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 Study1. 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. Screeening 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 earliier. 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.
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/overtreatment) 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.

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 MRIs 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, 1.9cm; range 0.1cm-6cm) 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.

VSBR31

Breast Series: Emerging Technologies in Breast Imaging

Series Courses

DM  BR
AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 4.00
Tue, Dec 2 8:30 AM - 12:00 PM Location: Arie Crown Theater

Participants

Moderator
Liane Elizabeth Philpotts MD: Nothing to Disclose
Moderator
Margarita Louise Zuley MD: Research Grant, Hologic, Inc

Sub-Events

VSBR31-01  Contrast Enhanced Digital Mammography

D. David Dershaw MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the method of generating a contrast enhanced mammographic imaging. 2) To learn how iodine contrast enhancement differs from gadolinium enhancement. 3) To understand what the current experience in contrast mammography suggests how it might be clinically useful.

ABSTRACT

The presentation will review the principles behind generating a contrast enhanced digital mammographic image after the injection of iodine contrast. Risks of the procedure will be presented. Enhancement kinetics will be discussed and compared with date on gadolinium. Experience of several investigators with contrast enhanced mammography will be reviewed, and the possible clinical usefulness of contrast mammography will be discussed.

VSBR31-02  The Potential Impact of Applying Magnetic Resonance Imaging ACR BI-RADS Lexicon Morphology 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, Dorria 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, Rada Essam MBBS: Nothing to Disclose, Lamia Adel MD: Nothing to Disclose, Yassmine Mourir MD: Nothing to Disclose, Iman Godda MD: Nothing to Disclose, Nelly Alieldin 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 non 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 (193/202, 95.5%) than in benign ones (68/148, 45.9%). 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.

VSBR31-03 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%-6%), 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 stop-shot breast unit.

VSBR31-04 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 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/specifity 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, Lamia Adel MD : Nothing to Disclose, Omnia Mokhtar MD : Nothing to Disclose, Sahar Mansour MD : Nothing to Disclose, Nelly Alieldin 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.

CONCLUSION

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.

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 could improve the performance and provide better evaluation of breast lesions.
**DBT Technique**

Martin J. Yaffe, PhD (Presenter): Research collaboration, General Electric Company Founder, Matakina International Ltd Shareholder, Matakina International Ltd Co-founder, Mammographic Physics Inc

**LEARNING OBJECTIVES**

1) To review the basic principles of digital breast tomosynthesis (DBT). 2) Identify factors that may impact image quality and interpretation.

**Dosimetric Properties of a Clinical DBT System: Relative Dose Contributions of 2D vs. 3D Exposures for Varying Breast Density**

Laurie Lee Fajardo, MD, MBA (Presenter): Scientific Advisory Board, Hologic, Inc Scientific Advisory Board, Koninklijke Philips NV, Limin Yang, MD, PhD: Nothing to Disclose, Mark Bennett Williams, PhD: Institutional research agreement, Hologic, Inc.

**PURPOSE**

To characterize the dosimetric properties of clinical digital breast tomosynthesis (DBT) systems during a single combo (2D + 3D) scan in a screening environment.

**METHOD AND MATERIALS**

Mean glandular radiation dose as recorded in the DICOM header was extracted for 950 asymptomatic patients (mean age 56.3 yrs; range 28 - 90 yrs) undergoing routine 2D + 3D combo breast screening (CC and/or MLO compressions, 3449 breasts) on one of two Hologic Dimensions systems. Dose was evaluated as a function of compressed breast thickness (CBT). Analysis was performed for individual BIRADS tissue density categories as determined by expert radiologists.

**RESULTS**

BIRADS breast tissue density among the study group was: almost entirely fatty (11.1%); scattered fibroglandular densities (51.5%); heterogeneously dense (28.2%) and extremely dense (9.2%). CBT ranged from 1.4 - 10.7 cm (mean = 6.0 cm). For 2D images with CBT < 7 cm (n = 2610), a tungsten/rhodium anode/filter combination was used with dose ranging from 0.54 - 4.49 mGy (mean = 1.62 mGy). For 2D images with CBT > 7 cm (n = 839), tungsten/silver anode/filter combination was used and dose ranged from 1.43 - 4.88 mGy (mean= 2.46 mGy). For DBT images, a tungsten/aluminum anode/filter was used for all compressed thicknesses (n = 3449) with dose ranging from 0.94 - 4.69 mGy (mean = 2.39 mGy). The total dose for a 2D+3D combo exam ranged from 1.56 mGy - 8.88 mGy (mean = 4.12 mGy), with 28 of 3504 (0.8%) combo exposures ≥ 3 mGy for breasts with CBT ≤ 4.2 cm. The relative dose contribution from the 2D and 3D portions of the scan changed monotonically with changing BIRADS classification, with 3D+2D dose ratio increasing from ~1 for extremely dense breasts to > 1.5 for fatty breasts.

**CONCLUSION**

Based on current automatic exposure control algorithms used in DBT, reconstructing 2D images from DBT projection images will reduce radiation dose by ~50% for dense breasts and ~40% for fatty breasts, enabling opportunities to refine the dosimetric properties of DBT and improve image quality.

**CLINICAL RELEVANCE/APPLICATION**

Breast screening using 2D + 3D combo DBT has demonstrated improved breast cancer detection and reduced FP (recall) rates. Dose in the majority of combo exposures is ≥3mGy; thus, substituting "synthetic 2D" for conventional DM images affords opportunities to better refine the dosimetric properties and image quality of DBT.

**Radiation Dose during Screening Digital Breast Tomosynthesis: Does Patient Age, Compression Thickness or Breast Tissue Density Matter?**

Francesca Proulx, MD, FRCP (Presenter): Nothing to Disclose, Shambhavi Venkataraman, MD: Nothing to Disclose, Richard Earnest Sharpe, MD, MBA: Nothing to Disclose, Alexander Brook, PhD: Spouse, Research Grant, Guerbet SA, Vandana Mukesh Dialani, MD: Nothing to Disclose, Valerie J. Fein-Zachary, MD: Research Consultant, Siemens AG, Priscilla Jennings Slanetz, MD, MPH: Nothing to Disclose, Tejas S. Mehta, MD, MPH: Nothing to Disclose

**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 (craniocaudal 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.

VSB31-09
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 maligmant 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.

VSB31-10
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) VSBR31-09 VSBR31-10 versus digital 2D mammography for the detection of T1 breast cancer.
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), compare 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.
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 syn2D/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.

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.

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.

**VSB31-15**

**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. 52 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.

**VSB31-16**

**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 by FFDM alone 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 cancers, 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, 157 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.
SSJ01

Breast Imaging (Quantitative Imaging)

Scientific Papers

AMA PRA Category 1 Credits™: 1.00
ARRT Category A+ Credit: 1.00
Tue, Dec 2 3:00 PM - 4:00 PM Location: Arie Crown Theater

Participants

Moderator
Robyn L. Birdwell MD: Nothing to Disclose

Moderator
Emily F. Conant MD: Scientific Advisory Board, Hologic, Inc

Sub-Events

SSJ01-01

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, 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.

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% 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% CI: 0.98-0.99) and r = 0.88 (95% CI: 0.81-0.93); as well as with the MR-based estimates with r = 0.95 (95% CI: 0.91-0.96) and r = 0.76 (95% CI: 0.63-0.85), respectively (p<0.001). Corresponding correlations between DM and MRI are r = 0.95 (95% CI: 0.92-0.97) and r = 0.73 (95% 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 unnecessary biopsies and improve diagnostic decision making.

CLINICAL RELEVANCE/APPLICATION

Three-Compartment Breast Imaging quantitatively assesses tissue composition of breast lesions and parenchyma and yields information largely independent from what can be gleaned from mammography alone, which could help increase biopsy yield while reducing unnecessary biopsies.

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 Deasy 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.

Relationship of Quantitative MRI-based Phenotypes and the Molecular Classifications of Breast Cancers in the TCGA/TCIA Dataset


PURPOSE

To investigate the performance of MRI-based phenotypes in predicting the molecular classification of breast cancers in The Cancer Genome Atlas dataset of NCI.

METHOD AND MATERIALS

Quantitative image analysis was performed on 98 de-identified, MRI studies depicting biopsy-proven breast cancers MRI studies from the NCI’s multi-institutional The Cancer Imaging Archive and The Cancer Genome Atlas project. Immunohistochemistry molecular classification determined estrogen (ER+82/ER-16), progesterone (PR+75/PR-23) and HER2 (HER2+16/HER2-16) receptor status for each case. Computerized 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.
Psychosexual dysfunction: Risk factors, consequences and treatment.

Sub-Events

SSJ02-01
Breast Imaging Keynote Speaker: Contrast Mammography
John Morton Lewin MD (Presenter): Research Consultant, Hologic, Inc Scientific Advisory Board, Hologic, Inc Research Grant, Hologic, Inc

SSJ02-02
Clinical Help of Enhancement by Dual Energy Contrast-enhanced Spectral Mammography on Impalpable Breast Microcalcifications
Yun-Chung Cheung MD (Presenter): Nothing to Disclose, Yu-Ching Lin MD: Nothing to Disclose, Shir-Hwa Ueng: Nothing to Disclose, Hsiu-Pei Tsai: Nothing to Disclose, Yung-Feng Lo MD: Nothing to Disclose

PURPOSE
Mammographic impalpable microcalcifications have various probabilities of cancers. This retrospective study was to evaluate the help of enhancement by Dual Energy Contrast-Enhanced Spectral Mammography (DE-CESM) clinically on the concern impalpable breast microcalcifications

METHOD AND MATERIALS
Reviewed 256 DE-CESM examinations from 2012 to 2013, 59 sites of pathologic proved impalpable microcalcifications in 52 women (ranged from 30 y/o to 69 y/o, average 48.9 y/o) were enrolled in this study. All the microcalcifications were classified to ACR-BIRADS 4. The DE-CESM was performed standardized with craniocaudal and mediolateral oblique views of bilateral breasts 2 minutes after bolus injection of iodinated contrast medium. The diagnostic profiles for sensitivity, specificity, positive predictive value, negative predictive value and accuracy were calculated. The enhanced appearances and sizes of cancers were reviewed.

RESULTS
Twenty-two microcalcifications (37.3%) were histologic diagnosed to cancers (16 Ductal Carcinoma In Situ (DCIS), 6 Invasive Ductal Carcinoma (IDC)); 19 (32.2%) were atypia lesions (6 Atypical Ductal Hyperplasia, 13 Flat Epithelial Atypia) and 18 (30.5%) were benign. Enhancement was revealed at 27 microcalcifications including 6 IDC (100% of IDC), 14 DCIS (87.5% of DCIS), 4 atypia (21%) and 3 benign lesions (16.7%). However, 2 low grade DCIS were not enhanced. The enhanced cancers appeared as masses in 5, regional in 6, segmental in 4, clump (cluster of foci) in 3 and foci in 2. The diagnosis of enhancement on DE-CESM were 90.9% in sensitivity, 81.1% in specificity, 74% in positive predictive value, 93.75% in negative predictive value and 84.7% in accuracy. The average size of 18 operated cancers was 1.77 cm on subtracted mammograms that was close to 1.72 cm on microscopy.

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 : Research Grant, Bayer AG Research Grant, Koninklijke Philips NV, Héba Ahmed Àmer : Nothing to Disclose, Corinne Bailegyguier 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 MBCh, MRCPI (Presenter): Nothing to Disclose, Siobhan O’Neill MBCh: Nothing to Disclose, Flachra Gerard Moloney MBCh, MRCPI: Nothing to Disclose, Lorna Duddy MD: Nothing to Disclose, Nina Louise Marshall MBBS: Nothing to Disclose, Josephine Barry MBCh, FRCR: Nothing to Disclose, Max Frederick Ryan MBCh: 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

**CONCLUSION**

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.

**SSJ02-06**

**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 Gotlib 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 50years (27-74yrs), 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 mammography density BI-RADS score was 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.
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 42mAS 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.

---

**RC515**

**The New BI-RADS (An Interactive Session)**

*Refresher/Informatics*

**Sub-Events**

**RC515A**  
**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. They 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.

**RC515B**  
**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.

**RC515C**  
**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.
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.

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.

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

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.

SSK01-02 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.

SSK01-03  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.

SSK01-04  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+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). DBT, whether presented before or after PRIORS, reduced recall rate recommendations of negative/benign cases. 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

Tomasynthesis 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.

SSK01-07

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, 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.

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.
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.

**MSCB51**

**Case-based Review of Breast (An Interactive Session)**

*Multisession Courses*

<table>
<thead>
<tr>
<th>AMAPRA Category 1 Credits ™: 1.50</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARRT Category A+ Credits: 1.50</td>
</tr>
</tbody>
</table>

**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.

**RC715**

**Digital Breast Tomosynthesis**

*Refresher/Informatics*
Sub-Events

**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 is 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.

**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.

**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.

---

**Medical Physics 2.0: Mammography**

Refresher/Informatics

**Active Handout**

**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.

**Mammographic Interpretation**

Refresher/Informatics

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50
Fri, Dec 5 8:30 AM - 10:00 AM Location: E450A

**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.
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. 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.

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.

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?

Taehee Kim MD, PhD (Presenter): Nothing to Disclose, Seon Young Park MD: Nothing to Disclose, Young Keun Sur MD: Nothing to Disclose, Doo Kyoung Kang MD: Nothing to Disclose

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, 5-33days). 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, 8 of 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.
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.

**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 Χ² 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.