%) would have avoided what we see as unnecessary surgery.

CONCLUSION

In our series, 0 of the 48 patients diagnosed on CNB with RS/CSL without atypia had associated malignancy on SE. Our results are in disagreement with several older studies that suggest a small (<10%) upgrade rate, perhaps at least in part due to improving sampling and histologic techniques. A large-scale prospective study is needed to confirm the true risk of RS/CSL without atypia. Regardless, women should be well informed of the low or absent risk of associated malignancy.

CLINICAL RELEVANCE/APPLICATION

There is growing concern among patients and physicians regarding false positive diagnoses in mammography. Our intent is to incite change in the management of radial scars/complex sclerosing lesions.

Core Biopsy Diagnosis of Papilloma and Radial Scar: Do We Follow-up or Excise These High Risk Lesions? (Station #2)

Sadia Choudhery MD (Presenter): Nothing to Disclose, Kinsey Rowe Pillsbury MD: Nothing to Disclose, Stephen Jacob Seiler MD: Nothing to Disclose, Sally Goudreau MD: Nothing to Disclose

PURPOSE

Radial scars and papillomas have historically been considered high-risk lesions because of their association with malignancy and have warranted surgical excision after diagnosis with core needle biopsy. There is limited data supporting the need for surgical excision of these lesions when diagnosed with vacuum-assisted biopsy. The aim of our study is to determine if the use of large gauge vacuum-assisted biopsy devices to diagnose radial scar and papilloma accurately confirms benignity of these lesions. Our hypothesis is that the incidence of upgrade to atypia or malignancy is low enough in lesions sampled with a 12 gauge or larger vacuum-assisted needle, versus those biopsied with a 14 gauge spring loaded needle, that subsequent surgical excision is not needed.

METHOD AND MATERIALS

A retrospective chart review was performed of all core needle biopsy cases between January 2008 and January 2014 which yielded radial scar and/or papilloma as the highest risk lesion. The needle gauge of the initial biopsy sample, pathology at surgical excision, and stability at follow up were evaluated.

RESULTS

Out of 86 papillomas without atypia, 77 (90%) were confirmed benign with greater than 2 year follow-up or surgical excision. Seven lesions (8%) were upgraded to atypia and 2 lesions (2%) were upgraded to ductal carcinoma in-situ (DCIS). There were no cases upgraded to invasive disease. Eight (90%) of the lesions that were upgraded to either atypia or DCIS were biopsied with a 14 gauge needle, and the remaining lesion (10%) was biopsied with a 12 gauge needle. Out of 39 radial scars without atypia, 32 (82%) were confirmed benign with greater than 2 year follow-up or surgical excision. Six lesions (15.4%) were upgraded to atypia and 1 lesion (2.6%) was upgraded to DCIS. There were no cases upgraded to invasive disease. Five (71.4%) of the lesions that were upgraded to either atypia or DCIS were biopsied with a 14 gauge needle, and the remaining 2 lesions (28.6%) were biopsied with a 9 gauge and 12 gauge needle.

CONCLUSION

The incidence of lesion upgrade to atypia or malignancy is significantly low for papillomas and radial scars diagnosed with a 12 gauge or larger vacuum-assisted core needle biopsy.

CLINICAL RELEVANCE/APPLICATION

The diagnosis of benign papilloma or radial scar obtained with vacuum-assisted core needle biopsy utilizing a 12 gauge or larger needle is accurate and obviates the need for subsequent surgical excision.
BRS280

Pathologic and Clinical Outcomes at US-Guided Vacuum-Assisted Removal of Probably Small Benign Papillomas Detected on US in Patients with Nipple Discharge (Station #3)

Jose Maria Oliver-Goldaracena (Presenter): Nothing to Disclose, Marta Onate Miranda MD: Nothing to Disclose, Vicenta Cordoba Chicote: Nothing to Disclose, Agustin Andres Mateo: Nothing to Disclose, Maria Jose Roca Navarro: Nothing to Disclose, Carlos Rubio Hervas: Nothing to Disclose

PURPOSE

To review clinical and pathologic outcomes in patients with pathologic nipple discharge and US findings concordant with small benign papilloma at US-Guided Vacuum-Assisted (US-VA) removal.

METHOD AND MATERIALS

At our institution patients with pathologic nipple discharge are evaluated with US. Diagnosis of benign papilloma is considered when a single benign intraductal mass (BI-RADS 3) within a dilated duct is detected on US and fulfills at least one of these criteria: color-Doppler signal, correlation on ductography or FNA suggesting benign papillary lesion. Since April 2010, we have been managing those lesions of 20mm or less with US-VA removal. We performed a retrospective review of the pathology records of US-VA removal of 61 probably benign intraductal papillomas (mean size 9mm, range 3-20mm) in a consecutive series of 57 patients (mean age 64, range 24-85) between April 2010 and October 2013. Histology was reviewed by three pathologists. Follow up and histological diagnosis were recorded.

RESULTS

At histology, 60 lesions were intraductal papillomas (98%), 58 benign and 2 atypical; in 1 case the diagnosis was periductal fibrosis. Nipple discharge disappeared in all but one case. All patients underwent US follow-up (mean 18 months, range 5-42) and 7 patients with benign papilloma, one of them with persistent unicisal nipple discharge, showed residual lesions. In these cases a second US-VA removal was performed (between 2-6 months after the first US-VA removal). In 2 of them histology showed fibrosis and in 5 benign papillomas. In these 5 patients follow-up US was normal. The 2 patients with atypical papilloma did not show residual lesions on the follow up US. Pathological nipple discharge disappeared in all patients.

CONCLUSION

Ultrasound-Guided Vacuum-Assisted removal of suspected small benign intraductal papillomas seen on US, in patients with pathologic nipple discharge allows histological confirmation of benign papilloma in most of the lesions and eliminates nipple discharge in all patients.

CLINICAL RELEVANCE/APPLICATION

Percutaneous US-VA excision is appropriate for the management of patients with pathologic nipple discharge in whom ultrasound shows a probable small benign papilloma.

BRS281

Does the Benefit of the Addition of Digital Breast Tomosynthesis (DBT) Vary with Reader Experience? (Station #4)

Fiona Jane Gilbert MD (Presenter): Speaker, Bracco Group Research Grant, GlaxoSmithKline plc Research Grant, General Electric Company, Lorraine Tucker: Nothing to Disclose, Susan Mary Astley PhD: Nothing to Disclose, Paula Wilsher: Nothing to Disclose, Stephen W. Duffy: Nothing to Disclose

PURPOSE

To investigate if the benefit of the addition of digital breast tomosynthesis (DBT) to standard digital mammography varies with reader experience in a UK retrospective reading study.

METHOD AND MATERIALS

We collected prospective DBT and FFDM reading data on 1,160 women with cancer and 5,900 whose diagnosis was normal or benign. Each case was read 3 ways (FFDM alone; FFDM with DBT; synthetic 2D image with DBT) by different readers from other sites. A total of 24 readers from 6 sites read at least 200 cases in at least one arm. Mammogram experience ranged from 3 - 25 years (median 10) with cases read/annum ranging from 5,000 - 13,000 (median 8,000). Individual performance for each imaging combination was compared. We calculated sensitivities, specificities and ROC curves by reader experience. Matched comparison of cases by reader experience used McNemar methods.

RESULTS

When we divided reader experience by the median years (10), the FFDM with DBT and synthetic 2D with DBT had significantly greater specificity than 2D alone for those above and below the median (p<0.001). For those with experience less than 10 years, sensitivity was higher for FFDM with DBT (91%, with 95% CI 86-94%) than for FFDM alone (86%, with 95% CI 83-89%), but this did not reach statistical significance (p=0.1). For those with 10 years experience or more, sensitivity was 88% (95% CI 85-91% in both cases) for both FFDM alone and FFDM with DBT. The ROC curves showed a slightly greater improvement for FFDM plus DBT against FFDM alone in those with less than 10 years experience (82% vs 74%, p<0.001) than in those with 10 years or more (79% vs 72%). There were no significant or substantial non-significant differences in sensitivity between Synthetic 2D with DBT and FFDM alone.

CONCLUSION

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CONCLUSION

The addition of DBT to FFDM improves diagnostic accuracy over all categories of reader experience. There is suggestive evidence that the improvement is greater for readers with less experience.

CLINICAL RELEVANCE/APPLICATION

The addition of DBT may have more benefit for less experienced readers.

BRS282

Malignancy Detected in Women Under Age 30 Presenting With Palpable Findings: To Biopsy the Young or Not (Station #5)

Paul Martin Murphy MD, PhD (Presenter): Nothing to Disclose, Katherine Elizabeth Abihider BS: Nothing to Disclose, Ajay A. Rao MD: Nothing to Disclose, Jade De Guzman MD: Nothing to Disclose, Haydee Ojeda-Fournier MD: Nothing to Disclose

PURPOSE

The purpose of this study is to determine whether all palpable breast masses should be biopsied in patients under the age of 30 after considering imaging features from the 5th edition of BI-RADS.

METHOD AND MATERIALS

A retrospective review was performed on all ultrasound-guided breast biopsies performed in patients under the age of 30 presenting for a palpable finding from 2010 to 2014. Male patients, biopsies occurring in the axilla and cases suggestive of abscess were excluded. Age, BI-RADS features, risk factors and pathology were recorded.

RESULTS

221 cases were identified. The mean age was 23.4 years. Imaging features: 5 round, 186 oval, 30 irregular; 145 circumscribed, 8 angular, 48 microlobulated, 19 indistinct, 1 spiculated; 212 parallel, 9 not parallel; 172 hypoechoic, 2 isoechoic, 28 heterogenous, 1 hyperechoic and 18 complex cystic and solid; 117 no posterior acoustic features; 4 posterior shadowing, 87 posterior enhancement, 13 combined pattern. 1 intraductal mass was included. 5 of the 221 cases (2.3%) were diagnosed with malignancy. 3 of the 221 cases were diagnosed with a high risk lesion, two not upgraded to malignancy after surgery and one lost to follow up. 5 malignancies, 2 BI-RADS 5 (ages 27 and 29), both irregular masses, one with calcifications. Other 3 malignancies: 2 low grade DCIS occurring within fibroadenomas that were oval, parallel and microlobulated; grade 1 invasive mucinous carcinoma (patient known BRCA2 positive) oval parallel circumscribed hypoechoic mass with no posterior features. The remaining benign masses included 177 fibroadenomas.

CONCLUSION

Our series demonstrates that only 2% of palpable masses in patients under 30 were malignant. 100% of patients that were BI-RADS 5 had a malignant lesion. 1.4% of patients with BI-RADS 4 lesions were malignant.

CLINICAL RELEVANCE/APPLICATION

Short interval follow up as opposed to biopsy should be considered in patients who are not high risk and presenting with masses that have benign features and do not meet BI-RADS 5 criteria. Radiologists interpreting breast imaging cases should use the BI-RADS lexicon.

BRS284

Fine-needle Aspirates CYFRA 21-1 for Preoperative Detection of Lymph Node Metastasis in Breast Cancer Patients (Station #7)

Ji Soo Choi MD, PhD: Nothing to Disclose, Eun-Kyung Kim: Nothing to Disclose, Jung Hyun Yoon MD: Nothing to Disclose, Hee Jung Moon MD: Nothing to Disclose, Min Jung Kim MD (Presenter): Nothing to Disclose

PURPOSE

To compare the value of CYFRA21-1 in the aspirates of ultrasonography-guided fine-needle aspiration biopsy (US-FNAB) and cytopathologic results of US-FNAB specimen in the preoperative diagnosis of axillary lymph node metastasis in breast cancer patients

METHOD AND MATERIALS

US-FNAB was performed in 373 axillary LNs in 342 breast cancer patients (mean age: 49.5 years, range: 27-83 years). Concentrations of CYFRA21-1 were measured from washouts of the syringe used during US-FNAB. US-FNAB, intraoperative sentinel node biopsy, and surgical pathology results were reviewed and analyzed.

RESULTS

Among the 373 LNs, 136 (36.5%) were benign, and 237 (63.5%) were metastases. Mean concentrations of CYFRA21-1 were significantly higher in metastasis compared to benign LNs (P<0.001). Using cutoff value 1.93, Sensitivity and specificity of CYFRA21-1 were not significantly different compared to those of cytopathology (P=0.05). The area under the receiver operating characteristic curve (Az) of CYFRA 21-1 (Az=0.912) was comparable to that of cytopathology (Az=0.918) (P=0.05). Of the 20 ALNs (8 metastasis, 12 benign) which showed insufficient results on cytopathology, CYFRA 21-1 accurately diagnosed 15 ALNs (4 metastasis, 11 benign).

CONCLUSION
Diagnostic performance of fine-needle aspirates CYFRA21-1 is comparable with that of cytopathology for preoperative detection of ALN metastasis. Our results indicate that fine-needle aspirates CYFRA 21-1 can be a new useful method, which can be as good as US-FNAB cytopathology.

**CLINICAL RELEVANCE/APPLICATION**

Fine-needle aspirates CYFRA 21-1 can be a new useful method for preoperative detection of axillary lymph node metastasis, which can be as good as US-FNAB cytopathology.

**BRE185**

Granulomatous Mastitis: How Do We Tease Out This Rare but a Great Mimiker of All? Biopsy Proven Granulomatous Mastitis Pictoral Review (Station #8)

Kyungmin Shin MD (Presenter): Nothing to Disclose, Lorell Ruiz-Flores MD: Nothing to Disclose

**TEACHING POINTS**

1. To understand the pathophysiology of granulomatous mastitis
2. Review the examples of biopsy proven granulomatous mastitis as pictoral review
3. Discuss the management of granulomatous mastitis

**TABLE OF CONTENTS/OUTLINE**

- Background of granulomatous mastitis
- Epidemiology
- Pathology
- Spectrum of clinical presentation for granulomatous mastitis
- Spectrum of imaging presentation for granulomatous mastitis using BI-RADS lexicon and BI-RADS categories
- Pictoral review of biopsy proven cases of granulomatous mastitis at our institution
- Mammogram
- Ultrasound
- MRI
- Diagnostic dilemma and Management issues
- Summary

**BRE188**

Imaging after Surgery for Breast Cancer: A Pictorial Review (Station #9)

Laura Martinich MD (Presenter): Speaker, Bracco Group Consultant, Bayer AG, Eleonora Rachetta MD: Nothing to Disclose, Silvia Carabalona MD: Nothing to Disclose, Rita Giada Spinelli MD: Nothing to Disclose, Francesco Astegiano MD: Nothing to Disclose, Daniele Regge MD: Nothing to Disclose

**TEACHING POINTS**

1. To discuss pros & cons of imaging modalities after surgery for breast cancer (conserving therapy and oncoplastic surgery)
2. To illustrate appearance on mammography, ultrasound and MRI of normal, benign and malignant conditions after surgery for breast cancer
3. To discuss optimal diagnostic imaging workup for the clinical management of patients surgically treated for breast cancer.

**TABLE OF CONTENTS/OUTLINE**

- 1) Literature review of pros & cons of different imaging modalities (mammography, ultrasound and MRI) after surgery for breast cancer
- 2) Presentation of several clinical cases regarding normal, benign and malignant conditions after surgery for breast cancer, including discussion on multimodality imaging findings (mammography, ultrasound, DCE-MRI, DWI) and radiological/pathological correlation
- 3) Discussion of optimal imaging diagnostic work-up for patients surgically treated for breast cancer
- 4) Summary

**MSRT44**

ASRT®RSNA 2014: The Miracle of Breast MRI

**Multisession Courses**

**MR BR BR BR**

AMRA PRA Category 1 Credits ™: 1.00
ARRT Category A+ Credit: 1.00
Wed, Dec 3 1:00 PM - 2:00 PM Location: N230AB

**Participants**

David A. Strahle MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Explain the role dense fibroglandular tissue plays in hiding breast cancer
2) List four advantages Screening Breast MRI has over screening mammograms
3) Discuss how often Screening Breast MRI's should be obtained on a routine basis in women with dense breast tissue
4) Discuss the impact a national MRI screening program might have on saving lives and reducing costs
5) Identify eight financial advantages for insurance carriers who pay for annual Screening Breast MRI's

**ABSTRACT**

Mammograms have been the only screening imaging modality accepted for early detection of breast cancer for almost 50 years. Historically, Breast MRI has been used to define the extent of breast cancer only after identification by mammograms. Our research used Breast MRI to determine the presence of occult cancers missed by screening mammograms and the relationship of those cancers to dense breast tissue. In addition, we were able to identify a limited number of MRI sequences that are now being used for annual screening of women who have dense breasts without any other breast abnormalities. For two years, 671 women received a Breast MRI at no cost following a negative screening mammogram. Eighteen parameters were recorded including the density of her fibroglandular tissue and the location of any lesions inside or outside the fibroglandular tissue.
Numerous lesions (benign and malignant) missed by mammography were clearly identified by MRI. MRI detected cancer at a rate of 16.3 per 1000 women versus the mammogram detection rate of 2.7 per 1000 women. This correlates to a major shift in time of cancer detection 6 years earlier than screening the same women with mammography. Only 3 different MRI sequences detected all the cancers reducing scan time to only 12 minutes. Further, we were able to reduce unnecessary biopsies significantly below that of mammography. As a result of our research, effective November 18, 2013, the first insurance carrier in the nation began paying for annual Screening Breast MRI’s for all women with dense breast tissue between 40 and 80 years of age. They have estimated significant savings across eight major financial categories. In addition, lives saved due to super-early detection are expected to be high resulting in a major marketing advantage for the insurance industry.

Active Handout


SSM01

Breast Imaging (Ultrasound Diagnostics)

Scientific Papers

AMA PRA Category 1 Credits ™: 1.00
ARRT Category A+ Credit: 1.00
Wed, Dec 3 3:00 PM - 4:00 PM Location: Arie Crown Theater

Participants

Moderator
Catherine Streeto Giess MD : Nothing to Disclose
Moderator
Mary S. Newell MD : Nothing to Disclose

Sub-Events

SSM01-01 The Additive Role of 3D Reconstructed Ultrasound to the New Technologies of Digital Mammography in the Proper Assessment of Breast Cancer

Maha Hussein Helal MD (Presenter): Nothing to Disclose , Dorria Saleh Salem MD : Nothing to Disclose , Basma El Kalaawy MBCh : Nothing to Disclose , Lamia Adel MD : Nothing to Disclose , Sahar Mokhtar MD : Nothing to Disclose , Nadia Mokhtar MD : Nothing to Disclose , Nelly Aleldin MD : Nothing to Disclose , nagat mansour Khalifa : Nothing to Disclose , Noha Abdel Shafey MD : Nothing to Disclose , Rasha Mohamed Kamal MD : Nothing to Disclose , Omnia Mokhtar MD : Nothing to Disclose

PURPOSE

we aimed to elucidate the role of recent advances in digital mammography, versus 3D breast ultrasound in the staging of breast cancer prior management.

METHOD AND MATERIALS

This retrospective analysis with ethics committee approval included 115 masses in 103 cases. Evaluation methods included regular digital mammography, 3-D tomosynthesis, contrast enhanced mammography and 3D breast ultrasound. For mammography acquisition, a combined technique (2D+3D imaging) that acquires a traditional digital mammogram and a tomosynthesis scan in the same compression is performed. For applying contrast-enhanced images: low and high energy exposures were taken in the same projections after IV injection of contrast agent. Evaluated masses were biopsied and proved malignancy (70 masses) were further evaluated regarding lesions’ extension, size, multiplicity and related calcifications in correlation with data provided with 2D and automated 3D ultrasound examinations. Pathological specimen was the standard reference.

RESULTS

Comparable estimation to the pathology extension was provided by tomosynthesis (n=58, 83%) and 3D ultrasound (n=56, 80%) followed by contrast-enhanced (n=32, 46%) and regular mammography (n=51, 73%). Contrast-enhanced mammography presented the least assessment for calcifications, yet the most accurate size estimation with a median value of 0.4 compared to 0.5 and 1.5 for tomosynthesis and regular mammography respectively. Multiplicity was better demonstrated by contrast mammography with sensitivity of 92% followed by 3D ultrasound (87%), then tomosynthesis (77%) and regular mammography (54%). An accuracy of 92% presented by combined analysis of the advanced mammography applications and the 3D automated ultrasound in the pre-operative evaluation of breast cancer.

CONCLUSION

Digital mammogram with advanced applications (tomosynthesis and contrast-enhanced imaging) together with 2D and 3D automated ultrasound provide an utmost evaluation and proper staging of breast cancer.

CLINICAL RELEVANCE/APPLICATION

Digital mammography (DM) is still limited by overlapped densities that may provide false negative/positive diagnosis. Advanced applications of DM: tomosynthesis and contrast-enhanced mammography aided by the application of 2D and automated 3D ultrasound imaging represent the perfect mélange for proper prognosis assessment and prior management precise estimation.

SSM01-02 Quantitative Lesion Characterization Using Whole Breast Ultrasound Tomography: Initial Results from an ongoing Clinical Study
PURPOSE

We evaluated whether quantitative tissue parameters, obtained from whole-breast ultrasound tomography (UST), could enhance discrimination of breast masses, using automated regions-of-interest (ROI).

METHOD AND MATERIALS

This HIPAA compliant, IRB approved trial accrued 100 patients having breast masses identified on palpation, mammography or US, for a UST scan. Pathological correlation was based on biopsy results and standard imaging results (simple cysts). A sequential stack of full-breast, coronal B-mode images as well as quantitative sound speed (SS=m/sec) and attenuation (AT=dB/cm/MHz) images were generated. Identified areas of suspicion were outlined by a radiologist using an ROI ellipse, for which 10 progressive peritumoral and 10 intratumoral ellipses were then automatically generated for evaluation of quantitative trends in relative reflectivity, SS and ATT between the mass and its immediate surrounding peritumoral region.

RESULTS

27 palpable regions had no imaging findings on either standard imaging or UST. Of the remaining 73 subjects, 26 cancers, 16 Fibroadenomas, 20 Cysts and 11 miscellaneous benign histologies were noted. As seen in the figure, the full coronal B-mode image shows a ~1.5 cm hypoechoic mass at 1:00, overlaid by progressive intra-and peritumoral ROI’s. Radial trends in the reflectivity, SS and ATT of the ROIs from the tumor epicenter to the furthest peritumoral ellipse show a classic pattern for cysts with both low central reflectivity and attenuation [B], whereas malignant masses showed inverted ATT pattern with the highest values at the tumor center. In combination with a trinary (sharp/indistinct/irregular) tumor margin assessment, cysts and fibroadenomas and cancers showed quantitative separation [C]. This resulted in positive predictive values (PPV) for UST of 93%, compared with standard US BI-RADS of 59%.

CONCLUSION

The addition of through transmission provides a substantial increase in the PPV of UST over standard ultrasound BI-RADS criteria. A larger UST mass study of 300 patients is ongoing to validate these results.

CLINICAL RELEVANCE/APPLICATION

Whole breast UST provides quantitative evaluations of a tumor and its immediate surroundings, producing characteristic tissue trends that may aid rapid mass evaluations in larger trials.
CLINICAL RELEVANCE/APPLICATION

It appears that on a population basis, more harm than good is caused by the addition of breast ultrasound after a negative mammographic work-up.

SSM01-04

Outcomes of Breast MRI-detected Suspicious Non-mass Enhancement (NME): Correlation with Second-look Ultrasound (US) and Frequency of Malignancy

Adrienne Rebecca Newburg MD (Presenter): Nothing to Disclose, Chloe Muy-Chou Chhor MD: Nothing to Disclose, Leng Leng Young Lin BA, MD: Nothing to Disclose, Jennifer Gillman: Nothing to Disclose, Jin Ah Kim MD: Nothing to Disclose, Hildegard B. Toth MD: Nothing to Disclose, Linda Moy MD: Nothing to Disclose

PURPOSE

Prior studies have shown that MRI-detected malignant lesions are more likely than benign to have sonographic correlates, as are masses and foci compared to NME. The purpose of this study is to determine frequency of US correlate for NME, and to assess malignancy rate for NME with an US correlate versus NME without.

METHOD AND MATERIALS

An IRB-approved, retrospective review of 5,837 consecutive breast MRIs performed from 2005-2011 identified 928 NME lesions for which follow-up or biopsy was recommended. Two fellowship-trained breast radiologists evaluated these using 5th edition BI-RADS lexicon to define lesion type, distribution, and internal enhancement pattern. Patient demographics and pathology results, including frequency of malignancy, were recorded.

Of the 928 NME lesions, 332(36%) were recommended for second-look US. 284/332 (86%) had the recommended second-look US. 48/332(14%) of lesions did not have recommended second-look US, for reasons including loss to follow-up (29/48, 60%), subsequent surgery (18/48, 38%), and proceeding directly to MRI-guided biopsy (1/48, 2%).

RESULTS

In 64/284(23%), an US correlate was seen. US-guided biopsy was recommended for 43/64(67%) lesions. Of the 43 recommended US biopsies, 39/43(91%) were performed yielding: 7/39(18%) malignancies (4 IDC, 2 ILC, 1 DCIS), 6/39(15%) high risk (HR) lesions or atypia (3 papillomas, 3 atypia), and 24/39(62%) benign. 1/39 (3%) US biopsy was non-diagnostic but ultimately yielded DCIS on MRI biopsy. Pathology was not available for 1/39(3%).

Of the remaining 21/64(33%) cases in which a correlate was seen, 4/21(19%) were recommended for surgery/surgical consultation (2 IDC, 1 ILC, 1 papilloma), 4/21(19%) for 6-month follow-up US (no malignancy detected on f/u), and 13/21(62%) for 6-month f/u MRI (no malignancy on f/u).

In 220/287(77%) no US correlate was seen. MRI biopsy was performed on 107/220(48%) of these lesions which yielded 13/107(12%) malignancies (3 IDC, 7 DCIS, 3 ILC), 15/107(14%) HR lesions/atypia (3 papilloma, 4 LCIS, 5 radial scar/sclerosing lesion, 3 atypia), and 79/103(77%) benign pathology. 1/15(7%) HR lesion was upgraded at surgery to ILC.

CONCLUSION

The yield for detecting an US correlate for MRI-detected NME is low (23%) with an 18% rate of malignancy, compared with 12% of NME without US correlate.

CLINICAL RELEVANCE/APPLICATION

All suspicious NME should undergo biopsy, regardless of whether a sonographic correlate is identified.

SSM01-05

Rim and other Patterns of Stiffness on ShearWave™ Elastography (SWE) as Predictors of Malignancy in the BE1 Trial

Ellen Xiameng Sun (Presenter): Nothing to Disclose, Wendie A. Berg MD, PhD: Research Grant, Gamma Medica, Inc Research Grant, General Electric Company Equipment support, Gamma Medica, Inc Equipment support, General Electric Company, Joel Gay: Employee, SuperSonic Imagine, Claude Cohen-Bacrie MD, PhD: Executive Vice President, SuperSonic Imagine Officer, SuperSonic Imagine

PURPOSE

Stiffness within a mass ± surrounding tissue on ShearWave elastography (SWE) correlates with increasing risk of malignancy; we sought to determine if stiffness distribution was predictive of malignancy.

METHOD AND MATERIALS

From 9/2008 to 9/2010, at 16 centers in Europe and USA, 1647 women with breast masses consented to repeat US and SWE imaging (SuperSonic Imagine, Aix-en-Provence, France). 1562 women/masses had acceptable reference standard; 37 were excluded due to artifacts. Uniplanar SWE images were reviewed for visual and quantitative stiffness as well as pattern of maximum stiffness: rim, scattered foci within and adjacent to mass, only within mass, adjacent region, adjacent focus, stiffness neither within nor adjacent to mass, or no stiffness. We also evaluated BI-RADS 3/4a masses for any rim stiffness.
RESULTS

1525 women (median age 50 yrs, mean 51.8, range 21-94) and masses (median 12 mm, mean 14, range 1-53) were evaluated, including 494 (32.4%) malignant. Maximum stiffness as a rim was seen with 342 (22.5%) of masses: 177 (51.7%) malignant (odds ratio, OR, 19, 95%CI 6.2-55, after correcting for grayscale BI-RADS assessment). Other patterns also correlated with increased risk of malignancy, including within mass (OR 17), adjacent region or focus (OR 18 and 11 respectively), and scattered foci within or adjacent to mass (OR 10). Stiffness not within or immediately adjacent to mass was not predictive of outcome, with 5/97 (5.2%) of such masses malignant (OR 1.8, 95%CI 0.4-8.3); this likely represents artifact. Of 254 masses without any stiffness, 6 (2.4%) were malignant. Of 428 BI-RADS 3 lesions, 9 (2.1%) were malignant; 8/105 (7.6%) with stiff rim were malignant. Among 390 BI-RADS 4a lesions, 40 (10%) were malignant; 27/110 (24.5%) with stiff rim were malignant; 4/62 (6.5%) soft masses with any SWE rim were malignant; and 5/31 (16%) otherwise stiff masses were malignant. 4/187 (2.1%) soft BI-RADS 4a masses without any stiffness or rim were malignant.

CONCLUSION

Among BI-RADS 3 masses, 1/323 (0.3%) lacking a stiff rim on SWE were malignant. Among BI-RADS 4a masses, any pattern of SWE stiffness in or around the mass, or, for soft masses, a rim, would have identified 36/40 (90%) malignancies, leaving 4 (2.1%) malignancy rate among 187 remaining BI-RADS 4a masses.

CLINICAL RELEVANCE/APPLICATION

The presence of absolute ± rim SWE stiffness among probably benign or low suspicion masses seen on breast US should prompt biopsy.

SSM01-06

Clinical Value of Relative Quantification Ultrasound Elastography in Characterizing Breast Tumors

Alice Carboni (Presenter): Nothing to Disclose, Alfonso Fausto MD : Research Consultant, General Electric Company, Cosimo Damiano Forte : Nothing to Disclose, Luca Volterrani : Nothing to Disclose

PURPOSE

To evaluate ultrasound elastography using strain ratio (SR), a relative quantification approach for breast lesions characterization.

METHOD AND MATERIALS

One hundred forty-seven consecutive patients (52±14 years) with a total of 156 breast lesions underwent to ultrasound elastography. For each lesion evaluation, a movie of at least 5 seconds was recorded. Technical accuracy was assessed automatically. To obtain dynamic SR evaluation a rounded small region of interest was depicted inside the fat tissue (F), in the glandular tissue (G) and the in the lesion (L), preferably at the same depth. Mean value of the ratio between G and F resulted in background tissue composition elasticity: R1; mean value of L/F resulted in lesion elasticity: R2, both evaluated in arbitrary unit (au). A two-years follow-up and pathology results were the standard of reference. Discordances between BI-RADS classification and R2 values were also evaluated. Mann-Whitney test, ROC analysis and Chi-square with Yates correction were used.

RESULTS

A high technical accuracy was obtained in all examinations. Twenty-seven out of 156 lesions were cysts, 25 with a typical three-layer artifact. Seventeen were malignant lesions (13 IDC, 2 IDC+DCIS, 1 DCIS and 1 ILC) and 112 benign lesions (90 fibroadenomas, 7 lymph nodes, 5 fat necrosis, 5 sclerosing adenosis, 2 adenosis, 2 mastitis, 1 radial scar). R1 values were 1.6±0.7au and 1.2±0.9au (mean±SD); R2 values were 6.1±2.5au and 1.9±1.3au for malignant and benign lesions, respectively (P

CONCLUSION

Relative quantification of ultrasound elastography allows to find high levels of diagnostic accuracy in characterizing breast tumors above all in downgrading BI-RADS 3 and 4 lesions.

CLINICAL RELEVANCE/APPLICATION

A high specificity is found using a relative quantification ultrasound elastography despite of background tissue composition. The application of this technique could reduce useless biopsy.
**Comparison of Prone Stereotactic vs. Upright Tomosynthesis Guided Vacuum Assisted Core Breast Biopsies**

*Alexis Marie Smith DO, BA (Presenter): Nothing to Disclose, Jules Henry Sumkin DO: Scientific Advisory Board, Hologic, Inc, Margarita Louise Zuley MD: Research Grant, Hologic, Inc, Denise Chough MD: Nothing to Disclose*

**PURPOSE**

Digital breast tomosynthesis (DBT) is used across the country as a mammographic approach for breast screening and diagnostic workups. An attachment can be retrofitted onto an existing DBT system and used to guide core biopsy of the breast. Prone stereotactic biopsy is the current gold standard. The purpose of this study is to compare the efficiency and effectiveness of traditional prone 2D vacuum assisted core biopsy with the DBT (3D) guided upright biopsy system.

**METHOD AND MATERIALS**

In this IRB approved study, we performed to date (11/20/2013 to 3/10/2014) 114 breast biopsies as part of the patients' standard clinical care. Fifty nine were performed on the upright DBT unit and 55 on the prone stereotactic table. Data recorded for each biopsy included procedure time, type of target lesion, number of attempts to position target, number of images taken, complications, success, clip migration and subjective pain scale rating (1 - 10). Mean values were computed for each modality and compared.

**RESULTS**

The mean time was 29.1 and 32.4 minutes for the DBT guided and prone stereotactic biopsies, respectively. Calcifications constituted 87% and 99% of the targets on the DBT guided and prone biopsy units. Mean number of attempts to position the target was 1.6 for DBT guided biopsy and 2.3 for prone stereotactic biopsy. Mean values for total number of images taken was 7.6 and 10.0 for DBT and stereotactic guided biopsies. All 59 DBT guided biopsies were successful, whereas two of the prone stereotactic biopsies were not successful (aborted). Three of the patients undergoing DBT guided biopsy had a vasovagal reaction. Clip migration occurred in 11 of the DBT and 7 of the stereotactic cases. The mean subjective pain scale rating is 2.9 and 2.4 (scale 1 - 10; p>0.1) for the DBT and stereotactic biopsies, respectively.

**CONCLUSION**

Preliminary data show that on average, upright DBT guided biopsy is shorter in duration, has a higher success rate, takes fewer attempts to target and fewer images, hence, requiring less radiation. Clip migration occurred slightly more often with DBT guided biopsy. There is no significant difference in pain level between the two approaches.

**CLINICAL RELEVANCE/APPLICATION**

DBT guided biopsy is an acceptable approach that is as good as or better than conventional prone stereotactic biopsy in several respects.

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**Digital Breast Tomosynthesis (DBT) Guided Vacuum Assisted Breast Biopsy: Initial Experiences and Comparison with Prone Stereotactic Vacuum Biopsy**

*Simone Schrading MD (Presenter): Nothing to Disclose, Martina Distelmaier: Nothing to Disclose, Christiane Katharina Kuhl MD: Nothing to Disclose*

**PURPOSE**

Aim was to compare the clinical performance of digital-breast-tomosynthesis guided vacuum-assisted-biopsy (DBT-VAB) with that of prone stereotactic vacuum assisted biopsy using a biopsy table (PS-VAB) for histological clarification of lesions detected on full field digital mammography.

**METHOD AND MATERIALS**

During a one-year period, 184 patients with 191 suspicious mammographic findings were scheduled for mammography-guided vacuum biopsy. PS-VAB were performed by using a dedicated biopsy table (Lorad Multicare) on 159 patients with 165 target lesions. Since December 2013, a system for DBT-VAB was available (Affirm, Hologic) and was used for 25 consecutive patients with 26 target lesions. Biopsies were taken with a 9G EVIVA system. We compared biopsy success rates, and time to complete biopsy.

**RESULTS**

Technical success rate was 26/26 (100%) for DBT-VAB vs. 154/165 (93%) for PS-VAB. One of the 11 lesions in which PS-VAB failed underwent successful DBT-VAB. Time to complete vacuum biopsy was 13 ± 3.5 min for DBT-VAB vs. 28 ± 10.3 min for PS-VAB (p < 0.012). Main reason for this time difference was the process of re-identifying and targeting the lesion during PS-VAB, which took 15 ± 7.6 min, versus 4 ± 2.4 min for DBT-VAB. The actual tissue sampling procedure took about the same time (13.0±6.3 min for PS-VAB vs. 9.0±3.1 min for DBT-VAB). No minor or major complications occurred during none of the interventions.

**CONCLUSION**

Although here, we report on our first clinical experiences with DBT-VAB, we found that this technique outperformed SP-VAB in every aspect. DBT-VAB proved easy to learn, faster to complete and allowed successful tissue sampling even of low-contrast lesions and of lesions in locations that were difficult to reach for PS-VAB.
DBT-VAB helps avoid typical difficulties associated with PS-VAB, e.g. those caused by the small biopsy window, and will likely replace PS-VAB for tissue sampling of mammographic findings.

Proposed Breast Biopsy Performance Benchmarks for MRI Based on an Audit of a Large Academic Center


PURPOSE

Established biopsy performance benchmarks for mammography (MG) are widely utilized, yet there exists no such performance benchmarks for breast magnetic resonance imaging (MRI). In this study we audited our breast MRI biopsy performance using established MG benchmarks, and reviewed whether these benchmarks could be applied to a breast MRI practice.

METHOD AND MATERIALS

We retrospectively reviewed all breast MRIs performed at a large academic center from 10/1/12-9/31/13. Exams were interpreted by 7 radiologists, all with fellowship training and/or more than 10 years of experience in breast imaging. All MRIs reported as BI-RADS 4 or 5, and the associated core and/or surgical biopsy pathology results were tabulated. Using national MG benchmarks, we derived mean performance parameters, including abnormal interpretation rate, positive predictive value (PPV), cancer detection rate, percentage of minimal cancers (Stage 0 and stage 1 cancers <= 1cm) and axillary node-negative invasive cancers.

RESULTS

Of the 725 breast MRIs performed over a one year period, 522 (76.1%) were BI-RADS 1 or 2, 75 (10.3%) BI-RADS 3, 61 (8.4%) BI-RADS 4, 4 (0.6%) BI-RADS 5, and 33 (4.6%) BI-RADS 6. All 65 (100%) patients with BI-RADS 4 or 5 underwent biopsy: 22 (33.8%) were positive for cancer, 31 (47.7%) were high risk lesions (23 atypia; 8 LCIS), and 12 (18.5%) were benign. Abnormal interpretation rate was 3.3% (22/65); PPV for abnormal interpretation (PPV1), biopsy recommended (PPV2), and biopsy performed (PPV3), were all 33.84% (22/65); cancer detection rate was 33/1000 (22/725). Of the 22 cancers, 10 (45.5%) were in-situ and 12 (55.5%) were invasive. 9/12 (75.0%) invasive cancers were less than 1cm with negative lymph nodes, thus the percentage of minimal cancers was 86.4% (19/22). Two cancers were positive for lymph nodes and the largest invasive cancer size was 2.2 cm.

CONCLUSION

The breast MRI benchmarks closely mimic those of MG, with the expected exception of a higher cancer detection rate for breast MRI, likely resulting from its known higher sensitivity. Our study suggests established national MG benchmarks can be used to reliably audit a breast MRI practice, until which point MRI specific benchmarks are created.

CLINICAL RELEVANCE/APPLICATION

Auditing a breast MRI practice is essential, and accepted mammography benchmarks are reasonable performance evaluation tools, in the absence of MRI specific benchmarks.


Basak Erguvan Dogan MD (Presenter): Nothing to Disclose, Mark Joseph Dryden MD: Nothing to Disclose, Wei Wei: Nothing to Disclose, Bruno D. Fornage MD: Nothing to Disclose, Thomas A. Buchholz MD: Nothing to Disclose, Benjamin David Smith MD: Nothing to Disclose, Kelly K. Hunt MD: Nothing to Disclose, Wei Tse Yang MD: Researcher, Hologic, Inc

PURPOSE

To identify sensitivity, specificity and positive and negative predictive values of internal mammary (IM) ultrasound (US) and US-guided fine-needle aspiration biopsy (FNAB) in the diagnosis of clinically occult metastatic IM nodes (IM-LAP).

METHOD AND MATERIALS

The study included 595 consecutive patients with a newly diagnosed, intact breast cancer who underwent mammographic and breast US evaluation in our institution between September 1, 2011 and April 1, 2012. In all patients, US examination included survey of axillary (Ax), infraclavicular (IC), IM, and supraclavicular (Sc) nodal basins. Patient demographics, cancer histopathological type, biological subtype and grade, size, location (medial, lateral, or central) and presence or absence of metastatic Ax, IC, or Sc nodes were recorded. Fisher’s exact test and Wilcoxon rank test were used for statistical analysis.

RESULTS
58/595 (10%) patients had abnormal IM nodes on US. Patients with IM-LAP were younger than those without IM-LAP (mean, 46.8 years versus 55.8 years \(p<0.0001\)). Of these 58 patients, 8 (13.8%) had isolated IM-LAP, while 50 (86.2%) had metastatic nodes in other nodal basins. 29 (50%) of the 58 patients with metastatic-appearing IM nodes underwent US-guided FNAB, which confirmed malignancy in 26 (93%) patients and benign lymphoid tissue in 3 patients. The presence of metastatic IM nodes was associated with tumors of triple-negative type \(p<0.0001\), higher grade \(p<0.001\), located in the medial breast \(p<0.0001\), measuring \(\geq 5\) cm \(p<0.001\), and with the existence of other \(Ax, Ic,\) or \(Sc\) metastatic nodes \(p<0.0001\). 23/29 (79%) biopsies were performed in patients who had Stage I and Stage II cancer pre-IM FNAB. Of the 537 IM US (-) patients, 3 (0.6%) underwent an IM sentinel node biopsy, which revealed a metastasis in 1 patient (0.2%).

**CONCLUSION**

In our series, 10% of patients with newly diagnosed breast cancer had suspicious ipsilateral IM nodes on IMUS, with 1.2% of these patients having isolated IM-LAP. Younger patients with ER-HER2- cancers and medial tumors are more likely to have clinically occult IM node involvement. A negative IMUS excludes IM-LAP with a high level of confidence.

**CLINICAL RELEVANCE/APPLICATION**

IMUS and FNA may have staging and treatment implications for baseline breast cancer staging in young patients with medially located ER-HER2- breast cancer.

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**Interventional Molecular MRI/Radiofrequency Heat-Enhanced Chemotherapy of Breast Cancer**

**Yurong Zhou PhD** (Presenter): Nothing to Disclose, **Xiaoming Yang MD, PhD**: Nothing to Disclose, **Jihong Sun MD, PhD**: Nothing to Disclose, **Guocan Han**: Nothing to Disclose, **Yue Wang**: Nothing to Disclose, **ZhiMing Li**: Nothing to Disclose

**PURPOSE**

To validate the feasibility of using molecular MRI/ radiofrequency heat (RFH) to improve chemotherapeutic effects on breast cancers.

**METHOD AND MATERIALS**

Human breast cancer cells (Bcap-37) and 24 tumor-bearing mice were divided into four groups: (i) no treatment as a control; (ii) RFH-only; (iii) doxorubicin (ADM)-only; and (iv) combination therapy of ADM plus RFH. RFH was performed by using a 0.032-inch MRI heating-guidewire (MRIHG) at 42°C for 20 minutes. Cell proliferation and apoptosis were evaluated in vitro. Changes of tumor masses were monitored in vivo by MRI over time, with subsequent histological correlation.

**RESULTS**

Of in-vitro confirmation, cell proliferation in the combination therapy group decreased significantly compared to those in other three groups with no treatment, RFH-only and ADM-only (0.62±0.04 VS 1.19±0.02 VS 1.00±0.07 VS 0.71±0.07, \(P<0.0001\)).

**CONCLUSION**

MRIHG-mediated RFH can enhance the killing effect of doxorubicin on breast cancers, which may open new avenues in efficient treatment of breast malignancies by molecular MR/RF-integrated interventional oncology and chemotherapy.

**CLINICAL RELEVANCE/APPLICATION**

MRIHG-mediated RFH technique may open new avenues in efficient treatment of breast malignancies by molecular MR/RF-integrated interventional oncology and chemotherapy.

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**Breast-Specific Gamma Imaging (BSGI)-guided biopsy for the Diagnosis of Breast Cancer**

**Eric Stephen Rupe** (Presenter): Nothing to Disclose, **Jocelyn A. Rapelyea MD**: Research Consultant, Siemens AG Consultant, General Electric Company, **Megan Lenihan**: Nothing to Disclose, **Caitrin M. Coffey BS**: Nothing to Disclose, **Jennifer H. Lieberman BA**: Nothing to Disclose, **Rachel Frydman Brem MD**: Board of Directors, iCAD, Inc Board of Directors, Dillon Technologies LLC Stock options, iCAD, Inc Stockholder, Dillon Technologies LLC Consultant, U-Systems, Inc Consultant, Dillon Technologies LLC Consultant, Dune Medical Devices Ltd

**PURPOSE**

The aim of this study was to evaluate the outcomes of BSGI-guided biopsy in women with suspicious BSGI findings.

**METHOD AND MATERIALS**

All patients who underwent BSGI-guided biopsy between January 1, 2011 and October 9, 2013 were retrospectively reviewed. 38 women (age 39 to 79) had 40 BSGI-guided biopsies, all of whom were included. Patients who had abnormal BSGI findings in whom a directed ultrasound or directed re-evaluation of the mammogram did not demonstrate a targetable finding underwent BSGI-guided Gamma biopsy.

**RESULTS**

Of the 41 attempted biopsies, one was aborted due to vasovagal reaction, 40 (97.6%) were technically successful. In these there were no complications. Of the biopsies performed, pathology demonstrated 5 invasive...
ductal carcinoma (12.5%) and 1 DCIS (2.5%). High risk lesions included 1 LCIS (2.5%), 3 ADH (7.5%), 2 ALH (5%), and 1 flat epithelial atypia (2.5%). Of these high-risk lesions, 2 cases of ADH were upgraded to DCIS at surgery, for an overall cancer rate of 20% (5 IDC and 3 DCIS) and 15% high-risk lesions (6 LCIS, ADH, ALH, or flat epithelial atypia). Other pathologies include 9 usual ductal hyperplasia (22.5%), 7 fibrocystic changes (17.5%), 7 benign breast tissue (17.5%), and 2 adenosis (5%).

**CONCLUSION**

Of the 38 women with 40 suspicious BSGI findings not visible by mammography or ultrasound, BSGI-guided biopsy demonstrated 8 cancers (20%), 5 invasive and 3 DCIS. There were 6 cases of atypia (15%) for a total of 14 out of 40 (35%) cancer or high risk lesions.

**CLINICAL RELEVANCE/APPLICATION**

When a lesion is visible by BSGI, and not by mammography or ultrasound, our findings support BSGI-guided biopsy as a reasonable and accurate approach to biopsy the lesion. Our results compare favorably to those reported for MRI guided biopsy.

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**RC615**

**Breast US**

*Refresher/Informatics*

**RC615A**

**High-quality Breast US**

Janice S. Sung MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To review basic ultrasound principles used to create high quality images. 2) To understand appropriate breast ultrasound technique and documentation. 3) To improve knowledge regarding breast ultrasound accreditation, including image evaluation and biopsy case assessment.

**RC615B**

**Challenging Cases**

Bruno D. Fornage MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To review common and less common causes of artifacts, diagnostic errors, and pitfalls, and ways to identify them. 2) To describe tips and tricks to optimize the acquisition and interpretation of sonograms of the breasts and nodal basins.

**RC615C**

**Whole Breast Screening**

Stamatia V. Destounis MD (Presenter): Investigator, FUJIFILM Holdings Corporation Investigator, Seno Medical Instruments, Inc

**LEARNING OBJECTIVES**

1) Review of current screening breast ultrasound legislation and the impact on breast imaging centers. 2) To review and discuss available automated breast ultrasound technologies utilized for screening ultrasound. 3) Discussion of clinical experience with handheld screening ultrasound. 4) Review of current published literature.

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**SSQ01**

**Breast Imaging (Breast Density and Risk Assessment)**

*Scientific Papers*

**SSQ01**

**Breast Imaging (Breast Density and Risk Assessment)**

*Scientific Papers*

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
**The Potential Impact of Risk-based Screening Mammography in Women Age 40-49 Years**

Elissa Rhona Price MD (Presenter): Nothing to Disclose, Alexander W. Keedy MD: Nothing to Disclose, Rita Gidwaney MD: Nothing to Disclose, Edward A. Sickles MD: Nothing to Disclose, Bonnie N. Joe MD, PhD: Nothing to Disclose

**PURPOSE**

To determine the prevalence of very strong family history and extremely dense tissue in women aged 40-49 with breast cancer detected on screening mammography.

**METHOD AND MATERIALS**

All cancers detected by screening mammography at our institution between 1/1997 and 11/2012 in 40-49 year old women were retrospectively identified. Symptomatic patients undergoing diagnostic mammography and those with a personal history of breast cancer were excluded. Family history, breast density, type of malignancy, tumor receptor status and lymph node status were recorded.

**RESULTS**

During the study period, 194 cases of breast cancer were identified on screening mammography in 40-49 year old women; 53% invasive cancer and 47% ductal carcinoma in situ. Of the patients with invasive disease, 23% had axillary nodal involvement. A very strong family history was absent in 90%, and extremely dense breast tissue was absent in 86%. 78% patients had neither very strong family history nor extremely dense breasts, including 79% of the cases of invasive disease, of which 24% had axillary nodal involvement and 88% had positive hormone receptor status.

**CONCLUSION**

Very strong family history and extremely dense breast tissue were commonly absent in 40-49 year old women with breast cancer detected at screening mammography. Reducing the number of women to be screened in this age group by using a risk-based approach would reduce the number of screen-detected cancers by more than 75%, thereby forgoing most of the benefit of mortality reduction that already has been proven for screening women age 40-49 years.

**CLINICAL RELEVANCE/APPLICATION**

Using a risk-based approach to screening mammography (limiting screening to women with either very strong family history or extremely dense breasts) would reduce by more than 75% the number of screen-detected cancers, thereby forgoing most of the benefit of mortality reduction that already has been proven for screening women age 40-49.

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**Impact of State Breast Density Legislation on Primary Care Physicians**


**PURPOSE**

A state breast density law, effective April 1, 2013, requires mammography facilities in this state to inform patients if they have dense breasts and to direct them to their primary physicians for questions on breast density and supplemental screening tests. This study investigates primary physician awareness of the law and its impact on outpatient primary care practice and management.

**METHOD AND MATERIALS**

An online survey was distributed to 174 physicians within a large single primary care network system in February 2014, 10 months after a state breast density law took effect. Responses were anonymous. The survey was completed by 77 physicians, 39% from Internal Medicine, 47% from Family Medicine, and 9% from Obstetrics-Gynecology departments. A slight majority (53%) were female. 72% had been practicing for greater than 10 years.

**RESULTS**

49% of respondent physicians were not aware of the Breast Density legislation prior to the survey. 32% reported noticing a change in patient levels of concern about breast density in 2013 compared to prior years.
Only 5% of primary physicians were "completely comfortable" answering patient questions about breast density, while 25% were "mostly comfortable". 51% reported themselves as "somewhat comfortable" discussing such questions and 11% were "not comfortable". 48% of respondents reported that they "rarely" answer questions about breast density. Twenty percent of physicians reported that they had ordered supplementary screening tests for women with dense breasts who had no other breast cancer risk factors. Of those that ordered additional testing, 44% ordered Breast MRI, 22% ordered whole breast ultrasound, 11% ordered tomosynthesis, and 22% ordered other unspecified testing.

CONCLUSION

Nearly half of physicians from one primary care network were not aware of the state's breast density notification law, 10 months after it went into effect. Most were not completely comfortable discussing breast density with patients. Enactment of breast density notification laws without the provision of adequate primary physician education and resources is unlikely to significantly impact patient care.

CLINICAL RELEVANCE/APPLICATION

15 states have enacted breast density laws. Physician awareness of the laws and knowledge about breast density are crucial in deciding whether renewal or adoption in additional states is warranted.

Automated Volumetric Breast Density and Risk of Cancer Stratified by Pathological Attributes

Stephen W. Duffy: Nothing to Disclose, Oliver William Edmund Morrish MSc: Nothing to Disclose, Lorraine Tucker: Nothing to Disclose, Richard Black MS: Nothing to Disclose, Fiona Jane Gilbert MD (Presenter): Speaker, Bracco Group Research Grant, GlaxoSmithKline plc Research Grant, General Electric Company

PURPOSE

To estimate the extent to which automatic measures of density are predictive of breast cancer risk, and in particular risk of the potentially fatal cancers which are prime targets of early detection.

METHOD AND MATERIALS

In a retrospective study of breast tomosynthesis in addition to standard full field digital mammography, we had Volpara automated volumetric density on 7019 subjects (1157 cancers) and Quantra automated volumetric density on 7005 subjects (1156 cancers). Data were analysed using logistic regression.

RESULTS

These was a significant (p<0.001) 3% (95% CI 1-5%) increased risk of breast cancer per 10 cm³ increase in fibroglandular (dense) tissue measured by Volpara, and a significant (p<0.001) 2% (95% CI 1-3%) increase per 10 cm³ as measured by Quantra. In both cases, the effect was stronger in invasive grade 3 cancers than in grade 2 or grade 1. Risk of grade 3 breast cancer increased by 4% per 10 cm³ increase in dense tissue measured by Volpara (95% CI 1-7%) and by 3% per 10 cm³ as measured by Quantra (95% CI 1-5%). The effect of neither density measure on risk varied substantially by lymph node status. The effect of Volpara density was considerably stronger for risk of invasive tumours of size greater than 20 mm, at 6% increased risk per 10 cm³ increase dense tissue (95% CI 3-9%). The effect of the Qūantra measure had a weaker association with tumour size.

CONCLUSION

Automated volumetric breast density is predictive of breast cancer risk. There is evidence that it has stronger predictive power for potentially fatal large and grade 3 invasive cancers. This suggests that automated volumetric breast density has a potential role in risk stratification and management of breast cancer risk.

CLINICAL RELEVANCE/APPLICATION

Automated calculation of fibroglandular volume appears to indicate risk of developing breast cancer.

Enhanced Personalized Breast Cancer Screening Using an Ensemble Model of Mammographic Texture and Density


PURPOSE

Mammographic Density (MD) is scientifically well established as an independent breast cancer risk factor and is increasingly used in clinical practice for personalized screening. Mammographic parenchymal patterns/textures beyond MD is known to provide further risk segregation. We investigate the risk segregation potential of an ensemble of mammographic density and texture measures from FFDM.

METHOD AND MATERIALS

A case/control study was selected from the Dutch Breast Cancer Screening program. Mammograms were acquired on a Hologic Selina FFDM system with a 70μm pixel size. 250 screen detected cancer cases were chosen randomly and likewise for 750 cancer-free controls. Cases were represented by the latest cancer-free
prior contralateral MLO view (if available) and otherwise by the contralateral MLO view at time of diagnosis. Controls were represented by the latest available MLO view (laterality matched individually per case).

Volumetric density was calculated using Volpara 1.45. Based on a large literature review (e.g. Giger, Manduca, Hoberle, Heine), a total of 56 measures of mammographic texture were implemented and measured for each mammogram. Furthermore, a novel machine learning based texture measure was trained on an independent training set and measured on each mammogram. A multivariate logistic regression model for all 58 measured (and linearly age-corrected) markers was 5-fold cross-validated and evaluated for association to cancer outcome through AUC.

RESULTS

In total, 28 of the age-corrected markers resulted in AUCs significantly better than chance. Specifically, the novel machine learning based measure resulted in an AUC of 0.65 (95% CI 0.61–0.69) whereas volumetric density was non-significant (AUC 0.51). The multivariate logistic regression yielded a pooled AUC across the five folds of 0.75 (0.71–0.79).

CONCLUSION

By combining a representative range of published mammographic texture measures with a novel machine learning based approach, it was possible to separate future cancer cases from healthy controls to a degree that a) clearly improves on what is attainable through density alone and b) could facilitate personalized screening of, e.g., high risk women.

CLINICAL RELEVANCE/APPLICATION

Clinical practice includes screening based on, e.g., age and family history through risk models as Gail and Tyrer-Cuzick. Such models could be enhanced by texture measures from routine mammograms.

Comparing Breast Density Measurement Techniques in Screening Digital Mammography

Oliver William Edmund Morrish MSc (Presenter): Nothing to Disclose, Lorraine Tucker: Nothing to Disclose, Richard Black MS: Nothing to Disclose, Stephen W. Duffy: Nothing to Disclose, Fiona Jane Gilbert MD: Speaker, Bracco Group Research Grant, GlaxoSmithKline plc Research Grant, General Electric Company

PURPOSE

To compare different methods of assessing breast density in a UK screening population.

METHOD AND MATERIALS

Conventional two-view digital mammograms were collected from six centres from 8867 women attending either a screening assessment clinic, or screening for family history. Breast density was assessed by 26 experienced image readers on a visual analogue scale and by two automated volumetric density tools (QuantraTM, Hologic and VolparaTM, Matakina). Total breast volume, fibroglandular volume and percent volume density for each view were combined logically to produce results for each woman.

RESULTS

There was a good linear correlation (R2=0.95) between Quantra and Volpara for total breast volume with a mean difference of 43.5cm³ (5.04% of the mean result ±0.2%, 2sem). There was less correlation for fibroglandular volume (R2=0.74) and the mean difference was 30.3cm³ (21.19%±0.72%). On average Quantra gave the larger value and the difference tended to increase with increased volume. For the percent volume density the mean difference was 1.61% (16.32%±0.69%) and R2 was 0.65. Comparison of the observer’s scores with the area-based Quantra density yielded a poor correlation (R2=0.31). Exponential correlations of observer’s scores with the volumetric density results gave R2 values of 0.33 and 0.38 for Quantra and Volpara respectively.

CONCLUSION

There is poor correlation of breast density scored by observers and automated techniques. In part this may be explained by differences in the quality being measured (area vs volume) and image presentation (for presentation vs for processing). However inter-observer variability in the UK may be high as quantitative estimations of breast density are not made routinely. If automated methods are to be used differences in their output, caused by differences in the underlying algorithm, need to be understood.

CLINICAL RELEVANCE/APPLICATION

There are differences in the results of each of the breast density measurement methods. These differences need to be understood if management decisions are based on breast density.

The Diagnostic Effect of Digital Breast Tomosynthesis in Relation to Visually Assessed and Automated Volumetric Breast Density

Stephen W. Duffy: Nothing to Disclose, Oliver William Edmund Morrish MSc: Nothing to Disclose, Lorraine Tucker: Nothing to Disclose, Richard Black MS: Nothing to Disclose, Fiona Jane Gilbert MD (Presenter): Speaker, Bracco Group Research Grant, GlaxoSmithKline plc Research Grant, General Electric Company

PURPOSE

To assess the benefit in terms of diagnostic accuracy of addition of digital breast tomosynthesis (DBT) by breast density, as measured on a visual analogue scale and by automated volumetric software.
**METHOD AND MATERIALS**

In a retrospective study of DBT in addition to standard full field digital mammography, we had visually assessed density on 6969 subjects (1153 cancers), Volpara automated volumetric density on 7019 subjects (1157 cancers) and Quantra automated volumetric density on 7005 subjects (1156 cancers). All subjects had mammography by 2D digital mammography alone and by 2D digital mammography plus DBT. Sensitivity and specificity was compared for between 2D mammography alone and 2D plus DBT using McNemar methods.

**RESULTS**

Median and interquartile ranges were 38% (23-50%) for visually assessed percent density, 72 cm³ (51-103) for absolute dense volume as measured by Volpara and 93 cm³ (51-143) for absolute dense volume measured by Quantra. Specificity was significantly improved with the addition of DBT in all tumours and in all subgroups as defined by breast density (p<0.001 in all cases). Sensitivity was improved significantly (p=0.03) with the addition of DBT in those subjects with visual density at or above the 3rd quartile (50%), with 86% sensitivity (95% CI 82-90%) for 2D mammography alone and 93% (95% CI 90-96%) for 2D mammography plus DBT. A significantly improved sensitivity (p=0.02) was also observed for those at or above the third quartile of Volpara density (103 cm³) Volpara, with a sensitivity of 87% (95% CI 83-91) for 2D mammography alone and 93% (95% CI 90-96%) for 2D mammography plus DBT. No significant difference in sensitivity was observed for those with high density as measured by Quantra, and no significant difference was observed for those with low density as measured by any of the three methods.

**CONCLUSION**

DBT has the potential to improve sensitivity of mammography in women with dense breast tissue.

**CLINICAL RELEVANCE/APPLICATION**

In women with more than 50% breast density, the addition of DBT may increase cancer detection.

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**SSQ01-07 Quantitative Background Parenchymal Enhancement in Breast DCE-MRI Is Associated with Breast Cancer Risk**


**PURPOSE**

Visually estimated background parenchymal enhancement (BPE) by BI-RADS categories in breast dynamic contrast enhanced MRI (DCE-MRI) has been correlated with breast cancer risk in high-risk women. We tested this association using fully automated, objectively derived, quantitative BPE measurements.

**METHOD AND MATERIALS**

A retrospective case-control study was performed using breast DCE-MRI scans from 102 patients (mean 47.2±7.3 YO) who underwent either open surgical biopsy or core biopsy from 2009-2011: 51 women had unilateral breast cancer and 51 were age- and date-of-MRI matched controls with a unilateral biopsy-proven benign. The MRI was analyzed using fully automated computer algorithms, generating two quantitative BPE measures computed from the third post-contrast series: the absolute BPE volume (|BPE|) and its relative amount over the whole breast volume (BPE%). Breast density BI-RADS was retrieved from the mammography report (< 6 months) prior to diagnosis. Volumetric absolute and relative amounts of fibroglandular tissue (|FGT| and FGT%) were also automatically quantified from the MRI. Multivariable conditional logistic regression was performed to assess BPE measures as predictors of breast cancer risk: (comparison 1) breasts contralateral to the cancers vs. benign breasts of the controls, and (comparison 2) breasts contralateral to the cancers vs. contralateral (negative) breasts of the controls.

**RESULTS**

After adjustment for breast density, |FGT|, and FGT%, odds ratio (OR) for comparison 1 was 1.84 (95% confidence interval [CI]: 1.08, 3.14; p=0.02) for |BPE| and 3.85 (95% CI: 1.34, 11.05; p= 0.01) for BPE%. OR for breast density alone was 0.75 (95% CI: 0.35, 1.59; p=0.5). For comparison 1, OR was 1.19 (95% CI: 0.71, 1.97; p=0.5) for |FGT|, and 0.71 (95% CI: 0.19, 2.67; p=0.6) for FGT%; for comparison 2, OR was 1.14 (95% CI: 0.72, 1.81; p=0.6) for |FGT|, and 0.70 (95% CI: 0.19, 2.52; p=0.6) for FGT%.

**CONCLUSION**

Increased BPE (both |BPE| and BPE%) in breast DCE-MRI are predictive of breast cancer risk, independent of measures of breast density and FGT.

**CLINICAL RELEVANCE/APPLICATION**

Objectively quantified BPE in breast DCE-MRI has potential for use as a biomarker of breast cancer risk and may be included to improve breast cancer risk assessment and stratification.
After adjustment for breast density and the amount of FGT, the OR for mean wash-in-slope was 1.12 (95% confidence interval).

RESULTS

Conditional logistic regression was performed to estimate odds ratios (ORs) for breast cancer. The region of the fibroglandular tissue (FGT) was estimated in the MRI for each breast. Following biopsy, 102 women underwent breast biopsies from 2009-2011: 51 women had unilateral breast cancer and 51 were age- and date-of-MRI matched controls with a unilateral biopsy-proven benign. BI-RADS-based mammographic breast density was retrieved from the latest (< 6 months) mammography report prior to diagnosis. The breast MRI at time-of-diagnosis (cancer or benign) was analyzed on the normal breast contralateral to cancer (for cancer cases) or benign (for controls). The region of the fibroglandular tissue on MRI was analyzed breast using a fully automated computer algorithm. Based on the extent of enhancement over the estimated FGT region, mean and variance of the voxel-wise values of each of the four kinetic parameters were then computed, generating a total of 8 kinetic measures. We compared these kinetic measures between the normal breasts contralateral to the cancers and the contralateral (negative) breasts of the controls. Multivariable conditional logistic regression was performed to estimate odd ratios (ORs) for breast cancer.

CONCLUSION

Increased BPE may be associated with a higher probability of developing breast cancer in high-risk women. Amounts of fibroglandular tissue measured by mammography or MRI may be less predictive of future breast cancer diagnosis in the high-risk population.

CLINICAL RELEVANCE/APPLICATION

Increasing background parenchymal enhancement on MRI correlated with future breast cancer development among high-risk women and could be used as a predictive biomarker of breast cancer risk.

METHOD AND MATERIALS

After IRB approval, we identified all high-risk screening MRIs at our institution from 1/2006 to 12/2011 in women ≥18 years with no history of breast cancer. Outcomes were determined from our regional tumor registry. Women diagnosed with breast cancer any time after the index MRI comprised the cancer cohort. A 1:1 case control was created from a randomized cohort of women who did not develop breast cancer by last follow-up (minimum 3 years after index MRI), matching for age and BRCA mutation, and maximizing follow-up time. BPE, amount of fibroglandular tissue on MRI, and mammographic density were assessed on index exams and compared between the cancer cohort and negative controls using conditional logistic regression analyses.

RESULTS

From 5333 exams during the study interval, 23 high-risk women (6 BRCA mutations) with no history of breast cancer underwent screening MRI and were subsequently diagnosed with breast cancer during the follow-up interval (12 invasive, 11 in situ). Cancer cohort mean age was 47 ±10 years. Mean time-to-diagnosis of cancer was 779 ± 600 days, and mean follow-up time for negative controls was 2037 ± 458 days. Women with mild, moderate, or marked BPE on their index MRI had an approximately 9 times greater risk of cancer diagnosis during the follow-up interval than those with minimal BPE (OR=9.0, CI: 1.1-71.0). Neither amount of fibroglandular tissue on MRI nor mammographic density was a significant predictor of cancer risk (OR=1.2, CI: 0.4-3.9; OR=1.4, CI: 0.4-4.4, respectively).

CONCLUSION

Contrast enhancement kinetics derived from breast dynamic contrast enhanced MRI (DCE-MRI) has been shown to have diagnostic value. We investigated the relationship between objectively quantified kinetic parameters in DCE-MRI and breast cancer risk.

METHOD AND MATERIALS

A retrospective case-control study was performed based on a group of 102 women (mean 47.2±7.3 YO) who underwent breast biopsies from 2009-2011: 51 women had unilateral breast cancer and 51 were age- and date-of-MRI matched controls with a unilateral biopsy-proven benign. BI-RADS-based mammographic breast density was retrieved from the latest (< 6 months) mammography report prior to diagnosis. The breast MRI at time of diagnosis (cancer or benign) was analyzed on the normal breast contralateral to cancer (for cancer cases) or benign (for controls). The region of the fibroglandular tissue (FGT) was estimated in the MRI for each analyzed breast using a fully automated computer algorithm. Based on the enhancement time-signal intensity curves of three DCE post-contrast series, four kinetic parameters, i.e., peak enhancement, time to peak enhancement, wash-in-slope, and wash-out-slope were quantified for each voxel specifically over the estimated FGT region; mean and variance of the voxel-wise values of each of the four kinetic parameters were then computed, generating a total of 8 kinetic measures. We compared these kinetic measures between the normal breasts contralateral to the cancers and the contralateral (negative) breasts of the controls. Multivariable conditional logistic regression was performed to estimate odd ratios (ORs) for breast cancer.

RESULTS

After adjustment for breast density and the amount of FGT, the OR for mean wash-in-slope was 1.12 (95% confidence interval).
Confidence Interval (CI): 1.01, 1.25; p=0.04) and 1.81 (95% CI: 1.13, 2.91; p=0.01) for the variance of wash-in-slope. Variance remained significant (OR was 1.80 [95% CI: 1.07, 3.03; p=0.03]), even after additional adjustment for quantitative measures of background parenchymal enhancement (BPE). The ORs for all other 6 kinetic measures were not statistically significant.

CONCLUSION

The mean and variance of wash-in-slope in breast DCE-MRI are associated with breast cancer risk.

CLINICAL RELEVANCE/APPLICATION

The kinetic parameters of wash-in-slope quantified in breast DCE-MRI show potential as biomarkers of breast cancer risk and may be included to potentially improve breast cancer risk prediction.

BRS-THA

Breast Thursday Poster Discussions

Scientific Posters

BRS

AMA PRA Category 1 Credits ™: .50
Thu, Dec 4 12:15 PM - 12:45 PM  Location: BR Community, Learning Center

Participants

Moderator
Sarah Maier Friedewald MD : Consultant, Hologic, Inc Research Grant, Hologic, Inc

Sub-Events

BRS285

Full Automated Quantitative Analysis at Breast MR Imaging and Breast Cancer Risk (Station #1)


PURPOSE

The purpose of this study is to evaluate breast cancer risk with fully automated quantitative analysis of three indices with breast magnetic resonance images (MRI), i.e. amount of fibroglandular tissue (FGT), background parenchymal enhancement (BPE), and background parenchymal enhancement intensity (BPEI), and find thresholds associated with breast cancer risk.

METHOD AND MATERIALS

Among 14033 women who underwent breast MR examination among October 2009 and December 2012, we selected 101 identified breast carcinoma cases, and normal and benign control cases were selected in pairs with each breast cancer case on the basis of age and menstrual status. We used a fully automated quantitative analysis method to calculate three indices of FGT, BPE, and BPEI (BPEI=Glands signal difference before and after enhancement / Glands signal before enhancement×100%). We obtained the area (AUC) under the receiver operating characteristic (ROC) curve, and found the threshold associated with breast cancer risk threshold.

RESULTS

In premenopausal women, BPE have high correlation with breast cancer risk (AUC = 0.610, p = 0.034), and its corresponding threshold associated with breast cancer risk is 24.85% (sensitivity = 70.21%, specificity = 59.57%). In postmenopausal women, both BPE and BPEI have high correlation with breast cancer risk (AUC = 0.651, p = 0.002 for BPE; AUC = 0.614, p = 0.018 for BPEI), and their corresponding thresholds associated with breast cancer risk are 13.30% (sensitivity = 72.22%, specificity = 50.00%) and 27.35% (sensitivity = 44.44%, specificity = 80.55%), respectively. FGT is not significantly correlated with breast cancer risk (AUC = 0.530, p = 0.564 for premenopausal cases; AUC = 0.550, p = 0.299 for postmenopausal cases).

CONCLUSION

BPE have high correlation with breast cancer risk in both premenopausal and postmenopausal women, and BPEI have high correlation with breast cancer risk in postmenopausal women.

CLINICAL RELEVANCE/APPLICATION

The determination of thresholds associated with breast cancer risk could be helpful for accurate assessment of breast cancer risk.
Fibroadenoma Transformation and Upgrade to Phylloides Tumors Post Core-Biopsy: A Longitudinal Review of Fibroepithelial Spectrum Lesions (Station #2)

Jaron Chong MD (Presenter): Nothing to Disclose, Shaza Alsharif MD: Nothing to Disclose, Sarkis Meterissian: Nothing to Disclose, Benoit Delphin Mesurolle MD: Nothing to Disclose

PURPOSE
The purpose of this study was to evaluate the longitudinal follow-up patterns of core-biopsy diagnosed fibroadenomas and to conduct a cost-effectiveness utility analysis of post-biopsy ultrasound examinations.

METHOD AND MATERIALS
Core-biopsy diagnosed fibroadenomas from ultrasound and stereotactic guided breast biopsies performed over a 6-year period (2008-2013) were identified. The complete clinical records of these patients was retrospectively analyzed to assess for the occurrence of lesion upgrade or transformation to a fibroepithelial or phylloides lesion. Analysis of follow-up practice behaviour was also performed to characterize the burden of post-biopsy follow-up examinations.

RESULTS
Of 754 core-biopsy diagnosed fibroadenomas, 125 (16.6%) demonstrated atypical characteristics involving hypercellularity, microcalcifications or adenosis, with 6 (0.8%) final diagnosis upgrade events identified. 5 typical fibroadenomas were upgraded to a benign phylloides and 1 atypical fibroadenoma was upgraded to a benign phylloides. For these lesions, the interval between fibroadenoma core-biopsy and full-excision diagnosis of a phylloides tumor was 39 - 479 days (mean 221.3 days). The final excisional size of upgraded lesions ranged from 1.5 - 4.6 cm (mean 2.9cm) and was not significantly different from non-upgraded lesions. Increase in size from previous was noted on 3 of the 6 lesions. Of the 748 non-upgraded lesions, 458 underwent a follow-up breast examination, and over 399 (53.3%) underwent a subsequent follow-up ultrasound, with the number of follow-up ultrasounds ranging from 1 to 8 (mean 2.1 examinations; total 829 examinations). Cost analysis of these post-biopsy ultrasound examinations, incurred potential estimated total costs of $82,900.

CONCLUSION
Upgraded re-classification of a fibroadenoma to a phylloides tumor post core-biopsy was a rare event. When upgrades did occur, suspicion due to growth was clinically evident or had atypia initially warranting aggressive investigation. In our case series, not performing lesion follow-up post core-biopsy diagnosis of fibroadenoma would have resulted in 6 missed diagnosis upgrades to benign phylloides out of 754 biopsies.

CLINICAL RELEVANCE/APPLICATION
Long-term follow-up of core biopsy proven fibroadenomas yielded rare upgraded diagnoses or transformations. Further investigation into the role for limited follow-up guidelines post core-biopsy is warranted.

Preliminary Assessment of the Potential Clinical use of Three-dimensional Mammographic Density (Quantra) for Risk Management in an Asian Screening Cohort (Station #3)

Jeon-Hor Chen MD (Presenter): Nothing to Disclose, Tsung-Lung Yang MD: Nothing to Disclose, Chen-Pin Chou MD: Research funded, Hologic, Inc., Huei-Lung Liang: Nothing to Disclose, Jer-Shyung Huang MD: Nothing to Disclose, Min-Ying Su PhD: Nothing to Disclose, Huay-Ben Pan MD: Support, Hologic, Inc

PURPOSE
Limitations of 2D area-based measures of breast density have led to the development of volumetric measures of breast density. Despite of the development of these new analysis tools, still it is not known how the acquired density results from the four views of the mammography should be interpreted. The purpose of this study was to evaluate the volumetric density data and explore how the density results can be used for future risk management.

METHOD AND MATERIALS
In a period of 7 months, a total of 2450 women who received mammographic screening and had complete four views (CC and MLO from bilateral breasts) studies were analyzed. The breast density assessment was based on a three dimensional (3D) volumetric tool (Quantra, Hologic), which provides an objective estimate of the total volume of fibroglandular tissue as well as the total volume of the breast. The 3D volume density (Vbd) acquired in the four views in each subject were compared.

RESULTS
The mean absolute and percent difference of Vbd between CC and MLO views was 2.8±3.0% and 23.8±22.8% in left the breast, and 2.9±3.2% and 24.7±23.9% in the right breast. A good correlation existed between the two views in each breast (r=0.84 for the left breast and r=0.83 for the right breast). The Vbd was also well correlated between LCC vs. RCC (r=0.86) and LMLO vs. RMLO (r=0.84). Remarkable discrepancy of Vbd between CC and MLO views was, however, noted in 11.9% of subjects in the right breast, and 11.2% of subjects in the left breast, showing >50% difference of Vbd, and in 28.9% of subjects in the right breast, and 28.5% of subjects in the left breast, showing >30% difference of Vbd. Percentage of discrepancy decreased remarkably for subjects with dense breast (Vbd >20%).

CONCLUSION
Our preliminary analysis showed that despite Vbd was well-correlated between CC and MLO views of each breast, and the left and right breasts in general, many women did show high discrepancy of intra-subject density results.

**CLINICAL RELEVANCE/APPLICATION**

Volumetric density analysis tools are increasingly being used for quantification of breast density. Before the 3D density tools can be applied for risk prediction or management, there is an urgent need to investigate the factors accounting for the inconsistent measurements among the four views of the same subject.

**BRS288**

**Associations between Body Mass Index and Breast Density: Implications for Breast Cancer Risk Assessment (Station #4)**

Brad M. Keller PhD (Presenter): Nothing to Disclose, Anne Marie McCarthy: Nothing to Disclose, Jinbo Chen PhD: Nothing to Disclose, Nigel Sloan Bristol: Nothing to Disclose, Marie Synnestvedt: Nothing to Disclose, Emily F. Conant MD: Scientific Advisory Board, Hologic, Inc, Despina Kontos PhD: Nothing to Disclose

**PURPOSE**

We investigate the association between measures of area and volumetric breast density and body mass index (BMI) in a large cohort of women screened with digital mammography. Understanding the magnitude and directionality of this association can aid in the assessment of confounding by BMI on the association between breast density and breast cancer risk.

**METHOD AND MATERIALS**

We retrospectively collected and analyzed digital mammograms from a total of 3041 women (mean age 56.9y±10.9y) who had recorded BMI measures and raw ("For Processing") images available from a total of 10751 consecutive women screened for breast cancer over the course of one year at our institution (2010-11). A previously-validated fully-automated software algorithm developed at our institution was used to generate per-woman estimates of absolute dense area and area percent density. Volumetric estimates of absolute and percent dense tissue were obtained using FDA-cleared software (Quantra™, Hologic, Inc). The Pearson correlation (r) was used to assess the association between the breast density measures and BMI, and the coefficient of determination (R2) was used to determine the percentage of breast density variation explained by age and race-adjusted BMI.

**RESULTS**

BMI has a moderate, negative association with percent area (r=-0.34, p<0.001) and percent volume density (r=-0.31, p<0.001), a moderate positive association with absolute dense volume (r=0.47, p<0.001) and a weak association with absolute dense area (r=0.08, p<0.001). After adjustment for age and race, the strongest overall association is between BMI and absolute dense tissue volume (R2=0.26).

**CONCLUSION**

Breast density is significantly associated with BMI; however, only up to 26% of the observed differences in breast density between women can be attributed to differences in their BMI, age and race. Furthermore, given the negative association between percent density measures and BMI, yet their positive associations with risk, not considering BMI likely leads to an underestimation of the risk for breast cancer due to a woman's breast percent density.

**CLINICAL RELEVANCE/APPLICATION**

A woman's BMI should be routinely collected and incorporated into risk assessment models, especially when also using breast density, in order to more accurately measure risk for breast cancer.

**BRS289**

**Comparison of the Clinical, Imaging, and Histopathologic Features of Screen Detected vs Interval Cancers on Breast MRI (Station #5)**

Sarah Stamler MD (Presenter): Nothing to Disclose, Janice S. Sung MD: Nothing to Disclose, Christopher E. Comstock MD: Nothing to Disclose, D. David Dershaw MD: Nothing to Disclose, Kirti Magudia PhD: Nothing to Disclose, Elizabeth A. Morris MD: Nothing to Disclose

**PURPOSE**

To compare the clinical, imaging and histopathologic features of MRI screen detected (SCA) and interval cancers (IC).

**METHOD AND MATERIALS**

Retrospective review of 28,061 breast MRIs performed between 2005-2010 identified 120 SCA and 48 IC (cancer diagnosed within 364 days after a negative MRI). Medical records were reviewed for age at diagnosis, risk factors (family or personal history of breast cancer, BRCA status, prior high risk lesion), and tumor histopathology. For IC, the method and time interval from the negative MR were determined. Statistical analysis was performed using Prism software (GraphPad Software). The unpaired t and one-way ANOVA tests were performed to determine p-values.

**RESULTS**

Median age at diagnosis was 53 years for SCA and 50 years for IC. IC were not associated with any risk factor or tumor subtype (p>0.36). Mean size of invasive cancers was 0.8 cm for SCA and 0.7 cm for IC. SCA were highly associated with invasive cancers (SCA: 87/120, 73%, IC: 18/48, 37%, p
CONCLUSION
Screening MRI preferentially detects invasive cancers and intermediate and high grade DCIS. Most IC after a negative MRI are detected as mammographic calcifications, representing low to intermediate grade DCIS. No clinical or histopathologic features are associated with the development of IC.

CLINICAL RELEVANCE/APPLICATION
Tumor biology of MRI SCA differ from IC. Women undergoing breast cancer screening with mammography and MRI may benefit from alternating screening at 6 month intervals, regardless of BRCA status.

BRE158
Beyond Gynecomastia: Less Common Entities in Male Breast Disease — A Pictorial Review (Station #6)
Lilian Wang MD (Presenter): Nothing to Disclose

TEACHING POINTS
The aim of this exhibit is to review the clinical presentation, imaging features, and management of less common entities in male breast disease.

TABLE OF CONTENTS/OUTLINE
Review anatomy of the male breast. Briefly discuss diagnostic evaluation of the symptomatic male patient and more common entities of gynecomastia and male breast cancer. Multimodality pictorial review with pathologic correlation for less common entities in male breast disease: diabetic mastopathy myofibroblastoma epidermal inclusion cyst Poland syndrome lipoma edema secondary to ESRD papillary carcinoma DCIS metastatic melanoma Review current literature on epidemiology, imaging findings, and management for each entity.

BRE129
Diagnostic Breast Tomosynthesis: Should We Dispense of Conventional Diagnostic Mammography Views? (Station #7)
Deanna Lynn Lane MD (Presenter): Nothing to Disclose, Monica Liwen Huang MD: Nothing to Disclose, Marion Elizabeth Scoggins MD: Nothing to Disclose, Beatriz E. Adrada MD: Nothing to Disclose, Basak Erguvan Dogan MD: Nothing to Disclose

TEACHING POINTS
Tomosynthesis helps characterize lesion margins and may increase diagnostic accuracy for noncalcified masses, distortions, and asymmetries. Lesions may appear to resolve on conventional spot compression views, but can be identified as true lesions on tomosynthesis. Tomosynthesis can define the accurate location of lesions seen on only a single conventional mammographic view. In some cases, tomosynthesis may obviate the need for multiple mammographic images obtained during conventional diagnostic work-up and result in radiation dose-reduction. Diagnostic tomosynthesis may resolve pseudolesions on BIRADS-0 screening callbacks and obviate the need for sonography in some cases.

TABLE OF CONTENTS/OUTLINE
Review basic principles of digital breast tomosynthesis Case-based presentation to illustrate the use of tomosynthesis in the diagnostic setting. Case examples will include: Tomosynthesis used for diagnostic workup of BIRADS 0 screen callback cases, particularly for architectural distortions, noncalcified masses, and focal asymmetries. Lesions visualized on tomosynthesis, but occult or less conspicuous on conventional spot compression. Imaging features of these lesions will be reviewed, and pathologic correlation will be included. Lesions seen in a single mammographic view, but accurately localized by tomosynthesis.

BRE148
Interpretation of Breast MRI Utilizing the BI-RADS 5th Edition Lexicon: How Are We Doing and Where Are We Headed? (Station #8)
Kyungmin Shin MD (Presenter): Nothing to Disclose, Kanchan Phalak MD: Nothing to Disclose, Anthony Sam Hamame MD: Nothing to Disclose, Mahdieh Parizi MD: Nothing to Disclose

TEACHING POINTS
1. Understanding the role of breast MRI (i.e. screening, diagnosis, and problem solving)
2. Review the new BI-RADS 5th edition lexicon for breast MRI with pictorial examples
3. Review the changes and new descriptors from the BI-RADS 4th edition to the 5th edition
4. To understand how appropriate utilization of BI-RADS 5th edition lexicon could help with interpretation of breast MRI and its clinical application

TABLE OF CONTENTS/OUTLINE
Role of breast MRI • high risk screening • problem solving • extent of disease evalution • implant evulation • others BI-RADS 5th edition lexicon for breast MRI with pictorial examples • Amount of tissue and background enhancement • Focus • Mass • Non-mass enhancement • Non-enhancing findings • Fat containing lesions • Skin lesion • Intramammary lymph node • Associated features • Kinetic curve assessment • Implants Changes in lexicon from the BI-RADS 4th to the 5th edition and what is new on the 5th edition Current and future directions of breast MRI and summary Brief quiz for reinforcement of appropriate use of the BI-RADS 5th edition lexicon for breast MRI
**Association between Oncotype Dx® Breast Cancer 21-gene Assay Recurrence Score and Computer-derived Imaging Features (Station #1)**

*Elizabeth J. Sutton MD (Presenter): Nothing to Disclose, Jung Hun Oh PhD: Nothing to Disclose, Britanny Dashevsky MD, DPhil: Nothing to Disclose, Harini Veeraraghavan: Nothing to Disclose, Joseph Owen Deasy PhD: Nothing to Disclose, Elizabeth A. Morris MD: Nothing to Disclose, Aditya Prakash Apte PhD: Nothing to Disclose, Girard Gibbons BA: Nothing to Disclose*

**PURPOSE**

Oncotype Dx® Breast Cancer 21-gene Assay Recurrence Score (RS) is used clinically in early stage estrogen receptor (ER) positive breast cancer to quantify (range 0-100) the likelihood (increased with score) of recurrence and magnitude of chemotherapy benefit. The purpose of this study was to investigate the association between Oncotype Dx® RS and texture features extracted from magnetic resonance imaging (MRI).

**METHOD AND MATERIALS**

This retrospective study received institutional review board approval and need for informed consent waived. Between 2006-2012, we identified women with: a) ER+, progesterone receptor positive (PR+) and HER2 negative invasive ductal carcinoma (IDC); b) Preoperative breast MRI; c) Oncotype Dx® RS. Clinical and pathologic data were collected. Tumors were contoured on the fat-suppressed T1-weight pre- and three post-contrast images. Shape-, texture- and histogram-based features were extracted using in-house software (Computational Environment for Radiological Research). Linear regression analysis was performed to investigate the association between Oncotype Dx® RS and different clinical, pathologic and imaging features.

**RESULTS**

Ninety-five ER+, PR+ and HER2- patients were included in the study sample with a median Oncotype Dx® RS of 16 (range 0-45). The median follow-up time was 33.3 months (range: 0.2-57.3 months) and at the end of follow-up, no patients had recurred or died. In univariate linear regression analysis, three features significantly correlated with Oncotype Dx® RS: nuclear grade and two kurtosis features with p=0.0105, 0.0056, and 0.0005, respectively. Using these three features, multiple linear regression analysis was performed, resulting in significant correlation with Oncotype Dx® RS with R-squared = 0.228 (p = 0.0002) and Spearman’s rank correlation coefficient = 0.485 (p < 0.0001).

**CONCLUSION**

IDC computer-derived imaging features correlate with Oncotype Dx® RS suggesting, that these are image-based biomarkers that reflect the likelihood of recurrence and magnitude of chemotherapy benefit. Further investigation on larger datasets is necessary to validate this observation.

**CLINICAL RELEVANCE/APPLICATION**

Computer-derived imaging features significantly correlate with Oncotype Dx® RS, which is a clinically validated genetic test that directs treatment.

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**Voxel-Wise Correlations of Glucose Uptake and Intra-voxel Incoherent Motion Parameters from Simultaneous MR/PET in Locally Advanced Breast Cancer (Station #2)**


**PURPOSE**

Diffusion-weighted MRI (DWI) and FDG-PET have strong track records in the setting of breast cancer, but their intratumoral interrelationship is not completely understood. In a simultaneous MR/PET system, we derive intra-voxel incoherent motion (IVIM) diffusion and perfusion metrics and compare them with spatially correlated FDG SUV values in breast cancer patients.

**METHOD AND MATERIALS**

In this IRB approved, HIPAA compliant study, we imaged 17 women with histologically proven invasive cancers on a 3T Siemens Biograph mMR MR/PET system immediately following the patients' whole body PET/CT without additional FDG injection. Concurrent with FDG-PET, we acquired DWI using a prototype fat-suppressed, twice-refocused spin echo EPI sequence with eddy-current distortion correction and 10 b-values (0 to 800 s/mm²), followed by Gd-DTPA contrast agent and T1-weighted imaging. DWI and PET volumetric images were independently registered to the post-contrast T1 and resampled to its matrix and resolution. DWI were fit voxelwise to a bi-exponential IVIM model to derive tissue diffusion ($D_t$) and perfusion fraction ($f_p$). Pearson correlation coefficients for SUV vs. $D_t$ and SUV vs. $f_p$ were derived for each lesion. SUV and diffusion/perfusion relationships were visualized using correlated 2D histogram analysis.
RESULTS
The relationships between SUV vs. DT/fp were individually distinct, but most fell into two categories: Type A (N=6, SUV vs. DT negative correlation, SUV vs. fp positive or no correlation) and Type B (N=6, SUV vs. DT showing a DT limit, and SUV vs. fp a negative correlation). The remaining 5 cases were too small or heterogeneous to be classified. The Pearson’s r values reflect these visual correlations. Type B cases were more likely than Type A’s to be metastatic (80% vs. 50%) and Type B’s had a higher Ki-67 expression (55% vs. 36%).

CONCLUSION
Co-registration of DWI and PET imaging in breast cancer has revealed diverse relationships between diffusion, perfusion, and glucose uptake on an intra-lesion level which can be visualized using a correlated 2D histogram and each lesion broadly typed. Further correlation with clinical data may reveal more connections between 2D histograms and prognostic factors or clinical endpoints.

CLINICAL RELEVANCE/APPLICATION
The spatial correlation of tumor metabolism with microstructural markers via PET and DWI betters understanding of lesion heterogeneity and how it relates to disease aggression and prognosis.

BRS292
Utility of MRI for Assessment of BI-RADS Category 4 Findings Made in Screening Mammography and Screening Ultrasound (Station #3)
Kevin Strobel MD, PhD (Presenter): Nothing to Disclose, Nienke Lynn Hansen MD: Nothing to Disclose, Alexandra Barabasch MD: Nothing to Disclose, Simone Schrading MD: Nothing to Disclose, Christiane Katharina Kuhl MD: Nothing to Disclose

PURPOSE
We investigated whether breast MRI can be used for non-invasive assessment of findings categorized as BI-RADS-4 on screening-mammography or ultrasound.

METHOD AND MATERIALS
IRB-approved prospective study on 340 patients with 353 screening-mammography or screening-US-findings which, after appropriate conventional work-up, had been categorized as BI-RADS-4. Women then underwent standard DCE-MRI for further assessment. Women who, after a negative/benign MRI, did not proceed to biopsy did undergo intensified follow-up for at least 18 months; pure clustered microcalcifications (PCM) were followed for at least 24 months.

RESULTS
Of the 353 study-findings, 66 (18.7%) were finally shown to be true-positive (23 DCIS, 43 invasive), and 287 (81.3%) false-positive. MRI-assessment correctly diagnosed absence of breast-cancer in 264/287 (92%) study-findings without breast-cancer, and confirmed presence of breast-cancer in 63/66 malignancies. False-negative-rate for PCM was 12% (3/25) due to 3 non-enhancing low-grade-DCIS; in turn, MRI detected additional invasive-cancers in 3 women whose BI-RADS-4 study-findings had been false-positive (benign). For mammographic findings other than PCM, MRI increased the PPV from 17.5% (21/120) to 77.8% (21/27), with a false-negative-rate of zero. For all US-findings, MRI increased the PPV from 12.9% (20/155) to 69.0% (20/29), again with a false-negative-rate of zero. MRI caused false-positive findings that required MR-guided-biopsy in 5 participants (5/340, 1.5%).

CONCLUSION
MRI is useful for non-invasive work up of mammographic or ultrasound BI-RADS-4 findings, and can avoid 92% of unnecessary biopsy-procedures. For all ultrasound-findings and for all mammographic-findings except for PCM, the false-negative-rate was zero, and additional invasive cancers were identified in 3 women whose BI-RADS-4 study-findings had been false-positive.

CLINICAL RELEVANCE/APPLICATION
MRI appears to be a reliable method to demonstrate absence, as well as confirm presence of breast cancer in women with possibly malignant findings on screening mammography and/or screening ultrasound, at least for findings not due to pure clustered microcalcifications.

BRS293
Feasibility of Fully-Automated Breast Density Reporting in a Large Academic Center: Prospective Data from a One-Year Screening Cohort (Station #4)
Brad M. Keller PhD (Presenter): Nothing to Disclose, Jinbo Chen PhD: Nothing to Disclose, Nigel Sloan Bristol: Nothing to Disclose, Meng-Kang Hsieh: Nothing to Disclose, Shonket Ray PhD: Nothing to Disclose, Marie Synnestvedt: Nothing to Disclose, Emily F. Conant MD: Scientific Advisory Board, Hologic, Inc, Despina Kontos PhD: Nothing to Disclose

PURPOSE
Breast density assessment is known to be subject to substantial intra- and inter-reader variability. Given the increased legislation mandating routine reporting of breast density, we evaluate the feasibility of fully-automated breast density assessment in a large screening cohort.

METHOD AND MATERIALS
We report data from 10,751 screening mammography exams from an entire one-year cohort at our institution
RESULTS

Both the absolute area and PD% automated measures demonstrate high reproducibility with a strong bilateral per-woman correlation (r>0.93, p<0.001). Substantial agreement (k=0.63; p<0.001; CI: 0.62-0.60) is observed between the algorithm-estimated and radiologists' BI-RADS density scores, which is in range of previously reported inter-radiologist agreement in the literature. The automated BI-RADS density estimate is also a significant predictor of recall (OR: 1.17 per increasing density category; test-for-trend p=0.002), as were age (p<0.001) and the availability of prior mammograms (p<0.001).

CONCLUSION

Fully-automated analysis of "For Presentation" digital mammograms can be used to obtain reproducible measures of both continuous and categorical breast density estimates. This could be of particular use when "For Processing" images are not routinely available for analysis.

CLINICAL RELEVANCE/APPLICATION

Accurate and reproducible breast density estimation using fully-automated software may be feasible for large-volume breast screening centers for the purpose of standardized density reporting.

BRS294

Getting Worked Up Over Nothing: Strategies to Further Reduce False Positives from Tomosynthesis Screening Mammography (Station #5)

Liane Elizabeth Philpotts MD (Presenter): Nothing to Disclose, Sarah Lyla Steenbergen MD : Nothing to Disclose, Jaime Lynn Geisel MD : Consultant, Siemens AG, Liva Andrejeva-Wright MD : Nothing to Disclose, Madhavi Raghu MD : Nothing to Disclose, Melissa Angeline Durand MD : Nothing to Disclose, Paul H. Levesque MD : Nothing to Disclose

PURPOSE

Tomosynthesis is a more accurate mammogram resulting in fewer false positives. The purpose of this study was to review recalls from screening tomosynthesis exams to determine which findings represent true lesions and which remain false positives to further refine what constitutes a necessary tomosynthesis recall.

METHOD AND MATERIALS

A retrospective review of the breast imaging database was performed to identify all BIRADS 0 (n=295) from 2936 screening (combination 2D and tomosynthesis) exams during a 6 month period (7/1/13 - 12/31/13); recall rate 8.4%. All non-calcification cases (n=157) were retrospectively reviewed on a dedicated workstation by 2 radiologists, with >2 years tomosynthesis experience and the lowest recall rates, who were blinded to further diagnostic imaging and biopsy. The 'lesions' in question were assessed for mammographic finding (mass, asymmetry, architectural distortion), seen on 2D (CC, MLO, or both), seen on tomo (CC, MLO, or both), assessment as a true lesion or not, and forced BIRADS and probability of malignancy (1-100%). The outcome after diagnostic work up, and biopsy (if relevant), determined if cases proving to be false positives (BR 1 or 2) could have been prospectively identified.

RESULTS

The forced BIRADS was 61% BR1/2, 24% BR3, 15% BR4/5. After diagnostic workup, the final BIRADS assessment was: 70 (45%)BR1/2, 67 (42%)BR3, 20 (13%) BR4/5. Biopsy was performed in 20 cases revealing 8 cancers. All 8 malignancies presented as masses (7) or architectural distortion (1) and were correctly identified and scored as BIRADS 4b, 4c or 5 on the forced assessment. 36% of cases were felt to be not real on forced assessment (79 % focal asymmetries, 21 % architectural distortion and 83% seen in neither or only 1 view), all of which were benign on final, most (91%) showing normal tissue.

CONCLUSION

Careful assessment of tomosynthesis screening images permits a high level of confidence in both identifying malignancies and judging normal tissue. Many tomosynthesis recalls could potentially have been avoided.

CLINICAL RELEVANCE/APPLICATION

Even with experience, false positives still occur from tomosynthesis screening as radiologists may have varying levels of confidence in reviewing tomosynthesis images. This study suggests that false positive recalls on screening tomosynthesis can be reduced, in turn reducing unnecessary radiation and cost as well as patient time.

BRE180

Diagnostic Algorithm of Nipple Discharge: All a Radiologist Should Know (Station #6)

Flavia Beatriz Sarquis MD (Presenter): Nothing to Disclose, Karina Pesce : Nothing to Disclose, Bernardo Oscar Blejman MD : Nothing to Disclose, maria jose chico : Nothing to Disclose, Vanina Kuznicki : Nothing to Disclose, Graciele Fernandez Alonso : Nothing to Disclose

TEACHING POINTS

1. False Positive Rate should be 5% or less by population.
2. All abnormal discharge should be investigated.
3. 2D mammography is a useful tool in nipple discharge.
1 - To list the different causes of breast discharge 2 - To describe the differential diagnosis of abnormal nipple discharge 3 - To review the radiological features of nipple discharge and establish the radiopathological correlation 4 - To learn the systematization of the ultrasound technique to assess secretion Nipple 5 - To discuss the diagnostic algorithm in patients with nipple discharge.

TABLE OF CONTENTS/OUTLINE

1 - Introduction 2 - Anatomy of the mammary gland and ducts 3 - Pathophysiology The pathophysiology of spills there are two steps: 1) the production of abnormal fluid (abnormal due to their characteristics, conditions or time of occurrence); 2) the liquid outlet to the outside. 4 - Etiology: 1) Physiological 2) Pathologic 5 - Diagnostic algorithm of nipple discharge. 6 - Mammographic findings in nipple discharge 7 - Ultrasound technique to evaluate nipple discharge 8 - Ultrasound appearance of the different causes of nipple discharge. 9 - Limitations of ultrasound: a) False positives b) False Negatives 10 - Clinical and cytological classification 11 - Clinical Cases 12 - Conclusions

BRE167

That Was Then This Is Now: A Pictorial Review Of Changes In BI-RADS 5th Ed (Station #7)

Ajay A. Rao, MD : Nothing to Disclose, Jade De Guzman, MD : Nothing to Disclose, Aritra Dey, BS : Nothing to Disclose, Youn Jeong Kim, MD : Nothing to Disclose, Haydee Ojeda-Fournier, MD (Presenter): Nothing to Disclose

TEACHING POINTS

Standardized terminology, report organization and assessment structure allows radiologists to communicate breast imaging findings with referring physicians in a clear and succinct manner. The much awaited American College of Radiology BI-RADS Atlas 5th edition was released in February 2014. Since the 4th edition was released more than 10 years ago, it may be difficult to remember all the specific changes in the 5th edition. While the majority of changes represent re-organization and consolidation of terms, there are also new descriptors in the lexicon. At the end of this educational exhibit the learner will: 1. Understand the changes to BI-RADS 5th edition. 2. Review those changes with imaging correlation on mammography, US and MRI. 3. Have an opportunity for self assessment with an interactive case review.

TABLE OF CONTENTS/OUTLINE


MSCB51

Case-based Review of Breast (An Interactive Session)

Multisession Courses

DM BR 3 ONLY

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 1:30 PM - 3:00 PM Location: S100AB

Sub-Events

MSCB51A

Screening: Digital Mammography and Tomosynthesis

Helen Anne D’Alessandro, MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To review the current role of screening digital mammography and tomosynthesis. 2) To demonstrate digital mammography and tomosynthesis use for evaluating screening callbacks of masses, calcifications, architectural distortion and summation artifacts. 3) To discuss tomosynthesis for decreasing callback rates, evaluating extent of disease and increasing cancer detection rates.

ABSTRACT

This case based review will demonstrate digital mammography and tomosynthesis use for evaluating callbacks of masses, calcifications, architectural distortion and summation artifacts. Practical considerations of digital mammography and tomosynthesis will also be discussed, including the effect of digital tomosynthesis on screening callback rates, evaluating extent of disease and increasing cancer detection rates.

MSCB51B

Supplemental Screening

Janice S. Sung, MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To review the various imaging modalities including MRI, ultrasound, and contrast enhanced digital mammography that are available as supplemental screening modalities. 2) To understand the clinical evidence supporting the use of these imaging modalities. 3) To discuss the advantages and disadvantages of each
modality.

**ABSTRACT**

This talk will focus on the various imaging modalities that are available for supplemental screening for intermediate and high risk patients, including ultrasound, MRI, and contrast enhanced digital mammography. The clinical evidence supporting their use for supplemental screening will be reviewed. The advantages and disadvantages of each modality will also be reviewed during this case based session.

**MSCB51C**

**Evaluating the Symptomatic Patient**

Catherine Margaret Appleton MD (Presenter): Consultant, Hologic, Inc Consultant, Biomedical Systems

**LEARNING OBJECTIVES**

1) To understand the clinical presentation of benign and malignant breast conditions. 2) To review current guidelines for evaluating the symptomatic patient. 3) To discuss specific imaging approaches for evaluating breast symptoms.

**MSCB52**

**Case-based Review of Breast (An Interactive Session)**

*Multisession Courses*

**Sub-Events**

**MSCB52A**

**Percutaneous Breast Biopsies**

Wendy Burton Demartini MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the advantages and limitations of percutaneous breast biopsy. 2) Compare the different potential methods of core needle biopsy. 3) Apply techniques for the biopsy of routine and challenging cases using mammography, ultrasound and MRI guidance.

**MSCB52B**

**Post biopsy Radiologic-Pathologic Correlation**

Sughra Raza MD (Presenter): Consultant, Seno Medical Instruments, Inc

**LEARNING OBJECTIVES**

1) The importance of following up on and communicating pathologic results of image-guided breast biopsies. 2) How to determine if a pathologic result is concordant or discordant with imaging. 3) When to recommend repeat core biopsy or surgical excision based on the biopsy result.

**MSCB52C**

**Performance Measures**

Janie M. Lee MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify the data to be collected and calculate performance measures for the basic clinically relevant breast imaging audit. 2) Compare audit results with appropriate performance benchmarks. 3) Understand additional data and calculations needed to perform a comprehensive breast imaging audit.

**RC715**

**Digital Breast Tomosynthesis**

*Refresher/Informatics*
Sub-Events

RC715A  Basics and Implementation
Catherine Margaret Appleton MD (Presenter): Consultant, Hologic, Inc Consultant, Biomedical Systems

LEARNING OBJECTIVES

1) Understand the challenges and potential pitfalls of implementing tomosynthesis in a clinical practice. 2) Review options for technical and interpretive workflow including issues related to patient selection, and screening versus diagnostic use. 3) Recognize the importance of referring physician and patient education in the implementation process: the pros and cons including radiation dose.

ABSTRACT

This presentation will outline considerations, and pro-active strategies for successful implementation of digital breast tomosynthesis into clinical practice. The significance of patient and referring clinician education will be discussed. Workflow challenges including interpretation time and patient selection will be discussed.

RC715B  Clinical Utility of Digital Breast Tomosynthesis
Laurie Lee Fajardo MD, MBA (Presenter): Scientific Advisory Board, Hologic, Inc Scientific Advisory Board, Koninklijke Philips NV

LEARNING OBJECTIVES

1) Review scientific literature on the performance of digital breast tomosynthesis in diagnostic and screening environments. 2) Review patterns of benign and malignant disease; provide tools to better discriminate “actionable” findings. 3) Apply digital breast tomosynthesis effectively to reduce false positives and false negatives and increase breast cancer detection.

ABSTRACT

This presentation will demonstrate approaches to the interpretation of digital breast tomosynthesis to cultivate a greater understanding of its use in both diagnostic and screening environments and the scientific evidence supporting each. Strategies and approaches to interpreting digital breast tomosynthesis will be discussed.

RC715C  Difficult Cases
Steven P. Poplack MD (Presenter): Research Grant, Hologic, Inc

LEARNING OBJECTIVES

1) Recognize the non-calcified mammographic finding types that are more difficult to detect using Digital Breast Tomosynthesis. 2) Identify one important potential cause of Falsely Negative Digital Breast Tomosynthesis. 3) Comprehend management strategies for abnormalities that are only visible on Digital Breast Tomosynthesis.

ABSTRACT

This case-based presentation is intended to familiarize the audience with some of the limitations and challenges in the interpretation of Digital Breast Tomosynthesis.
Mammography Perspective

Douglas E. Pfeiffer MS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the history and development of mammographic imaging equipment. 2) Understand the impact of equipment development on testing protocols. 3) Understand the impact of equipment development on regulation.

ABSTRACT

Mammographic imaging has undergone tremendous change since its inception. Rapid development from screen-film imaging to nearly universal acceptance of digital imaging has required a shift in testing methodology. This talk will briefly introduce the developments that have taken place and discuss the impact that this development has had on testing and regulation.

Mammography 1.0

Melissa Carol Martin MS (Presenter): Nothing to Disclose, Eric A. Berns PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Current requirements for Quality Control for Hologic Digital Mammography Units. 2) Current requirements for Quality Control for General Electric Digital Mammography Units. 3) Current requirements for Quality Control for Fuji Computed Radiography for Mammography Units. 4) Current requirements for Quality Control for Printers used with Digital Mammography Units. 5) Current requirements for Quality Control for Monitors used with Digital Mammography Units.

Mammography 2.0

Andrew Karellas PhD (Presenter): Research collaboration, Koning Corporation

LEARNING OBJECTIVES

1) To provide an overview of how the Medical Physicist can prepare for the future of clinical mammography physics. 2) To provide a landscape of mammography imaging technologies. 3) To describe methods of image quality metrics, dose reduction, and quality control in relation to mammography technologies. 4) To describe the future roles of the Medical Physicist in clinical mammography physics.

MR Imaging-guided Breast Biopsy (Hands-on Workshop)

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 4:30 PM - 6:00 PM   Location: E260

Participants

Amy Denise Argus MD (Presenter): Advisory Board, Devicor Medical Products, Inc
Wade Christian Hedegard MD (Presenter): Nothing to Disclose
Christiane Katharina Kuhl MD (Presenter): Nothing to Disclose
Wendy Burton Demartini MD (Presenter): Nothing to Disclose
W. Phil Evans MD (Presenter): Scientific Advisory Board, VuCOMP, Inc
Jennifer Ruth Cranney MD (Presenter): Nothing to Disclose
Amy L. Kerger DO (Presenter): Nothing to Disclose
Colleen H. Neal MD (Presenter): Nothing to Disclose
Michael Patrick McNamara MD (Presenter): Stockholder, Apple Inc Stockholder, General Electric Company
Carol M. Dell MD (Presenter): Nothing to Disclose
Mitva J. Patel MD (Presenter): Nothing to Disclose
Candice W. Bolan MD (Presenter): Nothing to Disclose
Kathleen R. Gundy MD (Presenter): Nothing to Disclose
Christopher Patrin Ho MD (Presenter): Nothing to Disclose
Roberta A. Jong MD (Presenter): Nothing to Disclose
Hiroyuki Abe MD (Presenter): Consultant, Seno Medical Instruments, Inc
Karla A. Sepulveda MD (Presenter): Nothing to Disclose
Kirti Manohar Kulkarni MD (Presenter): Nothing to Disclose
Andrew Bowman MD, PhD (Presenter): Nothing to Disclose
Stamatia V. Destounis MD (Presenter): Investigator, FUJIFILM Holdings Corporation Investigator, Seno Medical Instruments, Inc
Su-Ju Lee MD (Presenter): Spouse, Stockholder, General Electric Company
Michelle V. Lee MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Establish criteria for MR Image-guided breast biopsy patient selection. 2) Cultivate a working understanding of MR Image-guided biopsy and needle localization instrumentation and implementation. 3) Basic MR Image-guided biopsy and needle localization parameters and requirements for appropriate coil, needle and approach selection. 4) Discuss practice integration issues. 5) Benefits and limitations of availability of MR Image-guided biopsy/needle localization in your practice.

ABSTRACT

This course is intended to provide both basic didactic instruction and hands-on experience in the application of MRI guided breast biopsy. MRI provides greater sensitivity for detecting breast cancer compared with mammography and ultrasound, although with imperfect specificity. MRI guided biopsy is required to confirm or exclude malignancy for MRI only findings. This course will be devoted to the understanding and identification of the following pertaining to MRI guided biopsy: 1) appropriate patient selection 2) optimal positioning for biopsy 3) target selection and confirmation 4) various biopsy technologies and techniques 5) potential problems and pitfalls.

RC752

US-guided Interventional Breast Procedures (Hands-on Workshop)

Refresher/Informatics

US TR BR US IR BR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 4:30 PM - 6:00 PM Location: E264

Participants

Jocelyn A. Rapelyea MD (Presenter): Research Consultant, Siemens AG Consultant, General Electric Company
Margaret M. Szabunio MD (Presenter): Nothing to Disclose
Liane Elizabeth Philpotts MD (Presenter): Nothing to Disclose
Shambhavi Venkataraman MD (Presenter): Nothing to Disclose
Angélique C. Floerke MD (Presenter): Nothing to Disclose
Rachel Frydman Brem MD (Presenter): Board of Directors, iCAD, Inc Board of Directors, Dilon Technologies LLC Stock options, iCAD, Inc Stockholder, Dilon Technologies LLC Consultant, U-Systems, Inc Consultant, Dilon Technologies LLC Consultant, Dune Medical Devices Ltd
Karen S. Johnson MD (Presenter): Research Consultant, Siemens AG
Nicole Sondel Lewis MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the equipment needed for ultrasound guided interventional breast procedures. 2) Review the basic principles of ultrasound guidance and performance of minimally invasive breast procedures. 3) Practice hands-on technique for ultrasound guided breast interventional procedures.

ABSTRACT

This course is intended to familiarize the participant with equipment and techniques in the application of US guided breast biopsy and needle localization. Participants will have both basic didactic instruction and hands-on opportunity to practice biopsy techniques on tissue models with sonographic guidance. The course will focus on the understanding and identification of: 1) optimal positioning for biopsy 2) imaging of adequate sampling confirmation 3) various biopsy technologies and techniques 4) potential problems and pitfalls

RC815

Mammographic Interpretation

Refresher/Informatics

DM BR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Fri, Dec 5 8:30 AM - 10:00 AM Location: E450A

Sub-Events

RC815A

Analysis of Asymmetries and Distortions

Jessica Wai Ting Leung MD (Presenter): Speakers Bureau, Hologic, Inc Scientific Advisory Board, Hologic, Inc

LEARNING OBJECTIVES

1) Learn the definitions and types of asymmetries and architectural distortion identified at mammography. 2) Understand the imaging evaluation and clinical significance of asymmetries and architectural distortion identified at mammography. 3) Know the pathology correlation of asymmetries and architectural distortion identified at mammography.

ABSTRACT

Asymmetries and architectural distortion are challenging signs of malignancy at mammography.
Evaluation of Calcification

Michael N. Linver MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Distinguish major differences between typically malignant and typically benign calcifications on the mammogram. 2) Recognize the appearance of calcifications considered indeterminate in nature on mammography. 3) Develop strategies for followup and management of suspicious calcifications, including the role of other imaging modalities.

ABSTRACT

Calcifications on the mammogram are often the only clue to the presence of malignancy. The appearance of typically benign and malignant calcifications will be reviewed, as well as emerging concepts surrounding those associated with high grade and low grade malignancy, and the importance of distinguishing between these for further treatment and outcomes. Imaging techniques to maximize visualization of calcifications on the mammogram will be outlined. The evolving role of other imaging modalities in the followup and management of suspicious calcifications will also be discussed.

Management of High-risk Lesions

Jiyon Lee MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Define 'high-risk lesions'. 2) Present several of the most common high-risk lesions. 3) Discuss management of the entities presented.

ABSTRACT

The so-called 'high-risk lesions' occupy a gray-zone between benign and malignant diagnoses. They continue to merit discussion as their management can sometimes be confusing and institution-dependent. Adding to this confusion is the occasional addition to or name change among the existing pathological entities. In this session, we will present and discuss several of the most common 'high-risk' lesions and their management.

Breast Imaging (Multi-Modality Imaging)

Cost-Effectiveness of Screening Mammography in an Organized Program- A Modelling Study


PURPOSE

To examine the effect of screening regimen (age to begin and discontinue screening and interval between screens) on cost effectiveness and cost utility of screening in the context of modern imaging technology and therapies within an organized screening program as delivered in Canada

METHOD AND MATERIALS

We modified the validated University of Wisconsin CISNET Breast Cancer Simulation Model to estimate breast cancer incidence and mortality on an unscreened Canadian population. After calibrating the model using empirical data on the sensitivity and specificity of mammography, we calculated cancer incidence versus age and 'stage' for several screening scenarios and created a distribution of receptor positivity for hormone receptors and HER2. Outcomes for therapy, administered according to current practice guidelines, were predicted based on published data. For each scenario we calculated the number of breast cancers, deaths and years of life lost due to premature death. We factored the quality of life into our analysis by weighting with utilities and disutilities associated with various health states related to breast cancer, to express results in quality-adjusted life-years (QALY). We considered both the costs of screening and treatment to the health care system and the additional costs to society such as loss of productivity. Finally, we performed a sensitivity
analysis with respect to parameters associated with screening and costs of screening and therapy.

RESULTS

Compared to No Screening, routine screening provided mortality reductions of 20-50%. Evaluating outcomes in terms of life-years gained rather than lives saved shifted the benefit toward younger ages to begin screening. In general the more screens a woman had between ages 40 and 74, the greater the reduction in mortality and the more LYG and QALYs gained, but the greater the cost to the health care system, the number of abnormal recalls, negative biopsies and presumably the amount of overtreatment.

CONCLUSION

Screening reduces breast cancer mortality and is cost effective by modern standards ($70K-$100K/QALY). The cost of screening examinations is the largest single cost factor in a breast cancer care program, but the average total lifetime cost per woman for screening and care of $4000 is reasonable compared to other health interventions.

CLINICAL RELEVANCE/APPLICATION

The model provides guidance for optimizing effectiveness and use of resources in a screening program.

SST01-02

Relevance of Additional Mammography and Ultrasonography for Newly Diagnosed Breast Cancer Patients (BI-RADS 6)

Rosalind Pitpitan Candelaria MD (Presenter): Nothing to Disclose, Monica Liwen Huang MD : Nothing to Disclose, Beatriz E. Adrada MD : Nothing to Disclose, Wei Tse Yang MD : Researcher, Hologic, Inc

PURPOSE

This study aims to determine if repeat diagnostic mammography (DM) and ultrasonography (US) performed at a tertiary cancer referral center for patients with newly diagnosed breast cancer yields incremental cancer detection.

METHOD AND MATERIALS

An institutional review board-approved retrospective, single institution database review was performed on 1000 patients diagnosed with primary breast cancer from January 1, to December 31, 2010. All patients had DM and US at an outside institution prior to referral to our cancer center. Exclusion criteria were prior breast MRI/PET-CT, prior excisional surgical biopsy, neoadjuvant chemotherapy, or stage IV disease. Data collected included tumor size, nipple/chest wall/skin involvement, regional nodal involvement, multifocal/multicentric (MF/MC) and contralateral (CL) disease, and surgical treatment (segmentectomy or mastectomy). The gold standard for diagnosis of malignancy was biopsy cytopathology and histopathology.

RESULTS

Final analyses included 404 patients. Median patient age was 54 years, range 21 to 92; median tumor size 2.4 cm, range 0.4 to 18. A total of 147 breast biopsies were performed in 109 women; 211 nodal biopsies in 173 women. PPV3 (positive predictive value for biopsies) was 45%. Upon initial referral to our center, 353/404(87.4%) patients had unifocal (UF) disease, 22(5.4%) MC, 26(6.4%) MF, and 3(0.7%) CL. Repeat DM and US yielded 292/404(72.3%) patients with UF disease, 54(13.4%) MC, 49(12.1%) MF and 9(2.2%) CL. Surgical management changed from segmentectomy to mastectomy in 50/404(12.4%) patients. Additionally, 9.6%(5/52) stage 0, 39.2%(62/158) stage I, and 44.6%(33/74) stage II patients were upstaged leading to a total upstage rate of 25%(100/404 patients). Restaging was more likely for older patients compared to younger (p=0.004), African-American or Hispanic patients compared to Caucasian or Asian (p=0.0008), ER- patients compared to ER+ (p=0.02), and HER2+ patients compared to HER2- (p=0.004).

CONCLUSION

Repeat DM and US in newly diagnosed breast cancer patients in a tertiary cancer center yields significant incremental cancer detection which impacts locoregional treatment.

CLINICAL RELEVANCE/APPLICATION

Rigorous staging work-up with DM and US in dedicated breast imaging centers may reduce disease burden underestimation in breast cancer patients and contribute to cost minimization of health care delivery.

SST01-03

Developing Asymmetry on Mammography: Histopathologic Findings and Effect of Correlative MRI and US on Management

Allyson Louise Chesebro MD (Presenter): Nothing to Disclose, Catherine Streeto Giess MD : Nothing to Disclose, Nicole S. Winkler MD : Nothing to Disclose, Robyn L. Birdwell MD : Nothing to Disclose

PURPOSE

To determine outcomes for developing asymmetries on diagnostic mammograms and the impact of correlative ultrasound (US) and breast magnetic resonance imaging (MRI) on clinical management.
METHOD AND MATERIALS
IRB approved, retrospective review of our mammography database from 1/1/2009 to 12/31/2012 identified 2354 diagnostic mammograms classified as "focal asymmetry", 521 with prior studies and prospectively classified as BIRADS 0, 3, 4, or 5. Retrospective image review of these 521 studies identified 202 developing lesions that met the BIRADS definition of asymmetry (one view) or focal asymmetry (two view), henceforth collectively "developing asymmetries". Patient demographics, correlative US and MRI, and outcomes were obtained from the longitudinal medical record.

RESULTS
Mean patient age was 56 years (range 31-82). 187/202 (92.6%) had targeted US with 75 correlates, 3 equivocal correlates, and 109 without correlate. BIRADS assessment after diagnostic mammography included 21 BIRADS 0, 121 BIRADS 3, and 60 BIRADS 4 or 5. An MRI correlate was present in 28/69 (40.6%) lesions. Biopsy was performed in 73 (36.1%) of 202 lesions, 31 (42.5%) malignant and 42 (57.5%) benign. Thirteen malignancies received BIRADS 3 (N=12) or BIRADS 0 (N=1) assessment on diagnostic mammography; an US correlate was absent in 10, present in 2, and US was not performed in 1.

CONCLUSION
Developing asymmetries were malignant in 15.3% cases and often lacked an US correlate. Diagnostic breast MRI can guide BIRADS assessment for developing asymmetries considered incomplete or probably benign after diagnostic mammography. Cancers with lobular pathology represented nearly half of malignancies.

CLINICAL RELEVANCE/APPLICATION
Developing asymmetries on mammography should be viewed with suspicion, despite lack of an US correlate. Diagnostic breast MRI can help guide assessment and management.

SST01-04
Comparison of the Clinical, Imaging, and Histopathologic Features of Screen Detected vs Interval Cancers on Breast MRI
Sarah Stamler MD (Presenter): Nothing to Disclose, Janice S. Sung MD : Nothing to Disclose, Christopher E. Comstock MD : Nothing to Disclose, D. David Dershaw MD : Nothing to Disclose, Kirti Magudia PhD : Nothing to Disclose, Elizabeth A. Morris MD : Nothing to Disclose

PURPOSE
To compare the clinical, imaging and histopathologic features of MRI screen detected (SCA) and interval cancers (IC).

METHOD AND MATERIALS
Retrospective review of 28,061 breast MRIs performed between 2005-2010 identified 120 SCA and 48 IC (cancer diagnosed within 364 days after a negative MRI). Medical records were reviewed for age at diagnosis, risk factors (family or personal history of breast cancer, BRCA status, prior high risk lesion), and tumor histopathology. For IC, the method and time interval from the negative MR were determined. Statistical analysis was performed using Prism software (GraphPad Software). The unpaired t and one-way ANOVA tests were performed to determine p-values.

RESULTS
Median age at diagnosis was 53 years for SCA and 50 years for IC. IC were not associated with any risk factor or tumor subtype (p>0.36). Mean size of invasive cancers was 0.8 cm for SCA and 0.7 cm for IC. SCA were highly associated with invasive cancers (SCA: 87/120, 73%, IC: 18/48, 37%, p

CONCLUSION
Screening MRI preferentially detects invasive cancers and intermediate and high grade DCIS. Most IC after a negative MRI are detected as mammographic calcifications, representing low to intermediate grade DCIS. No clinical or histopathologic features are associated with the development of IC.

CLINICAL RELEVANCE/APPLICATION
Tumor biology of MRI SCA differ from IC. Women undergoing breast cancer screening with mammography and MRI may benefit from alternating screening at 6 month intervals, regardless of BRCA status.

SST01-05
The Relationship of Obesity, Mammographic Breast Density, and Magnetic Resonance Imaging Features in Patients with Breast Cancer
Jennifer Gillman (Presenter): Nothing to Disclose, Jennifer Chun MPH : Nothing to Disclose, Shira Schwartz : Nothing to Disclose, Freya Schnabel MD : Nothing to Disclose, Linda Moy MD : Nothing to Disclose

PURPOSE
Obesity in post-menopausal women is associated with elevated breast cancer risk and mortality. The purpose of this study was to evaluate the relationship between body mass index (BMI), mammographic breast density, background parenchymal enhancement (BPE), and fibroglandular tissue (FGT) in women with newly diagnosed breast cancer. We further analyzed how obesity related to disease stage, clinical breast exam, and screening frequency.
METHOD AND MATERIALS

This study was IRB approved and HIPAA compliant. The Breast Cancer Database was queried for patients with both a mammogram and breast MRI between January 2010 and December 2011. Variables of interest included BMI, age, family history of breast cancer, atypical hyperplasia, lobular carcinoma in situ (LCIS), tumor characteristics, mammographic breast density, BPE, FGT, menopausal status, use of chemoprevention, and screening behavior. Statistical analyses included descriptive statistics, analysis of variance (ANOVA), linear regression, and Pearson's chi-square. BMI was analyzed as a continuous variable, as well as a dichotomous variable (BMI < 25 kg/m² and BMI ≥ 25 kg/m²).

RESULTS

A total of 187 women were analyzed, with a median age of 51 years (range 22-87). BMI was significantly associated with advanced stage (p=0.014), lower mammographic density (p < 0.0001), lower FGT (p < 0.0001), higher BPE (p=0.0004) and non-palpable lesions (p=0.04), independent of age and menopausal status. 58% of women underwent annual screening mammography exams.

CONCLUSION

In our study, higher BMI was associated with decreased breast density, decreased FGT, and increased BPE. Higher BMI was also associated with advanced breast cancer stage, and cancers that were non-palpable on clinical exam. Therefore, overweight and obese patients may benefit from regular screening with mammography.

CLINICAL RELEVANCE/APPLICATION

Obese and overweight women are more likely to have non-palpable, advanced stage breast cancer. Since this population also has lower breast density, obtaining regular screening mammograms is essential.

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SST01-06

Isolated Axillary Lymphadenopathy on Screening Mammography: Does Unilateral versus Bilateral Matter? Experience at a Tertiary-care Referral Center with Radiologic-pathologic Correlation

Mougnyan Cox MD (Presenter): Nothing to Disclose, Upasana Joneja MD: Nothing to Disclose, Angela Hou: Nothing to Disclose, Rashmi Balasubramanya MD: Nothing to Disclose, Tara Raquel Eisenberg MD: Nothing to Disclose, Annina Nicholas Wilkes MD: Nothing to Disclose

PURPOSE

Axillary lymphadenopathy (ALD) in the setting of an otherwise normal screening mammogram may be benign or malignant in etiology. While several authors have investigated the clinical relevance of ALD, no study has addressed the implications of unilateral versus bilateral ALD. In our study, unilateral and bilateral ALD were studied separately in an attempt to further risk-stratify patients for subsequent work-up.

METHOD AND MATERIALS

After Institutional Board Review approval, a retrospective review of screening mammograms at our institution from the year 2006 to 2013 was performed. Patients with isolated ALD were classified according to whether ALD was unilateral or bilateral. Ultrasound examination of the axilla was recommended in all cases with ALD. Further clinical history obtained from the primary care provider and patient records. Most patients were subsequently referred for biopsy after final interpretation of mammogram and ultrasound. Biopsy results were reviewed when available.

RESULTS

65 patients with ALD and otherwise normal mammograms were identified. 54 patients returned for subsequent work-up. Of the 54 patients, 19 (35%) had bilateral ALD and 35 (65%) had unilateral ALD. In the patients with bilateral ALD, 10 out of 19 cases (53%) were due to malignancy, all of which were hematologic (lymphoma). The most common hematologic malignancy was chronic lymphocytic leukemia (CLL), found in 8 out of 19 patients with bilateral ALD. No cases of occult breast metastases were found in patients with bilateral ALD. There were 8 patients with bilateral ALD over the age of 60, and every single case was due to lymphoma. 35 patients had unilateral ALD, of which 8 cases (23%) were due to malignancy. The most common malignancy was occult breast metastasis, found in 5 patients (14%). The other 3 patients with malignant unilateral ALD had lymphoma.

CONCLUSION

Bilateral ALD appeared to have a higher risk of malignancy, mostly hematologic. Unilateral ALD had a lower risk of malignancy overall, but most of the malignancies in this group were occult breast metastases. Patients over the age of 60 presenting with bilateral ALD have a high risk of lymphoma, and biopsy should be pursued in all cases.

CLINICAL RELEVANCE/APPLICATION

Bilateral lymphadenopathy on screening mammography has a high incidence of hematologic malignancy, particularly in patients over the age of 60.
**PURPOSE**

To evaluate the relevance of breast cancer subtype for the value of tumor FDG uptake for predicting axillary lymph node (ALN) metastasis in patients with invasive breast cancers.

**METHOD AND MATERIALS**

A total of 671 patients (mean age 52.6 years, range, 23-88 years) with invasive breast cancer (mean size 2.5 cm, range, 1.0-11.7 cm) who underwent preoperative 18F-FDG PET/CT and curative surgery were identified between January 2011 and December 2013. By using immunohistochemistry, tumors were divided into three subtypes: estrogen receptor (ER) positive/human epidermal growth factor receptor 2 (HER2) negative, HER2-positive, and triple-negative. Tumor FDG uptake, expressed as maximum standardized uptake value (SUVmax) and clinicopathological variables were analyzed. Multivariate regression analysis and receiver operating characteristic analysis were performed to identify the significant factors that were associated with ALN metastasis.

**RESULTS**

ALN metastasis was present in 187 (40.6%) tumors of 461 ER-positive/HER2-negative tumors, 54 (55.7%) of 97 HER2-positive tumors, and 38 (33.6%) of 113 triple-negative tumors. Tumor SUVmax, mean tumor size, histologic grade, and Ki-67 status were significantly associated with ALN metastasis. At multivariate analysis, tumor SUVmax (adjusted odds ratio [OR] =1.046, P = 0.022) and tumor size (adjusted OR =1.608, P < 0.001) were independent significant variables associated with ALN metastasis after adjusting for potential confounding variables. The area under the receiver operating characteristic curve was 0.71 (P < 0.001). In subset analyses, the association was significant for the ER-positive/HER2-negative (P < 0.001) and HER2-positive tumors (P = 0.001). No association was found for the triple-negative tumors (P = 0.36).

**CONCLUSION**

Tumor SUVmax on preoperative 18F-FDG PET/CT may be an independent prognostic factor for ALN metastasis in patients with invasive breast cancer, especially in ER-positive/HER2-negative and HER2-positive subtype, but not in triple-negative subtype.

**CLINICAL RELEVANCE/APPLICATION**

Tumor FDG uptake for predicting axillary lymph node metastasis is effective in ER-positive/HER2-negative or HER2-positive tumor but is inaccurate in triple-negative breast cancer.

**SST01-08**

**Preoperative Tamoxifen Treatment in Breast Cancer Patients with Moderate or Marked Parenchymal Enhancement: Could It Decrease Background Parenchymal Enhancement and Improve the Accuracy of Cancer Extent Evaluation?**

**PURPOSE**

We want to evaluate whether the background parenchymal enhancement (BPE) would decrease after preoperative tamoxifen treatment in breast cancer patients with moderate or marked BPE. Also, we want to evaluate if it could reduce false positive rate and improve the specificity of MRI.

**METHOD AND MATERIALS**

From October 2013 to March 2014, twenty-five premenopausal patients with moderate or marked BPE on preoperative MRI were included in the image analysis. These patients underwent preoperative MRI twice, before and after tamoxifen intake. Mean treatment period with tamoxifen was 9 days (range, 5-33 days). The signal intensity of the parenchyma was measured using four ROIs around the index cancer, and at the middle of the parenchyma of contralateral breast. Suspicious enhancing lesions besides index cancer were evaluated, around the index cancer, in other quadrant of ipsilateral breast, and in contralateral breast.

**RESULTS**

Among twenty-five patients, eight patients showed marked BPE and seventeen patients showed moderate BPE. On qualitative analysis, all 8 patients with marked BPE and 7 of 17 patients with moderate BPE showed BPE decrement after tamoxifen treatment. On quantitative analysis, the mean degree of parenchymal enhancement decreased from 93.5% to 73.4% after tamoxifen treatment. Tumor margins were non-visualized in 6 patients initially, which became distinct after tamoxifen treatment. Suspicious enhancing lesions besides index cancer were located around the index cancer in 12 patients, in other quadrant of ipsilateral breast in 3 patients, and in contralateral breast in 8 patients. These enhancements showed disappearance after tamoxifen treatment, resulting as a normal looking parenchyma.

**CONCLUSION**

Preoperative tamoxifen treatment in breast cancer patients with moderate or marked BPE could reduce false positive diagnostic rate and help to evaluate the accurate cancer margin and extent.
CLINICAL RELEVANCE/APPLICATION

Preoperative tamoxifen treatment can decrease background parenchymal enhancement (BPE), and is recommended in breast cancer patients with moderate or marked BPE for reduction of false positive diagnostic rate and accurate evaluation of cancer margin and extent.

**SST01-09**

**Does Breast Arterial Calcifications on Mammography Predict Elevated Risk of Developing Symptomatic Coronary Artery Disease?**

Tamuna Chadashvili MD, PhD (Presenter): Nothing to Disclose, Priscilla Jennings Slanetz MD, MPH: Nothing to Disclose, Diana Litmanovich MD: Nothing to Disclose, Ferris M. Hall MD: Nothing to Disclose

**PURPOSE**

To examine whether breast arterial calcifications (BAC) seen on mammography correlates with coronary artery calcium score, as a potential marker for increased risk of developing symptomatic coronary artery disease (CAD).

**METHOD AND MATERIALS**

Retrospective review of the imaging database at our institution identified 145 female patients who underwent coronary CT within a year of mammography. The mammograms were reviewed by breast radiologists who were blinded to patients' coronary calcium scores. The CT calcium score was calculated by multiplying area of calcification by weighted value assigned to its highest Hounsfield unit and summed for all lesions. Calculated scores were risk stratified for developing CAD as follows: 0-no risk; 1-10-minimal; 11-100-mild; 101-400-moderate; >400-high risk. Percentile distribution of calcium score adjusted by age, gender and race, was calculated based on results of the Multi-Ethnic Study of Atherosclerosis (MESA). The calcium scores and corresponding percentiles were correlated with BAC. Cardiac risk factors such as, diabetes, hypertension, hyperlipidemia, family history of CAD and smoking, were recorded for each patient. Data was analyzed using $\chi^2$ tests and multiple logistic regression analysis.

**RESULTS**

BAC correlated with coronary calcium score of >11 (p=0.0001), corresponding to mild or greater risk of developing CAD. Specifically, calcium score of >11 was seen in 68% (25/37) of patients without BAC and 31% (34/108) of patients with BAC. Accounting for race, gender and age, presence of BAC showed statistically significant correlation with percentile scores of >25. Namely, 70.4% (19/27) of patients with BAC vs. 44.6% (41/92) of patients without BAC showed percentile score of >25. Statistically significant association was observed of BAC with diabetes (p=0.01) and chronic renal disease (p=0.005). BAC showed no significant association with hyperlipidemia, hypertension, smoking and family history of CAD.

**CONCLUSION**

BAC predicts coronary artery calcium score of >11, which indicates mild or greater risk of developing CAD. Statistically significant correlation exists between BAC and cardiac risk factors, namely diabetes and chronic renal disease. Our study suggests that BAC on mammography can be utilized as a potential marker for increased risk of developing CAD.

**CLINICAL RELEVANCE/APPLICATION**

BAC on mammography is a noteworthy finding, as it correlates with coronary calcium score, elevated risk of CAD and cardiac risk factors.