Breast Imaging and Interventional
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TEACHING POINTS
The purpose of this exhibit is to: Discuss the fundamental differences in anatomy and pathophysiology of diseases in male breasts compared to female breasts. Review risk factors associated with primary male breast cancer. Illustrate cases of benign and malignant pathology in the male breast with clinical, radiologic, and pathologic correlation.

TABLE OF CONTENTS/OUTLINE
Overview of the epidemiology of male breast cancer. Discussion of the modifiable and non-modifiable risk factors associated with primary male breast cancer, in contrast to female patients. Discussion of how the anatomical differences of male breast development correlate with the pathophysiology of male breast diseases. Present imaging findings of benign breast pathology in male patients with relevant clinical history, imaging work up, and pathologic correlation. Examples of cases presented include: lipoma, hematoma, epidermal cysts, pubertal gynecomastia, other causes of gynecomastia, and benign axillary lymphadenopathy. Provide a case-based review of male breast malignancies with clinical, radiologic, and pathologic correlation. Examples of cases presented include: primary breast cancers, lymphoma, metastatic diseases, and malignant axillary lymphadenopathy.
There’s More than Meets the Eye: A Multi-Modality Framework for the Detection of Mammographically Occult Breast Lesions

All Day Room: BR Community, Learning Center

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TEACHING POINTS
1. To review imaging of benign and malignant mammographically occult breast lesions.
2. To highlight how other modalities, such as tomosynthesis, ultrasound, contrast-enhanced mammography, MRI and nuclear imaging can complement mammography in lesion detection.
3. To provide a multimodality framework to promote cost-effective use of other breast modalities besides mammography, so as to maximize cancer detection.

TABLE OF CONTENTS/OUTLINE
1. Review the incidence of mammographically occult breast disease and summarize the strengths and limitations of the more commonly available imaging technologies.
2. Show the multimodality imaging appearance of more commonly encountered mammographically occult benign and malignant breast pathologies.
3. Provide a diagnostic algorithm by which practicing radiologists can determine when additional imaging with other modalities may be indicated.
Fat Containing Lesions of the Breast

All Day Room: BR Community, Learning Center

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TEACHING POINTS
Review the imaging appearance of fat containing lesions of the breast on mammography and ultrasound. Describe the differential diagnosis, epidemiology, pathology, and etiology of different fat containing breast lesions. Review the BI-RADS classification of fat containing breast lesions.

TABLE OF CONTENTS/OUTLINE
Challenges of distinguishing benign fat containing breast lesions from malignant lesions
Role of imaging in distinguishing fat containing lesions
Differential diagnoses
Each case will review the BI-RADS description, epidemiology, pathology, and etiology.
Summary
Beyond Conventional Imaging: The Emerging Role of PET/MRI in Breast Cancer Management

All Day Room: BR Community, Learning Center

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TEACHING POINTS
In recent years, PET/MRI has emerged as a new tool with significant clinical potential for the evaluation and management of breast cancer patients. In this exhibit, we review the emerging role and current applications of PET/MRI in breast cancer imaging. The aims of the exhibit are to: Review the current imaging protocols and technical challenges in breast PET/MRI Compare the advantages of PET/MRI and PET/CT in breast cancer patients Illustrate, using a case-based approach, the emerging applications of PET/MRI in breast cancer imaging

TABLE OF CONTENTS/OUTLINE
Technical considerations and imaging protocols in breast PET/MRI: Imaging protocols for dedicated breast PET/MRI and for whole-body disease staging MRI-based attenuation correction Technical challenges
PET/MRI versus PET/CT in breast cancer imaging: what are the advantages? Comparison of the attributes of PET/MRI to those of PET/CT in breast imaging
Case-based examples to illustrate the emerging applications of PET/MRI in breast cancer imaging: Simultaneous primary tumor characterization and disease staging: the role of multi-parametric imaging Improved local and whole-body cancer staging Assessment of treatment response Impact of breast PET/MRI on clinical management decisions
Premammary Lesions of the Breast: Differential Diagnosis between Breast Skin Lesions and Superficial Breast Parenchymal Lesions

All Day Room: BR Community, Learning Center

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TEACHING POINTS

Premammary lesions of the breast are usually benign, and develop from the composition of the dermis and the subcutaneous fat. Although relatively uncommon, benign and malignant breast parenchymal lesions arising from anterior terminal duct lobular units are encountered within the premammary layer, and differential diagnosis between skin and superficial parenchymal lesions is necessary. The anatomic structures of the nipple-areolar complex are somewhat specialized, and we should understand its anatomy. By reviewing imaging findings of breast parenchymal lesions detected in the premammary layer, differential diagnosis between breast skin lesions and superficial breast parenchymal lesions can be achieved.

TABLE OF CONTENTS/OUTLINE

1. Normal skin anatomy of the breast
Patient-Related Artifacts in Mammography; Identification and Classification

All Day Room: BR Community, Learning Center

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TEACHING POINTS
Artifacts reduce the quality of mammograms and may mimic or obscure abnormalities and cause interpretation errors. Some of artifacts may obscure pathologic structure or create pseudo-lesions, causing interferes with image interpretation. Patients-related superimposed artifacts may be caused by objects or substances over the breast. Recognizing artifacts improves the quality of mammographic interpretation and prevents the characterization of artifacts as real breast pathology.

TABLE OF CONTENTS/OUTLINE
1. Classification of Artifacts. 1) Iatrogenic foreign materials in breast ; Surgical clips, Biopsy markers, Retained suture materials, Drain tubes, Acupuncture needles, Topical herbal patches, 2) Non-breast implanted medical devices ; Chemoport, Pacemaker, Ventriculoperitoneal shunt catheter, 3) Substances on the skin ; Deodorant, Talcum powder, Ointment, Skin markers, 4) Skin lesions ; Scar, Keloid, Nevus, Mole, Wart, Neurofibroma, Polythelia2. Location of Artifacts. 1) Skin, 2) Subcutaneous fat layer, 3) Mammary glandular layer, 4) Retromammary fat layer, 5) Chest wall and axilla
Incidental Extra-mammary Findings on Breast MRI: Is it Clinically Important?

All Day Room: BR Community, Learning Center

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TEACHING POINTS
1. To know that breast MRI can detect spectrum of extra-mammary findings which may be clinically significant.
2. To demonstrate the incidental extra-mammary findings on breast MRI with multimodality imaging findings.
3. To know that the evaluation should not be limited to the breast on breast MRI and systemic evaluation of other structures and organs should be performed.

TABLE OF CONTENTS/OUTLINE
A. Introduction
B. Breast MR protocol (FOV)
D. Frequency and clinical significance
A Radiology Resident's Video Guide to the Stereotactic Breast Biopsy

All Day Room: BR Community, Learning Center

Participants
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TEACHING POINTS
To review and reinforce the interventional methods and key concepts of the stereotactic breast biopsy.

TABLE OF CONTENTS/OUTLINE
A. Interventional Method. A simulated patient is represented by an apple, which is compressed by the paddle of a Hologic MultiCare Platinum prone breast biopsy table with an Eviva breast biopsy system. A scout image is obtained and the submitted video proceeds with meticulous attention to 3D localization, proper targeting, adequate sampling, and radiographic confirmation of simulated calcifications.B. Key Concepts/Teaching Points. The rationale of several key concepts are briefly reviewed, e.g. bilateral oblique projections with 30 degrees of separation between projections are obtained in order to determine the location of the 2D target in the 3D coordinate system. Proper positioning of the biopsy needle relative to the target on the paired images is emphasized to avoid undersampling.C. Technical Considerations. This 5 minute video takes the radiology resident through the numerous technical steps required to properly target and adequately sample calcifications. The junior resident is the target audience as there are visual explanations to numerous steps. However, the video is brief, searchable, and comprehensive, and will likely assist senior residents to efficiently and safely sample breast lesions and/or calcifications.
Multimodality Pre and Posttreatment Evaluation in Neoadjuvant Therapy for Breast Cancer. A Radiopathologic Review

All Day Room: BR Community, Learning Center digital education exhibit

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TEACHING POINTS

- Illustrate initial diagnostic features and analysis and stimulated response after neoadjuvant therapy clinically, on pathology and imaging in patients with breast cancer.
- Analyze the goals and limitations of the different techniques (clinical exam, mammogram, US, MR and combined approaches) in the monitoring of response, reviewing predictors of discordance and evaluation in different subtypes of breast cancer, pathological, clinical and imaging parameters.
- Emphasize diagnostic difficulties and differential diagnosis

TABLE OF CONTENTS/OUTLINE

We present:
Spindle Cell Lesions of the Breast: A Radiopathological Pictorial Review

All Day Room: BR Community, Learning Center

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TEACHING POINTS
To review imaging features  and pathologic findings in spindle cell lesions of the breast.To illustrate imaging findings (mammogram, US, MR) of cases from our series of breast spindle cell lesions with pathologic correlation.To analyze and discuss  the specific management of those lesions, including diagnostic difficulties in imaging and pathology.To emphasize pitfalls and clues to differential diagnosis.

TABLE OF CONTENTS/OUTLINE
We present:Clinical signs and symptoms.Imaging findings: Mammograms, US, MRDifferential diagnosis.Difficulties in core biopsy: the importance of distinguishing carcinoma from everything else.Diagnostic work-up and recommendations for management.Pathologic entities:- Bland spindle cells - Scar - Fibromatosis - Pseudoangiomatous stromal hyperplasia (PASH) - Myofibroblastoma - Adenomyoepithelioma - Atypical spindle cells - Phyllodes tumor - Nodular fascitis - Sarcoma - Spindle cell carcinoma (Primary/Metastatic) - Metastatic melanoma
Automated Breast Ultrasound Indications, Technique, Pearls and Pitfalls: The Dawn of a New Screening Technology

All Day Room: BR Community, Learning Center

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TEACHING POINTS
After reading this educational exhibit radiologists will know:
- Automated breast ultrasound (ABUS) target population
- How to operate and properly perform ABUS
- How to read an ABUS
- Identify potential pitfalls

TABLE OF CONTENTS/OUTLINE
- Approved indications for ABUS
- Siemens and GE Machine components and proper use
- Reading workstation layout and tips for its proper use
- Pearls of ABUS
- Pitfalls of ABUS
Everything You Always Wanted to Know About Breast Cancer Genomics, but Were Afraid to Ask

All Day Room: BR Community, Learning Center

Awards
Magna Cum Laude

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TEACHING POINTS
The purpose of this exhibit is to 1) Define the major molecular subtypes of infiltrating breast cancer: Luminal A, Luminal B, Human Epidermal Growth Factor Receptor-2 (HER) Enriched and Basal-Like Triple Negative. 2) Discuss and correlate the imaging findings characteristic of each major molecular subtype of breast cancer. 3) Describe the importance of advanced imaging in pre-surgical planning in relation to the different breast cancer subtypes. 4) Explain the importance of the molecular classification of breast cancer with recurrence rates, overall survival outcome and targeted therapies.

TABLE OF CONTENTS/OUTLINE
1) Introduction of molecular biomarkers of gene expression. 2) Definitions of the major molecular subtypes of invasive breast cancer. 3) Discussion of the similarities and differences between the subtypes with regard to immunohistological results, frequency, cancer grade and survival rates. 4) Testing the radiologist’s interpretation of imaging findings and knowledge of histopathological and genomic subtype classifications through example cases. 5) Future directions and conclusion.
A Case-based Approach to Understanding Radiopathologic Discrepancies in Breast Core-biopsy

All Day Room: BR Community, Learning Center

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TEACHING POINTS
1. Understand radiopathologic discordances in core needle biopsy.
2. Provide a case-based review, illustrating mammograms, US and MR imaging features and pathological correlates of core biopsy and excisional specimens of difficult radiopathologic correlation cases, highlighting useful clues and tricks.

TABLE OF CONTENTS/OUTLINE
We present:
1. Discordances in core biopsy.
   A. Microcalcifications
      - Imaging malignant calcifications: benign diagnosis is discordant.
      - Specimen radiograph is mandatory, cores with and without calcifications should be submitted separately.
      - Missing calcifications: calcium oxalate.
   B. Masses.
      - Spiculated mass. Benign diagnosis except radial scar is discordant.
   C. Non-mass lesions: focal asymmetry (mammograms), non-mass enhancement (MR): fibrotic breast tissue, pseudoangiomatous stromal hyperplasia (PASH).
   D. Difficult diagnosis
      - ADH/ DCIS / LCIS/ foci of invasion
      - Low-grade ductal carcinoma/benign sclerosing lesions
      - Papillary lesions, spindle cell lesions, columnar cell lesions, mucocle-like lesions/mucinous carcinoma, fibroepithelial lesions
2. Discordances in surgical specimen after core biopsy.
   - Missing malignancy:
     Different patient, biopsy site not removed, lesion entirely removed on biopsy, healing postbiopsy process, postneoadjuvant therapy, false positive biopsy result.
   - Measurement of tumor size
Breast Angiosarcoma: A Rare and Serious Entity

All Day Room: BR Community, Learning Center

Participants
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TEACHING POINTS
Angiosarcoma of the breast is a rare malignancy that develops from endothelial cells lining the blood vessels in the breast. It can manifest as a primary lesion or a secondary lesion that develops after breast cancer treatment. The objective is to review the clinical presentation, pathophysiology, and imaging findings of primary and secondary angiosarcoma of the breast. Challenges in diagnosing angiosarcoma and imaging mimics of the disease will also be reviewed.

TABLE OF CONTENTS/OUTLINE
Primary and secondary angiosarcoma of the breast introduction Clinical presentation Epidemiology Risk factors Pathophysiology Outcomes Anatomy of the breast Diagnostic work-up Review of imaging findings Mammogram Ultrasound MRI CT PET-CT Challenges in diagnosing angiosarcoma of the breast Mimics of angiosarcoma Post surgical/radiation skin thickening Dermal metastasis Interesting case examples Primary angiosarcoma in breast with implant Recurrent primary angiosarcoma after misdiagnosis as benign lobular hemangioma Secondary angiosarcoma in mastectomy scar Recurrent secondary angiosarcoma after local excision without preop imaging to evaluate extent of disease Future directions and summary
Differentiation between Benign Changes and Recurrences after Breast-conserving Surgery with Radiation Therapy in Mammography: A Pictorial Review

All Day Room: BR Community, Learning Center

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TEACHING POINTS

1. To show mammography images of benign post-treatment changes and recurrences after breast-conserving surgery with radiation therapy. 2. To demonstrate how to assess the detected findings based on the 5th edition of BI-RADS classification for the mammography. 3. To discuss the importance to find the hidden recurrences overlaid with benign findings and to avoid inappropriate biopsies.

TABLE OF CONTENTS/OUTLINE

The purpose of this work is to introduce the images of the benign changes (Category 2: fat-containing lesions, dystrophic or suture calcifications, trabecular thickening, skin thickening and other changes), probably benign lesions (Category 3: non-calcified circumscribed solid mass, focal asymmetry and solitary group of punctate calcifications), and recurrences (Category 4, 5: a group of amorphous or fine linear calcifications and indistinct mass) in mammography. In the last 10 years, a total of 604 cases undergoing mammography following breast-conserving surgery with radiation therapy were reviewed retrospectively. We also evaluated images of US, CT or MR in cases of suspected or proven recurrences in addition to original mammography images.
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TEACHING POINTS
The purpose of this exhibit is to: To discuss a rare benign disease, idiopathic granulomatous mastitis (IGM), including clinical presentation, epidemiology, and presumed etiology/pathogenesis. To learn imaging characteristics and distinguishing features of IGM as it appears on US, mammography and MRI. Describe and illustrate diagnostic mimics of IGM, which include TB, sarcoid and invasive ductal carcinoma, which have all contributed to the long-standing challenge of diagnosing IGM radiographically. To explore potential clinical data that may aid in the diagnosis of IGM including serological tests such as high serum prolactin, T-lymphocyte predominance in immunohistochemical studies and positivity for autoimmune markers such as rheumatoid factor, anti-nuclear antibody, anti-double stranded DNA. To discuss the diagnosis and management of IGM, which ranges from surgery to medical therapy to expectant management.

TABLE OF CONTENTS/OUTLINE
1. Clinical features of IGM Demographics Presentation Possible etiology/pathogenesis
2. Imaging features of IGM Ultrasound Mammography MRI
3. Differential diagnosis TB Sarcoid Malignancy
4. Diagnosis and pathology
5. Treatment, surveillance and recurrence
Imaging of Axillary Lymphadenopathy in Cancer Breast: Spectrum of Imaging Findings at Multi-imaging Modalities

All Day Room: BR Community, Learning Center

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TEACHING POINTS
1- To review typical and atypical imaging appearance of metastatic axillary lymphadenopathy in cancer breast at different imaging modalities.2- To evaluate role of imaging in nodal staging of cancer breast.3- To be familiar with imaging findings suspect other causes of axillary lymphadenopathy

TABLE OF CONTENTS/OUTLINE
1- Anatomical level of axillary LN
2- Staging of axillary lymph nodes
3- Management of axillary lymph nodes management according to American College of Surgeons Oncology Group (ACOSOG) Z00114
4- Impact of imaging of axillary lymph nodes on patient management
5- Ultrasound morphological findings, power Doppler angioarchitecture and ultrasound elastography parameters suggestive of metastatic axillary LN
6- Tips and tricks of ultrasound guided biopsy of axillary LN
7- Multi-parametric MR imaging including dynamic contrast enhancement MR, diffusion MR and MR spectroscopy biomarkers in assessment of metastatic axillary LN
8- Role of PET-CT in nodal staging of breast cancer
9- Digital mammography findings of metastatic axillary LN
10- Imaging findings suggestive of lymphomatous and granulomatous axillary nodes
11- Imaging findings of metastatic intramammary LN
12- Merits and limitations of different imaging modalities used for assessment of axillary nodes
13- Summary and future direction
Multi-Modality Imaging Manifestations of PASH

All Day Room: BR Community, Learning Center

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TEACHING POINTS
1. To review the clinical presentation and imaging appearance of pseudoangiomatous stromal hyperplasia (PASH).
2. To discuss radiologic concordance with pathologic finding of PASH.
3. To examine management options for PASH.

TABLE OF CONTENTS/OUTLINE
Background
Etiology and pathogenesis of PASH
Clinical presentation
Case-based review of imaging findings on mammogram, ultrasound, and MRI
Radiologic-pathologic concordance and management of PASH
Summary
Architectural Distortion of the Breast: Diagnostic and Management Algorithm with Radiopathologic Correlation

All Day Room: BR Community, Learning Center

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TEACHING POINTS

To review a variety of breast diseases that may present as architectural distortion with pathologic correlationTo give the radiologist an easy and useful diagnostic and management algorithm for architectural distortion

TABLE OF CONTENTS/OUTLINE

1. Review of multimodality imaging features of Architectural Distortion  
Mammography Ultrasound Magnetic Resonance Imaging  
2. A practical approach to the diagnosis of AD  
3. Ultrasound and MRI utility in the diagnosis  
4. Radiopathologic correlation in the spectrum of diseases presenting as AD  
   Primary AD  
   Complex Sclerosing Lesions and Radial Scars  
   Sclerosing Adenosis  
   Primary Breast Carcinoma (both invasive and in situ)  
   Secondary AD  
   Postsurgical scarring  
   Fat necrosis
Non Calcified DCIS in a Calcified World

All Day Room: BR Community, Learning Center

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TEACHING POINTS
Ductal carcinoma in situ (DCIS) usually manifest as microcalcifications. But about 10-20% of the DCIS present as noncalcified lesions. These can be subtle or even occult by mammography. Ultrasound findings can be nonspecific or can be misinterpreted as benign. As opposed to calcified DCIS, most patients with noncalcified DCIS present with symptoms. It is important for the radiologist to be familiar with the clinical and imaging appearance of noncalcified DCIS to avoid missing cancers. The purpose of this exhibit is to Describe the clinical and multimodality findings of noncalcified DCIS. Review differential diagnosis of noncalcified DCIS. Recognize that the imaging characteristics may mimic benign pathology. Provide histopathologic correlation for noncalcified DCIS.

TABLE OF CONTENTS/OUTLINE
Multimodality cases will be presented. Pathologic definition of DCIS Clinical presentation and diagnostic work up Mammographic, sonographic and MRI features of the noncalcified DCIS. Challenges in the diagnosis of noncalcified DCIS Histopathology images showing different subtypes of DCIS.
Cryoablation has become increasingly utilized and researched in the breast for the treatment of fibroadenomas and breast cancer. Studies are now being done in select patients using cryoablation as treatment for breast cancers. Readers are therefore likely to encounter patients previously treated with cryoablation. This exhibit will demonstrate 1) the cryoablation technique and mechanism of action, 2) the imaging findings post cryoablation on multiple modalities (2D mammography, ultrasound, and tomosynthesis), and 3) how 3D tomosynthesis helps image interpretation in cases where significant findings may be masked compared to 2D imaging.

TABLE OF CONTENTS/OUTLINE

I. Review cryoablation Technique Indications and inclusion criteria Fibroadenomas Breast cancer II. Discussion and case examples of expected imaging findings post cryoablation Mammography Ultrasound Tomosynthesis III. Discussion and examples of why tomosynthesis can improve interpretation in these post treatment cases IV. Discussion of the change in imaging findings over time Immediate post procedure findings Findings on follow up imaging V. Further studies needed to safely follow the selected patient population with tomosynthesis
**TEACHING POINTS**

Malignant papillary lesions of the breast accounts for 1-2% of all breast cancers. Imaging features mimic both benign papillary and malignant non-papillary pathology. Distinction of invasive papillary from non-invasive carcinoma is critical, as each entity carries a unique prognosis. Intracystic papillary carcinoma typically present as a complex solid and cystic mass on US. In such cases, sampling the solid components via core needle biopsy is prudent for accurate diagnosis. On ultrasound, a nonparallel orientation, echogenic halo, posterior acoustic enhancement, and associated microcalcifications are more likely to suggest a malignant papillary lesion. Invasive papillary carcinoma has a better prognosis, with less axillary lymph node involvement when compared to other forms of breast ductal carcinoma.

**TABLE OF CONTENTS/OUTLINE**

Background Malignant papillary breast lesions - Non-invasive and Invasive Clinical presentation Multimodality imaging appearance Features which raise suspicion for malignancy Techniques for optimization of tissue sampling Typical management Review of the imaging features Take home points
Use of Dual Energy Contrast-Enhanced Spectral Mammography, in Patients with Suspected Malignant Lesions and Its Histopathological Correlation

All Day Room: BR Community, Learning Center

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TEACHING POINTS
Contrast-Enhanced mammography data can avoid unnecessary biopsies and increase the diagnostic certainty in suspicious lesions. Contrast-enhanced mammography is an alternative method for patients that aren't candidates for breast MRI for the detection of multicentricity or multifocality as to assess the response to neoadjuvant chemotherapy.

TABLE OF CONTENTS/OUTLINE
Digital Breast Tomosynthesis: Challenging Traditional Workflow Dogma

All Day Room: BR Community, Learning Center

Awards
Identified for RadioGraphics

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TEACHING POINTS

1. Traditional work-up protocols used to localize and characterize breast lesions in screening and diagnostic imaging are being challenged with the incorporation of digital breast tomosynthesis. 2. The improved conspicuity of lesions with DBT allows expedited evaluations potentially reducing radiation, cost and patient anxiety.

TABLE OF CONTENTS/OUTLINE

I. Review traditional lesion workup protocols
   II. Using case examples, review the following:
      1. Screening workflow- reduced and/or expediting recalls
         Skin calcifications: improved skin localization eliminates recall, tangential views and possible intervention
         Mass on two views:
         -better margin characterization can skip diagnostic mammogram and proceed to ultrasound
         One view mass/asymmetry:
         -no longer need rolled views
         -better localization- reconsider the 90° lateral view in every workup
         -more focused ultrasound
         -one view lesions can be biopsied using 3D localization, can reduce need for excision
      2. Diagnostic workup-are "special views" necessary?
         Palpable lump:
         -more conspicuous masses make spot compression views unnecessary, can proceed directly to ultrasound
         Post-surgical changes (ie fat necrosis, parenchymal distortion):
         -better characterization increases reader confidence
         -do we need spot compression for post-surgical baseline studies and on serial surveillance?
Teaching Points

There is a vast array of uncommon primary breast lesions that may present a diagnostic and management dilemma when encountered upon pathology of image-guided core needle biopsy. These include a spectrum of benign, borderline, and malignant entities. Given the relative lower incidence of these lesions, they often present a challenge with pathology classification and recommendations as management decisions are based upon radiologic-histologic concordance. The purpose of this exhibit is to feature multimodality imaging characteristics of these unusual entities with imaging-pathology correlation, review current evidence, and provide management guidelines to facilitate appropriate recommendations in the context of radiologic-pathologic findings.

Table of Contents/Outline

Introduction
Lesions (clinical pearls, multimodality imaging characteristics, pathology correlation, and management strategies)

- Spindle cell lesion
- Granular cell tumor
- Tubular adenoma (and Lactational adenoma)
- Myofibroblastoma
- Cholesterol granuloma
- Radial scar/complex sclerosing lesion
- Phyllodes (benign, borderline, malignant)
- Pseudoangiomatous stromal hyperplasia (PASH)
- Hemangioma (capillary and cavernous)
- Mondor disease
- Amyloidosis
- Sarcoidosis
- Diabetic mastopathy
- Angiosarcoma
- Breast Plasmacytoma
- Primary breast lymphoma

Take-home Points

All Day Room: BR Community, Learning Center

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TEACHING POINTS
This exhibit will: Review literature and ongoing controversy regarding preoperative MRI in newly diagnosed breast cancer. Review cases of true positive and false positive preoperative breast MR where initial cancer was diagnosed by either DM or DBT. Identify patient populations that may benefit from preoperative breast MRI based on breast density, MR BPE, and cancer histology.

TABLE OF CONTENTS/OUTLINE
1. Brief literature review of the role of preoperative breast MRI. Case based review of preoperative MRI in over 300 breast cancer cases detected by DBT and DM during an 18-month period at our institution.
3. Case based examples of the diagnostic performance of preoperative breast MRI: True and false positive cases of multifocal or multicentric in the ipsilateral and contralateral breasts.
Beyond Wires and Seeds: Fiducial Guided Localization and Excision of Non-palpable Breast Lesions

All Day Room: BR Community, Learning Center

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TEACHING POINTS

Review methods of non-palpable breast lesion localization and excision
Learn how the SAVI SCOUT Surgical Guidance System works
Recognize appropriate cases for this new technology
Utilize case examples to learn how to place the reflector fiducial using mammography and ultrasound
Discuss advantages and disadvantages of available techniques in the context of published literature and experience at our institution

TABLE OF CONTENTS/OUTLINE

Background
Review standard localization techniques for non-palpable breast lesions (wire localization and radioactive seed localization)
Explain the SAVI SCOUT Surgical Guidance System
How it works: infrared activated electromagnetic wave reflector placed into the breast under image guidance by the radiologist and subsequently excised by the surgeon
Step by step explanation of percutaneous reflector placement for radiologists
Pictorial demonstration of SAVI SCOUT handheld device and reflector
Discuss advantages and disadvantages of SAVI SCOUT vs standard techniques utilizing available literature and our institutional experience
Present interesting cases from our institution
Discuss future directions including areas for further research and implementation of SAVI SCOUT into breast imaging and surgical practices
All Enhancing Lesions In the Breast Are Not Cancers; A Comprehensive Review of Imaging Findings In Acute and Chronic Mastitis

All Day Room: BR Community, Learning Center

Participants
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TEACHING POINTS
To describe the imaging findings in acute and chronic mastitis on Mammograms, Ultrasound and MRI That help in better clinical management of the disease process. To differentiate mastitis from malignant lesions on the basis of imaging findings. To emphasise the importance of diagnosing Idiopathic Granulomatous Mastitis correctly to avoid antituberculosis treatment and unnecessary surgeries in these patients.

TABLE OF CONTENTS/OUTLINE
Clinical findings in acute and chronic mastitis Imaging findings in patients with mastitis. Heirarchy of imaging modalities to be used for correct diagnosis. Important pointers on imaging that can help to distinguish mastitis from malignancy. Series of cases.
Spectrum of Suspicious Findings in Patients with Breast Implants: A Multimodality Imaging Review

All Day Room: BR Community, Learning Center

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TEACHING POINTS
Review imaging characteristics of suspicious findings in patients with breast implants as seen on mammography, digital breast tomosynthesis, breast ultrasound and contrast enhanced MRI.
Discuss possible differential diagnoses based on imaging findings.
Describe appropriate management of suspicious findings.

TABLE OF CONTENTS/OUTLINE
Discuss normal imaging evaluation of patients with breast augmentation Pitfalls of imaging patients with breast implants Review multimodality imaging of suspicious findings in patients with breast implants Digital mammography, digital breast tomosynthesis, breast ultrasound and breast MRI Discuss appropriate diagnostic evaluation Management based on imaging findings Biopsy techniques Determining histo-pathologic correlation Follow-up and summary
TEACHING POINTS

In current breast imaging workflow, breast US examination for screening and extent of disease in a newly diagnosed breast cancer patients is most likely to be performed by trained technologists rather physicians because of the financial disincentives. With the spread of breast density-inform legislation, the need of technologist-performed screening breast US imaging is more and more increasing. We should know the current status and clinical pathway about technologist-performed breast US. The major teaching points of this exhibit are: 

1. Standard approaches to training and documentation of technologist-performed breast US imaging are important.
2. A breast US examination performed by trained technologists should be interpreted by physicians together with the corresponding mammograms with one integrated impression and overall BI-RADS assessment.

TABLE OF CONTENTS/OUTLINE

1. Introduction
2. Current status about technologist-performed breast US
3. Training for breast US technologists
4. Technique and documentation for breast US technologists
5. Technologist-performed breast US outcomes and performance benchmarks
6. How to interpret both the mammography and US examination for physicians
7. Illustrative cases with integrated reports
8. How to determine correspondence of mammographic and sonographic findings
9. Summary
Granulomatous Mastitis: It has to be Cancer, Right?

All Day Room: BR Community, Learning Center

Participants
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TEACHING POINTS
1) To review the typical demographics and clinical presentation of patients with granulomatous mastitis.
2) To review the typical imaging findings of granulomatous mastitis.
3) To demonstrate discordant findings between pathology results and imaging characteristics and eliminate the need for repeat biopsies.
4) To raise awareness of granulomatous mastitis as a possible differential diagnosis consideration for a breast mass.

TABLE OF CONTENTS/OUTLINE
Clinical Presentation/Demographics
Pathophysiology of Granulomatous Mastitis
Imaging characteristics
- Mammography
- Ultrasound
- Magnetic Resonance Imaging
Typical BIRADS designation
Sample cases
Discussion
- treatment/future management
- concern over discordant imaging/pathology results and repeat biopsies
- consideration as differential diagnosis of breast mass
Expect the Unexpected: Spectrum of Imaging Findings in the Treated Breast

All Day Room: BR Community, Learning Center

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TEACHING POINTS
The treated breast includes the post lumpectomy, mastectomy, and reconstructed breast, the radiated breast, and breasts exposed to chemoprevention or neoadjuvant/adjuvant chemotherapy. The purpose of this exhibit is to review the spectrum of expected mammographic, ultrasound, and MR imaging findings of the treated breast in a case-based format. Several possible treatment-related complications will be highlighted. The breast imager should be familiar with the spectrum of expected findings in the treated breast to enable identification of suspicious radiologic features that warrant intervention or change in therapy.

TABLE OF CONTENTS/OUTLINE
Cases of expected, benign entities such as postoperative hematomas, seromas, fat necrosis, decreased breast density following chemoprevention, and decreased background parenchymal enhancement following radiation will be shown. Key clinical features distinguishing post-treatment changes such as fat necrosis or expected post-treatment skin thickening and enhancement from that of local recurrence will be depicted. Additional cases of adverse treatment events will include but are not limited to implant rupture and capsular contracture. Several complicated cases such as fat necrosis within a TRAM flap, a seroma resulting in nipple discharge, and residual fibroglandular tissue following mastectomy will also be included.
Can Contrast Enhanced Spectral Mammography Replace MR mammography as a Diagnostic Method for Breast Disease?

All Day Room: BR Community, Learning Center

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TEACHING POINTS
To introduce and explain the principle of contrast enhanced spectral mammography (CEMS). To demonstrate the findings of CEMS images of various breast pathologies including malignant and benign tumors and benign conditions. To discuss the advantage and disadvantage of both CEMS and MR mammography (MRM).

TABLE OF CONTENTS/OUTLINE
1. Introduction
2. The principle of CEMS
3. Images of CEMS of various breast disease
4. The advantage and disadvantage of CEMS compared with MR mammography.
5. Summary: Contrast enhanced spectral mammography (CEMS) is subtraction imaging of after the intravenous administration of an iodine-base contrast medium in dual-energy full-field digital mammography system. This method can demonstrate of angiogenesis of breast disease in the mammography suite. CEMS demonstrates contrast agent uptake in not only the malignant lesions but also benign conditions. The sensitivity of breast lesion is almost same as that of MRM. CEMS has both advantages and disadvantage to compare with MR mammography however, we believe this methods is useful for the detection and assessment of breast disease.
Awards
Identified for RadioGraphics

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TEACHING POINTS

1. Due to its high operator dependence, it is important for the radiologist to recognize poor image quality when interpreting breast ultrasound.  
2. If poor image quality is not recognized, it can lead to misinterpretation of malignancy as benign disease as well as unnecessary biopsies and follow-ups

TABLE OF CONTENTS/OUTLINE

Take a quiz comparing two ultrasound images: Identify the difference between the good and poor quality image. What ultrasound parameter was altered between the two images? The following ultrasound parameters will be demonstrated and reviewed: Transducer frequency Field of view Trapezoidal acquisition Focal zone placement Gray scale gain Spatial compounding Tissue harmonic imaging References
Fat Tissue: The Good Guy of the Breast but There are Always Exceptions

All Day Room: BR Community, Learning Center

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TEACHING POINTS
1. To review the differential diagnosis of the most common fat-containing breast lesions (FCBL)
2. To explain the radiologic features and management of the FCBL

TABLE OF CONTENTS/OUTLINE
- Differential diagnosis of FCBL depends on their mammographic appearance:
  Encapsulated (thin radiopaque capsule at mammography): benign FCBL Lipoma Hamartoma Oil cyst Galactocele
  Nonencapsulated: suspicious FCBL Invasive carcinoma (malignant masses that incorporate fat into the tumor as it grows) Radial scar Malignant adipocytic tumors (liposarcoma)
- Review of multimodality imaging features of FCBL: Mammography / Digital breast tomosynthesis Breast ultrasound MRI
- Clinical manifestations of FCBL: Asymptomatic (incidental finding) Symptomatic (local complaints) Physical examination
- Management / treatment of FCBL: Benign FCBL: follow up Suspicious FCBL: imaging-guided intervention / excision
Why the Long Wait? A Pictorial Review of Neglected Breast Cancers, Their Psychosocial Aspects and Outcomes

All Day Room: BR Community, Learning Center

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TEACHING POINTS
The purpose of this exhibit is:
1. To review the pathophysiology of locally advanced breast cancer
2. To provide a pictorial review of locally advanced breast cancer with relevant imaging, pathology and surgical examples
3. To discuss and explore the psychosocial aspects of those diagnosed with locally advanced breast cancer
4. To review treatments and outcomes
5. To discuss methods to help prompt patients to seek earlier diagnosis and treatment

TABLE OF CONTENTS/OUTLINE
Pathophysiology of locally advanced breast cancer
Sample cases with relevant imaging, pathology, and surgical examples
Discussion of the social situations of those diagnosed with locally advanced breast cancer
Discussion of treatment and outcomes
Discussion of methods to help prompt patients to seek earlier diagnosis and treatment
Summary
**TEACHING POINTS**

The purpose of this exhibit is: Review the indications and factors which influence the selection of wire versus radioactive seed localization in the treatment of nonpalpable breast cancer. Summarize patient experience and surgical outcomes.

**TABLE OF CONTENTS/OUTLINE**

Wire Localization Technique

- Eligibility criteria: Unifocal cancer: <2cm, 1 wire; >2cm, 2+ wires
- S/P chemotherapy
- Excisional biopsy of suspicious calcifications, high risk breast lesions, atypical papillomas

Benefits

- Standard of care
- Easily retrieved
- Can reposition

Obstacles

- Day-of placement restricts radiology and surgery
- Inconvenient
- Increased subjective pain

Examples from our institution

Radioactive Seed Localization Technique

- Eligibility criteria: Clip in unifocal mass <15 mm or cluster of calcifications
- Exclusions: displaced clip, hematoma/seroma

Benefits

- Convenient for patient and surgeon
- Flexible surgical approach
- Unlikely to dislodge

Obstacles

- Radiation issues
- If >1 seed is used, can misinterpret at surgery
- Cannot reposition
- Loss/non-recovery of seed

Examples

Outcomes

- Our institution and review of literature
- Equivalent surgical outcome, margins, and size of resection cavity
- Cosmesis
- Cost
Knowledge of the anatomy, normal variants, and benign and malignant processes of the NAC is needed to identify pathology and form an accurate differential. Due to the superficial location, even a small tumor may present as a palpable mass. Evaluation for pathology requires good clinical correlation. Meticulous imaging technique is needed in this region. Lesion visibility on MG can be improved by imaging the nipple in profile with good compression; and on US by using warm gel, angulation of the transducer and two handed compression and rolled nipple techniques. On MR, good positioning prevents compression of the NAC against the coil. The presence of Sappey’s retroareolar (RA) lymphatic plexus can cause early metastases to axillary lymph nodes, affecting prognosis and treatment. MR has high sensitivity for the diagnosis of NAC/RA cancers. It can help differentiate a cancer involving the NAC vs one limited to RA tissue, play an important role in evaluating Paget disease, and be helpful in cases where the MG and US are inconclusive.

TABLE OF CONTENTS/OPTIONLINE

1. Introduction
2. Normal anatomy including normal variants
3. Imaging appearance of the NAC on MG, US, and MR
4. Optimal multimodality imaging technique and pitfalls
5. Clinical and imaging signs of pathology
6. Multimodality appearance of common benign and malignant processes affecting the NAC
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**TEACHING POINTS**

Axillary adenopathy may be caused by a wide range of both benign and malignant etiologies. The purpose of this exhibit is:

- To review the normal anatomy of the axilla.
- To describe many benign and malignant causes of axillary adenopathy.
- To illustrate imaging findings of challenging lesions from our series with their pathologic correlates.
- To emphasize pitfalls, diagnostic difficulties and differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

- Anatomical characteristics of the axilla
- Clinical presentation
- Imaging findings
- Review of the most common extramammary incidental findings in the axilla
- Pictorial examples
- Discuss the impact of early and accurate diagnosis on the management options.
The Many Faces of Architectural Distortion

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TEACHING POINTS
Definition of architectural distortion (AD). Relationship of mammographic appearance of AD to the pathologic characteristics: review the malignant and benign causes. Methods for the detection of AD: morphologic features. Discussion of clinical management with specific pathologic diagnosis.

TABLE OF CONTENTS/OUTLINE
Understanding the definition of Architectural distortion by the Breast Imaging Reporting and Data System (BI-RADS) system. Multimodality findings of AD: additional views, ultrasound, role of tomosynthesis and MRI. The radiologist’s role in identifying lesions for biopsy. Illustration of its various manifestations: Benign and malignant causes of AD. Radiological-Pathological Concordance for appropriate management and follow-up.
Controversies and Literature Review of Management of Axillary Lymph Nodes in Breast Cancer: Update for Breast Imagers

All Day Room: BR Community, Learning Center

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TEACHING POINTS
Critical for radiologists to understand the current concepts and controversies in the management of axillary lymph nodes in breast cancer patients. Exhibit will review the recent literature and clinical trials, and update the radiologist in developments and controversies in the management of axillary lymph nodes.

TABLE OF CONTENTS/OUTLINE
1. Introduction
   - Anatomy of the axilla
   - Clinical significance and staging of axillary lymph nodes
2. Axillary lymph node dissection (ALND): Traditionally regarded as best method of assessing metastatic spread and achieving local control but has a high risk of morbidity
3. Sentinel lymph node biopsy (SLNB): Preferred surgical approach, but controversy on which clinical situations should be managed with SLNB
   - Indications and contraindications
   - Nuclear medicine isotope injection and lymphoscintigraphy: no consensus on the procedure method despite being standard of care for decades
   - Present how we perform SLNB and review technical controversies
   - Review major clinical trials (Z0011, Z1071) and their impact on clinical management
   - Update of American Society of Clinical Oncology Clinical Practice Guidelines
   - Novel techniques: Contrast enhanced US
4. Pictorial case examples: clinical findings, imaging, and management of the axilla in breast cancer patients with different scenarios based on evidence based medicine
It's Time Your Patients Return. When the Abnormal Finding Identified are Asymmetries
All Day Room: BR Community, Learning Center

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TEACHING POINTS
Asymmetry may be the only manifestation of breast cancer on standard mammographic views. Description of the four types of asymmetry found at mammography included in the fifth edition of the Breast Imaging Reporting and Data System (BI-RADS) atlas with illustrative examples. Definition of the routine assessment of a diagnostic mammogram in the evaluation of a questioned asymmetry. Discussion of tools useful in the work-up. Review the variety of possible conditions. Important pathologic considerations following biopsy

TABLE OF CONTENTS/OUTLINE
Understand the appearances and significance of BI-RADS fifth edition mammographic four types of asymmetry. A clinical history should be also considered. Describe imaging work up of asymmetries: additional mammographic views, ultrasound, and role of tomosynthesis. Illustrate examples. The list of cases includes: Benign conditions and Malignant lesions. Correlate the imaging with histology of benign and malignant lesions.

TEACHING POINTS

Review the types and imaging appearances of breast augmentation, including implants and direct injection of fat, silicone and other materials. Describe post-augmentation complications with multi-modality appearances. Identify the multi-modality imaging appearance of diseases and pathologies associated with breast augmentation.

TABLE OF CONTENTS/OUTLINE

We will present a case-based review of breast augmentation with particular emphasis on associated complications and diseases. Provide an overview of the types of breast augmentation available including silicone, saline, and dual lumen implants, free injection of silicone and polyacrylamide gel, and autologous fat augmentation. Discuss the imaging recommendations including discussion of technique and utilization of mammography, sonography, and MRI. Review common complications related to implants and other forms of augmentation, including early and late changes, such as peri-implant fluid collection or hematoma, infection, capsular contraction, rupture, and gel bleed. Provide a case-based multimodality review of unusual implant-associated complications, including peri-capsular lymphoma and other neoplasms, silicone granulomas, fibrosis, reactive lymphadenopathy, gel migration and fat necrosis. Discuss clinical management and prognosis for complications related to augmentation.
**Teaching Points**

Review the indications for male breast mammography/sonography. Illustrate common and uncommon findings of the male breast. Demonstrate the utility of mammography and sonography in the diagnosis of abnormal male breast findings. Briefly discuss management of male breast pathology.

**Table of Contents/Outline**

1. Review indications for performing mammography and sonography of the male breast
   - Palpable mass
   - Breast enlargement
   - Breast tenderness
2. Illustrate more common abnormalities of the male breast, including:
   - Lipoma
   - Breast abscess
   - Gynecomastia
   - Nodular
   - Dendritic
   - Diffuse glandular
3. Illustrate less common abnormalities of the male breast, benign and malignant, including:
   - Invasive mammary carcinoma
   - Malignant mesothelioma
   - Myofibroblastoma
   - Fluid collection secondary to disrupted ventriculoperitoneal shunt
4. Discuss management
   - Primary versus secondary malignancy management
   - Management of benign findings
   - Lipoma
   - Abscess
   - Gynecomastia
   - Myofibroblastoma
   - Management of post surgical complications
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TEACHING POINTS
The knowledge of typical imaging features that aid in distinguishing between benign and malignant breast lesions plays a critical role in the radiologic diagnosis of these lesions and patient management. However, there are a variety of benign breast lesions that commonly exhibit malignant imaging characteristics, making the distinction more challenging. The purpose of this exhibit is to familiarize the viewer with benign breast lesions that may appear malignant on different imaging modalities, correlate the lesions with their pathologic characteristics, and discuss the clinical implications of these findings.

TABLE OF CONTENTS/OUTLINE
Breast cancers caused by inherited gene mutations are rare but it is important for radiologist to be aware of the cancer susceptibility genes, clinical features of patients with such genes, screening recommendations, and the role of the genetics counselor and surgical oncologist. At the end of this educational exhibit the learner will: 1. Have an improved understanding of cancer susceptibility genes including: BRCA 1/2, TP53, PTEN, Peutz-Jegher syndrome (STK11/LKB1), ATM, CHEK2, PALB2, and CDH1, 2. Review the management strategies for this group of patients, 3. Become aware of the role of genetic counselors and breast surgical oncologists in the management of patients with gene mutations, 4. Learn the differences between different risk assessment models, 5. Be able to explain to both clinicians and patients the significance of gene mutations and modifiable v. non-modifiable risk factors.

TABLE OF CONTENTS/OUTLINE

Introduction; Definition and differences between familiar risk and hereditary breast cancer genes; Hereditary breast cancer syndromes; Clinical features of patients with gene mutations; Genetic testing v. genetic counseling; Screening strategy; Clinical and surgical management strategies; Algorithm for the management of mutations to the breast; Test yourself with image case review and multiple choice.
Positioning for Success: A Primer on Ergonomics and Arrangement for Ultrasound Guided Breast Biopsies

All Day Room: BR Community, Learning Center

Participants
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TEACHING POINTS

Discuss how proper positioning of the patient and your body will help give you maximal control during breast biopsies. Demonstrate how pitfalls in positioning can make the procedure more difficult. An appropriate layout of the procedure room will increase efficiency during the procedure.

TABLE OF CONTENTS/OUTLINE

Ultrasound guided breast biopsies has numerous advantages over other image guided breast biopsies, but is operator dependent. We will demonstrate how proper ergonomics of the physician relative to the patient are important to maximize fine motor control during the procedure, while minimizing body strain. Introductory review will include importance of keeping the needle parallel to the chest wall for visualization and patient safety, and how positioning of the patient can improve access to lesions. Teaching points relative to biopsy technique will include: how to stand relative to the patient and biopsy table, positioning of the radiologist’s upper body to minimize motion and muscle strain, and grip of the ultrasound transducer to maximize stability and patient comfort. We will contrast these points with how improper positioning can negatively affect control and result in motor strain, as well as patient discomfort. Finally, we will discuss how the layout of the procedure room can maximize the efficiency of the procedure.
Breast Lesions in CT

All Day Room: BR Community, Learning Center

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TEACHING POINTS
Breasts should be evaluated in each CT chest examination, especially if contrast media is applied to avoid a delay or miss the diagnosis of breast cancer. General radiologists should be aware that breast lesions can often be depicted in chest CTs especially in contrast enhanced CT. A lesion in the breast enhancing after contrast media application is highly suspicious for malignancy and should be mentioned in the report and further characterized by breast imaging work up. Microcalcifications as a further sign of potential malignancy of a breast lesion cannot be depicted by CT examinations due to the sparse resolution.

TABLE OF CONTENTS/OUTLINE
Introduction: CT examinations including the chest are more frequently performed in the general radiology, therefore also more women and breasts are being pictured. Malignant breast lesions: Take up mostly contrast media and the margins are not well defined. Invasive ductal cancer
Ductal carcinoma in situ
Invasive lobular cancer
Papillary cancer
Benign breast lesions: Have a smooth border and don’t take up contrast media. Fibroadenoma
Simple Cyst
Mastitis
Conclusion: The breast should be catechized in each CT examination of the thorax, especially if contrast media is applied to avoid delay of the diagnosis of breast cancer.
The Impostor: Fat Necrosis in the Breast

All Day Room: BR Community, Learning Center

Participants
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Liliana E. Sosa, MD, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To describe the imaging findings of the fat necrosis in the breast by: mammography, ultrasound and magnetic resonance imaging (MRI). To discuss the relationship between imaging and histopathological results. To recognize the different manifestations of fat necrosis in order to avoid unnecessary biopsies.

TABLE OF CONTENTS/OUTLINE
Introduction Pathophysiology Etiology Clinical findings Imaging and pathological findings: mammography, sonography, and MRI Correlates the imaging findings with the pathologic findings. Conclusions
Shed a Little Light on This: Technical Aspects and Applications of Optical Mammography in Breast Imaging

All Day Room: BR Community, Learning Center

Awards
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Participants
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TEACHING POINTS
The purpose of this exhibit is:
1. To review the basic technical aspects and physics of optical mammography.
2. To review the basic physiology of breast cancer oxygen saturation, water and lipid content which can serve as biomarkers captured through an optical mammogram.
3. To illustrate the potential role of optical mammography in breast imaging, including characterizing the intrinsic contrast of malignant lesions and evaluating tumor response.

TABLE OF CONTENTS/OUTLINE
1. What is optical mammography?
2. How does an optical mammography unit work? - Basic technical aspects and physics of how an optical mammography unit functions
3. How does optical mammography help identify malignancy? - To depict the relationship between breast cancer tumor biology and optical mammographic biomarkers including oxygen saturation, lipid and water content
4. Optical Mammography Case Examples - Cases distinguishing malignant lesions from normal breast tissue - Cases distinguishing benign from malignant lesions - Cases evaluating tumor response following neoadjuvant chemotherapy
5. Future applications and summary
Breast Cancer Recurrence in the Post-Operative Breast: Pearls and Pitfalls

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Marcia A. Koomen, MD, Chapel Hill, NC (Abstract Co-Author) Nothing to Disclose
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TEACHING POINTS

The purpose of this exhibit is to: Discuss risk factors associated with breast cancer recurrence. Provide an overview of the imaging appearances of common breast reconstruction procedures and how these procedures may affect patterns of recurrence. Provide a case-based overview of breast cancer recurrence in the post-operative breast with relevant clinical histories, imaging workup, and pathologic correlation. Discuss clinical considerations of breast cancer recurrence and how this differs from a primary diagnosis.

TABLE OF CONTENTS/OUTLINE

Overview of breast cancer recurrence statistics and risk factors. Expected benign changes of the post-surgical breast following breast-conservation therapy. Differences in skin-sparing, simple, and modified radical mastectomies. Imaging findings of common breast reconstruction procedures including tissue expanders, implants, reduction mammoplasty, and autologous flap reconstruction. Case-based review of common mammographic presentations of breast cancer recurrence in the post-lumpectomy patient with tomosynthesis, ultrasound, and MRI correlation. Imaging algorithm for breast cancer recurrence compared to primary disease and discussion of clinical mangement. Provide unknown cases to test the radiologist's knowledge.
Breast Masses Encountered during Lactation: Imaging Findings and What Radiologists Should Know

All Day Room: BR Community, Learning Center

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TEACHING POINTS
1. To understand the physiologic changes of breast during lactation
2. To overview the clinical presentations, pathologic and radiologic findings of breast diseases during lactation
3. To demonstrate the imaging findings of breast cancer during lactation with multimodality approach

TABLE OF CONTENTS/OUTLINE
A. Physiologic changes of breast during lactation
B. Clinical manifestation and diagnostic approach
C. Benign breast diseases
   1. Galactocele
   2. Inflammatory and infectious disease
   3. Lactating adenoma
   4. Growing fibroadenoma
   5. Fibroadenoma with infarction
D. Malignant breast diseases: Pregnancy-associated breast carcinoma
   1. Mammography
   2. US
   3. Breast MRI during lactation
E. Management
TEACHING POINTS

The successful acquisition and interpretation of mammograms and performance of breast procedures require a team-based approach in which technologists play a critical role. Beyond obtaining high quality images, technologists can resolve or triage issues that often arise in breast imaging and procedures. Interaction with patients during screening mammograms can be an important juncture to address patients’ concerns regarding breast health. The objective of this exhibit is to describe the role of the technologist as an integral part of the breast imaging team with an emphasis on case examples.

TABLE OF CONTENTS/OUTLINE

Describe the role of technologists in the collaborative team-based approach to breast imaging and procedures Emphasize the importance of the screening questionnaire and how the technologist can triage issues related to breast symptomatology (e.g. instruct the patient to see her physician for diffuse, intermittent breast pain) Discuss the role of skin markers (e.g. interpretation of an architectural distortion may differ if a scar marker is present) Review issues that may arise during the mammogram (e.g. pain and non-worrisome nipple discharge with compression) and how to address these patient concerns Display case examples where the technologist has played a key role in helping to resolve issues related to breast imaging and procedures

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at:
https://www.rsna.org/Honored-Educator-Award/

Catherine S. Giess, MD - 2015 Honored Educator
Are We There Yet? A Review of Abbreviated Breast MRI Protocols and Their Potential Impact on Clinical Practice

All Day Room: BR Community, Learning Center

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TEACHING POINTS

While MRI is sensitive for detecting breast cancer, its long acquisition time creates a barrier to patient use. Abbreviated breast MRI (AB-MR) protocols show promise to decrease acquisition and interpretation times. However, these protocols lack the full complement of information obtained with diagnostic scans and have yet to be adopted widely in clinical practice. The purpose of this exhibit is to:

1. Define AB-MR and review the spectrum of protocols described in the literature.
2. Identify limitations of AB-MR.
3. Describe a novel approach to AB-MR that meets America College of Radiology (ACR) accreditation requirements for screening and diagnostic breast MRI.

TABLE OF CONTENTS/OVERSEVIEW

Overview of AB-MR
- Variety of protocols described in the literature
- Comparison of AB-MR to conventional breast MR performance

Limitations of AB-MR
- Added value of T2-weighted sequence and kinetic analysis of multiphase post contrast images
- ACR breast MRI accreditation requirements

Novel AB-MR protocol for clinical use
- Protocol details:
  - Acquisition time
  - Technical parameters
  - Isotropic voxels with volumetric coverage enable multi-planar reformatting of axial sequences
  - Kinetic analysis based on pre-, initial, and delayed post contrast images
  - Enabling technologies:
    - Multi-channel coils
    - Higher magnetic field strength
  - Clinical examples
A Primer on Breast Aneurysm and Pseudoaneurysm

All Day Room: BR Community, Learning Center

Participants
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TEACHING POINTS
The purpose of this exhibit is to: Discuss 3 cases of breast aneurysm and pseudoaneurysm presenting either as a routine screening mammogram or as a complication after percutaneous biopsy. Provide an overview of breast aneurysm and pseudoaneurysm including etiology, presentation and background information. Address the diagnostic imaging findings of aneurysm and pseudoaneurysm in the breast. Review the treatment and management options. Recognize the rarity of breast aneurysm and pseudoaneurysm.

TABLE OF CONTENTS/OUTLINE
Table of Contents/Outline: Review of Cases Patient History Imaging Findings Treatment and Management Etiology of Breast Aneurysm and Pseudoaneurysm Patient Presentation Questions to Ask the Patient During History Taking Background Information Anatomy Predisposing Factors Diagnostic Imaging Findings Ultrasound Doppler Ultrasound Mammography Treatment and Management Options External Compression Interventional Radiology Options Surgery

All Day Room: BR Community, Learning Center

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TEACHING POINTS
1. To present and discuss the technique of strain and shear wave elastography
2. To describe technical challenges, and propose management tips
3. To review the spectrum of applications of elastography for breast imagers

TABLE OF CONTENTS/OUTLINE
1. Overview of the technique
2. Management tips for challenging cases: superficial lesions, deep lesions
3. Radio-pathologic correlation examples with management recommendations
4. False negative and false positive cases: how to identify and prevent them

Elastography became a complimentary tool of the breast imager yet the technique remains challenging and imperfect. Challenges include technical considerations related to scanning adequately. Through various examples using Doppler and other modalities correlation and pathology correlation, this exhibit will offer practical tips to the radiologists as well as propose evidence-based algorithms for the use of elastography in breast imaging according to the review of the literature.
Imaging of Mastitis: Clinical, Imaging and Pathology Prospective
All Day Room: BR Community, Learning Center

Participants
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Teaching Points
- To review the imaging features of various types of mastitis encountered in clinical practice
- To correlate imaging findings with clinical picture and evaluate pathology concordance in cases necessitating biopsy.

Table of Contents/Outline
The term mastitis in pathology doesn't usually mean infectious inflammatory process. We present a series of challenging cases in quiz format that are either presented with mastitis clinically or diagnosed as mastitis in pathology as well as mastitis mimickers in imaging. Clinical, imaging (mammogram, ultrasound, MRI) and pathology correlation will be presented and each case will be discussed based on imaging findings. Multiple-choice questions will be presented highlighting the important teaching points. The list of cases will include: puerperal mastitis, TB mastitis, Granulomatous lobular mastitis, Lymphocytic mastitis, Plasma cell mastitis, Periductal mastitis, lymphatic and venous obstruction, Inflammatory breast ca, ...
Images Following Implant Removal: A Pictorial Review

All Day Room: BR Community, Learning Center

FDA Discussions may include off-label uses.

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TEACHING POINTS

Learn through pictures and diagrams normal and abnormal findings following breast implants removal. Be able to describe and categorize these images in order to avoid biopsy.

TABLE OF CONTENTS/OUTLINE

Patients who have undergone augmentation mammoplasty are common in daily practice. Complications of implants are among the reasons why women choose to have the implant removed or replaced, and radiologists should be familiar with the images associated to this condition to avoid unnecessary biopsies. Silicone in breast tissue presents a dilemma for the radiologist because it interferes with the interpretation of mammographic and ecographic findings. The presence of bilateral, symmetric soft-tissue masses without distortion of the neighboring breast parenchyma are consistent with a residual fibrous capsule and scar tissue. Calcification that may develop in fibrous capsule surrounding the implants may be left behind at surgery and can be seen mostly as coarse, plaquelike calcification. Sometimes residual calcified material may mimic malignant microcalcifications. A detailed history should be obtained, together with physical examination, and comparison with previous exams may be valuable to obviate biopsy.
Inflammatory breast carcinoma (IBC), a rare and aggressive form of breast cancer. Ultrasound (US) plays an important role in the assessment of many IBC. In this exhibit, we will review the US appearance of various manifestations of IBC.

Objectives:
- Emphasize the common sonographic features of IBC which can render an accurate diagnosis
- Review available literature of the role of sonography as the unique imaging modality in the diagnosis of IBC
- Review cases

TABLE OF CONTENTS/OUTLINE
1- Introduction
3- US technique for identifying IBC
4- The appearance of IBC at ultrasound
5- Differential Diagnoses
6- Cases
7- Conclusions
Stereotactic Biopsy of Breast Architectural Distortion with Intraprocedure Ultrasound Correlation as an Alternative to MRI-guided Breast Biopsy

All Day Room: BR Community, Learning Center

Participants
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TEACHING POINTS

(1) Architectural distortion may be well visualized on mammography with tomosynthesis, but identification of architectural distortion with ultrasound can be challenging at times(2) Breast MRI is usually performed to further assess architectural distortion identified on mammography that cannot be confidently identified with breast US, but if deemed suspicious on MRI, repeat "second-look" US may not always identify a lesion with confidence; in addition, some patients cannot under breast MRI or MRI-guided breast biopsy due to medical comorbidities(3) Biopsy of architectural distortion can be performed with stereotactic, US, or MRI-guidance, and the decision of which tool(s) to guide biopsy often is directly related to confidence in our ability to visualize the lesion(4) Combined use of stereotactic guidance and US guidance (simultaneously in one procedure) can increase radiologist confidence of correct-site biopsy when MRI-guided breast biopsy is unavailable or when patient MR safety issues exist

TABLE OF CONTENTS/OUTLINE

A. Breast anatomy and pathologyB. Tools for breast imaging - mammography, tomosynthesis, US, and MRI. Interventional biopsy tools and procedures (procedure time/cost)D. Simultaneous stereotactic/US-guided breast biopsy with multiple case examples with pathologic correlationE. Follow-up management and Outcomes
**TEACHING POINTS**

To review breast cancer high risk factors and how to identify high risk patients
To know the differences in pathological and radiological features of breast tumors according to high risk factors
To understand how these differences may influence screening strategies

**TABLE OF CONTENTS/OUTLINE**

Explore high risk factors for breast cancer and how to identify high risk patients
Brief review of possible management strategies: surveillance, surgical and chemoprevention
Case based review to show specific radiological features of tumors in women at high risk
Screening strategies and recommendations and how differences on Rad-Path features of the tumors according to the high risk factor may influence screening strategies
Conclusion
More Than Skin Deep—When Being Superficial is Significant or Not in Breast?

All Day Room: BR Community, Learning Center

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TEACHING POINTS
Superficial breast is comprised of the epidermis/dermis, hypodermis, (and parenchyma) which vary in their histology. Understanding this anatomy will enable proper localization to prevent incorrect labeling of superficial cancers as skin lesions and guide appropriate differential diagnosis and management. Specific imaging signs delineate the dermis and hypodermis on ultrasound (US), mammography (MG) and MR and indicate that the lesion is dermal, likely benign. With rare exceptions, majority of dermal lesions are benign. US given its high spatial resolution is best for localizing superficial lesions. "Claw sign" and acute lesion margin angles are helpful imaging findings that localize hypodermal lesions as dermal in origin. Calcifications can be identified as dermal in location both on tangential views and tomosynthesis, thus avoiding unnecessary biopsy.

TABLE OF CONTENTS/OUTLINE
Anatomy of dermis, hypodermis, (and parenchyma) on US, MG and MRI. Explain how certain lesions may be limited to specific layers due to intrinsic histology within the layers and provide a differential for each anatomic layer. Demonstrate how to localize a superficial breast lesion with imaging examples. Provide biopsy proven imaging examples of common and uncommon lesions that arise from different layers. Discuss limitations, pearls, potential pitfalls and biopsy considerations/precautions.
Pictorial Review: Benign and Malignant Disease in Postoperative Patients for Breast Cancer—Clinical Presentation, Imaging, Management and Histopathologic Correlates

All Day Room: BR Community, Learning Center

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TEACHING POINTS
Close clinical and imaging follow up is important in breast cancer patients with prior mastectomy or lumpectomy for early detection of recurrence and new cancers. The postoperative breast may present with a myriad of findings that radiologists should be familiar with. This exhibit will review the commonly and uncommonly encountered benign and malignant lesions in the postoperative breast. 1. Review findings in post-mastectomy or post-lumpectomy patients: - Malignant lesions: local recurrence, contralateral cancer, axillary or distant metastases - High-risk benign lesions: atypical ductal hyperplasia - Benign lesions: scar, cellulitis, fluid collections, lymphadenopathy, fat necrosis, traumatic neuroma 2. Review clinical presentation, patient characteristics, work-up and management 3. Correlate with histopathology 4. Illustrative examples of benign and malignant postoperative cases

TABLE OF CONTENTS/OUTLINE
1. Description of different surgical treatments for breast cancer
2. Detailed literature search: - Recurrence in the postoperative breast - Range of benign disease in the postoperative/reconstructed breast
Starting from 0: The Role of Cone Beam CT for BIRADS 0

All Day Room: BR Community, Learning Center

Participants
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TEACHING POINTS
To discuss the limitations of screening mammography, leading to a BIRADS 0 To learn the importance and impact of BIRADS 0 on the patient To demonstrate why Cone Beam CT can be a useful tool in diagnostic imaging, especially in regards to BIRADS 0

TABLE OF CONTENTS/OUTLINE
BIRADS 0 - Definition
Limitations of Conventional Screening Mammography
  Limited Contrast Resolution
  Overlapping Breast Tissue
  Decreased Sensitivity with Increasing Breast Density
Starting From 0, a Patient with Everything to Lose
  Psychological Effects
  Discomfort of Compression
  False Positives
Role of Cone Beam CT in Diagnostic Imaging, in Comparison to Diagnostic Mammography
  Improved Contrast Resolution
    Better differentiates neoplasm from lobular hyperplasia, fibrocystic or cystic disease
    Including lateral, medial, inferior, and posterior aspects of the breast
  Better Breast Coverage
  Dose
    Similar to typical 3-6 additional views for diagnostic mammography
No Breast Compression Required
  Avoids tissue overlap
  Better localization of lesions
  More accurate measurements
  Improved patient comfort
Name that Enhancement: Characteristic Patterns of Residual Disease Seen on Breast MRI in Post-Lumpectomy Patients with Positive Surgical Margins

All Day Room: BR Community, Learning Center

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TEACHING POINTS
Discuss the optimal time to perform breast MRI in post-lumpectomy patients with positive margins, and the clinical advantages of this timeframe. Review 4 common MRI enhancement patterns that are encountered in post-lumpectomy patients. Review radiology-pathology correlation for each of these 4 scenarios, including histology images for each case. Understand the different management strategies that arise from these enhancement patterns, underscoring the utility of MRI in this patient population.

TABLE OF CONTENTS/OUTLINE
Role of breast MRI in post-lumpectomy patients Optimal timeframe and rationale Differential diagnosis Fat necrosis Residual tumor Pre-malignant/others Review of common enhancement patterns at the lumpectomy site Normal post-op seroma pattern Focal irregular pattern with nodularity along seroma Clumped non-mass enhancement pattern extending from seroma Synchronous pattern (additional lesions in ipsilateral or contralateral breast) Sample cases Criteria for MR-guided biopsy vs re-excision Radiology-pathology correlationMimics and pitfallsClinical management strategies/implications Paradigms at our institution Review of literatureFuture directions Cost analysis: Re-excision vs pre-surgical staging MRI
Inappropriate use of BI-RADS Category 3: 'An Expert is a Person Who has Made all the Mistakes That Can be Made in a Very Narrow Field.'

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Jason Messinger, MD, Louisville, KY (Presenter) Nothing to Disclose

TEACHING POINTS
Review BI-RADS 3 definition
Review findings appropriate for BI-RADS 3 assessment based on the BI-RADS Atlas Review cases in which BI-RADS 3 was assessed but on follow-up were false negative cases, to help avoid imaging and assessment pitfalls
Show how ACR Appropriateness Criteria can help avoid inappropriate use of BI-RADS 3

TABLE OF CONTENTS/OUTLINE
We will use case material to demonstrate findings of cancers diagnosed following false negative BI-RADS 3 assessment at diagnostic work-up. We have collected 8 cases recalled from screening and assessed BI-RADS 3 at diagnostic work-up. At follow-up, the assessments were changed to BI-RADS 4, with recommendation for biopsy. These cases presented as either calcifications, masses, asymmetries, or architectural distortion. We will review why BI-RADS 4 would have been most appropriate from initial diagnostic work-up.

TABLE OF CONTENTS:
Review definition of the BI-RADS 3 assessment, including the body of literature to support the assessment in mammography and ultrasound
Review specific characteristics for imaging findings, including calcifications and masses, appropriate for BI-RADS 3
Review specific features of imaging findings which should be excluded from the BI-RADS 3 category
Case review of false negative BI-RADS 3 assessment and application of BI-RADS 3 rules to understand how such an assessment was inappropriate
Pathologic Results of Digital Breast Tomosynthesis (DBT) Guided Biopsies of 3D Only Detected Architectural Distortions and Upgrade Rate at Surgery

All Day Room: BR Community, Learning Center

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Cathleen M. Kim, MD, Burlington, MA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Detection of architectural distortion (AD) can be difficult to detect by digital mammography alone, particularly in heterogeneously or extremely dense breasts. DBT allows for improved detection of AD by clearly identifying superimposed tissue from true distortion. There are no distinct mammographic features of architectural distortion to confidently differentiate between benign and malignant pathology, based on imaging alone. The absence of a sonographic correlate should not sway any decision to proceed to biopsy based on mammographic findings. 33 tomographically guided biopsies of distortions were performed; 20% were malignant. The total upgrade rate for those that yielded benign pathology and proceeded to surgery was 10.4%, including an upgrade rate of 4.9% for radial scars/complex sclerosing lesions.

TABLE OF CONTENTS/OUTLINE
Overview of Digital Breast Tomosynthesis and improved invasive cancer rate detection compared to 2D mammography
Availability of tomosynthesis units and biopsy capability in the US
DBT appearance of ADRadiological-Pathological correlation of AD
Overview of radial scar including our upgrade rate as compared to those cited in the literature
Digital Breast Tomosynthesis (DBT) Guided Breast Biopsy of 3D Only Detected Architectural Distortion (AD); Strategies to Maximize Success

All Day Room: BR Community, Learning Center

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TEACHING POINTS
DBT allows for the improved detection of architectural distortion by eliminating overlapping breast tissue. Pre-procedural preparation includes identification of adjacent landmarks such as calcifications and fat-glandular interfaces as reference points to increase the level of confidence at time of biopsy. Localization bar aids in detection of AD in both projections, however it is important to utilize other landmarks to confirm location. Biopsy should initially be attempted in the view where the AD is best seen and should not be limited to only CC or 90 degree views, but can include MLO view. Confirmation of successful biopsy and clip location using post biopsy DBT.

TABLE OF CONTENTS/OUTLINE
Review of DBT Procedural review of DBT guided breast biopsy using the Affirm™ device by Hologic® Strategies to increase the chance of an accurate and successful biopsy Review of the challenges and potential pitfalls of DBT guided breast biopsy including 1 view finding Radiology-Pathology Concordance
A Sheep in Wolf’s Clothing: The Varied Appearance of the Post-procedural Breast

Participants
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TEACHING POINTS
The purposes of this exhibit are to:
1. Demonstrate common benign imaging findings of the post-procedural breast.
2. Identify appropriate timing for post-procedural imaging.
3. Examples will be presented with clinical history and findings on mammography and ultrasound.
4. Assist in differentiation of benign post-procedural findings from concerning findings that may necessitate intervention or closer follow-up.

TABLE OF CONTENTS/OUTLINE

| Biopsy                       | Core needle biopsy | Clip placement | Hematoma | Architectural distortion/scarring | Fat necrosis | Lumpectomy | Denser breasts | Skin and trabecular thickening | Architectural distortion | Benign calcifications | Suture calcifications | Post-mastectomy reconstruction | TRAM Flaps | Implants | Implant displacement positioning | Collapsing envelope | “Linguine” sign | Reduction mammoplasty | Redistribution of fibroglandular tissues | Nonanatomic parenchymal bands/scars | Fat necrosis | Seroma | Suture calcifications | Elevated nipple-areolar-complex |
Breast Arterial Calcification Scoring: Using Mammography to Assist Our Primary Care Physicians in Identifying Those at Risk for Cardiovascular Disease

All Day Room: BR Community, Learning Center

Participants
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TEACHING POINTS
1. The presence of breast arterial calcification has been shown to correlate with the presence of coronary artery calcification which in turn correlates with cardiovascular disease risk. A breast arterial calcification score is as good if not better than Framingham Risk Scores or the 2013 Cholesterol Pooled Cohort Equation for estimating coronary artery calcification.2. Breast arterial calcification is readily visible on digital mammography and one can quantify its presence by assessing its density, length of vessel involvement and the number of vessels involved.3. This exhibit will show and allow the viewer to practice scoring arteries of the breast by evaluating density, length and number of vessels involved.

TABLE OF CONTENTS/OUTLINE
1. Review of breast arterial calcification literature and the reasons why breast imagers should begin to report.2. Explanation of method of quantifying breast arterial calcification.3. Examples of breast arterial calcification on full field digital mammography, synthesized images and digital breast tomosynthesis.4. Suggestions for future research into the benefits of reporting BAC for screening mammogram patients with the goal of decreasing cardiovascular morbidity and mortality.
Keep Your Friends Close and Your Enemies Closer: BIRADS Based Review

All Day Room: BR Community, Learning Center

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TEACHING POINTS
- To learn the imaging findings of malignancies mimicking probably benign masses and the pathological features leading to this appearance
- To learn the imaging findings of benign entities mimicking malignancy and the pathological features leading to this appearance
- By the end of the presentation you will be able to learn: Some imaging tips and tricks related to assessment of various breast masses
- The commonly encountered diagnostic pitfalls during evaluation of breast masses

TABLE OF CONTENTS/OUTLINE
Imaging features of breast masses can be deceiving, benign diseases can mimic malignancy and malignancy can mimic benign diseases. In our series, we present cases in quiz format illustrating the key imaging features that would upgrade / downgrade masses illustrating the important educational objectives. The list of cases include: mucinous carcinoma, grade 3 invasive ductal carcinoma, medullary carcinoma, intracystic papillary neoplasm, lymphoma, phyllodes tumor, radial scar, granulomatous mastitis and fat necrosis, ...
Revisiting Microcalcifications on Mammograms in Neoadjuvant Chemotherapy for Breast Cancer

All Day Room: BR Community, Learning Center

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TEACHING POINTS
Although MRI is more accurate than clinical examination, mammography and ultrasonography for predicting residual breast cancer after neoadjuvant chemotherapy (NAC), associated microcalcifications cannot be evaluated on MRI. The aims of this exhibit are: To understand the standard concepts in imaging evaluation of breast cancer response to NAC. To discuss the significance of mammographic microcalcifications in evaluation of tumor response according to their histopathology.

TABLE OF CONTENTS/OUTLINE
1. Introduction
2. Comprehensive review of imaging evaluations of tumor response to NAC
   The Response Evaluation Criteria in Solid Tumors (RECIST)
   Tumor response dependent on histological and molecular subtypes and chemotherapy regimens
   Comparison of imaging modalities to assess the response to NAC
   Limitations in assessing residual disease: false positives and false negatives
3. The significance of mammographic microcalcifications in NAC
   Correlation between tumor subtypes and microcalcifications
   Comparison of residual microcalcifications on mammography and contrast enhancement on MRI after NAC
   Histopathology of residual calcifications
   How do we manage residual mammographic microcalcifications for presurgical planning
4. Conclusion
Implantable Cosmetic Silicone...What Can Go Wrong? Cases of Rare Complications of Both Implantable and Injectable Silicone

All Day Room: BR Community, Learning Center

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TEACHING POINTS
1. Review imaging findings of silicone lymphadenitis, an under-reported complication of silicone breast implant rupture.
2. Review imaging findings of the rare complication of silicone embolization syndrome caused by the subcutaneous injection of silicone.
3. Review imaging findings of silicone granulomas caused by injection of free silicone for breast augmentation.

The complications of silicone breast implant rupture have been widely reported in literature; however, there have been few reports of the complications associated with the dangerous practice of injecting free silicone into the subcutaneous soft tissues for cosmetic purposes. Using case examples seen in our emergency department and breast center, this exhibit will aim to educate radiologists on complications associated with the injection of free silicone, as well as a relatively underreported complication of silicone breast implant rupture, silicone lymphadenitis.

TABLE OF CONTENTS/OUTLINE
1. Background of implantable and injectable silicone.
2. Silicone lymphadenitis; case example and review of clinical symptoms and imaging findings.
3. Silicone embolization syndrome; case example and review of clinical signs and imaging findings.
4. Silicone injection granulomas; case example and review of common imaging findings.
5. Summary/conclusion.
Participants
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TEACHING POINTS
1. Discuss common presentations of benign inflammatory breast lesions
2. Review the appearance of benign inflammatory breast lesions on mammogram, ultrasound and MRI
3. Explore management options for benign inflammatory lesions of the breast

TABLE OF CONTENTS/OUTLINE
Challenges in prospectively diagnosing benign inflammatory lesions in the breast
Common presentations
Role of imaging
Review of findings by modality (mammogram, ultrasound, MRI)
Differential diagnoses
Inflammatory breast carcinoma, infection
Role of pathologic confirmation
Case examples of pathologically proven benign inflammatory lesions of the breast
Diabetic mastopathy
Granulomatous mastitis
Postpartum mastitis
Rosai-Dorfman disease limited to the breast
Xanthomatous inflammation of the breast
Management options for the above conditions
Summary
Precursor Lesions of Breast Cancer: Radiological, Pathological and Clinical Issues

All Day Room: BR Community, Learning Center

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TEACHING POINTS
The purpose of this exhibit is:
A. To Understand the Current Status of Breast Cancer Precursors Lesions and their Role as High Risk Factors for Breast Cancer
B. To Improve the Comprehension of Management of these lesions in Percutaneous Biopsies
C. To comprehend controversies in Screening Recommendations for Women with Prior Breast Cancer Precursors Lesions Diagnosis

TABLE OF CONTENTS/OUTLINE
Who are the breast cancer precursor lesions?
Pathologic Diagnostic Criteria and Radiological Features
Underestimation on Percutaneous Biopsy: Rates and Causes
Surgical excision update: yes, no or maybe?
Samples Cases
Breast Cancer Screening for Women with Prior Precursors Lesions Diagnosis: Currents Recommendations and Controversies
Screening recommendations for precursor lesions
How to Make Use of Non-fat-suppressed Precontrast T1-weighed Image in Breast MRI: Systematic Approach to Diagnosis with the Emphasis of Fat Signal Intensity

All Day Room: BR Community, Learning Center

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TEACHING POINTS
This exhibit focuses on the use of non-fat-suppressed precontrast T1-weighted image (T1WI). Non-fat-suppressed precontrast T1WI, in phase and with high spatial resolution can be scanned within one minute. This sequence is characterized by high signal intensity from fat and excellent fat-soft tissue contrast with fat-rich background breast tissue. Our proposed diagnostic approach to make use of this sequence is to identify the followings; Fat in the lesion. Fat-containing lesions (hamartoma, fat necrosis etc.) are usually benign. Fat-soft tissue contrast around the lesion. This is useful in evaluating spiculated margin of the lesion, pectoralis major muscle invasion, and identifying post NAC scar. Low signal intensity lesions/structures in the fatty breast background. Hemosiderin, metal clips, and implants show low signal intensity and are easier to be identified on non-fat-suppressed precontrast T1WI with bright fat background, in contrast to fat-suppressed T1WI with dark background.

TABLE OF CONTENTS/OUTLINE
Introduction
Technical aspects: theories and scan methods
Systematic assessment of signal intensity on non-fat-suppressed precontrast T1WI
Practical use of non-fat-suppressed precontrast T1WI with case presentation
Pitfalls of non-fat-suppressed precontrast T1WI
Reference
Beyond Paget Disease: Tutorial of Nipple Tumors
All Day Room: BR Community, Learning Center

Participants
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TEACHING POINTS
1. Defining and understanding the differential diagnosis for primary and secondary nipple tumors is essential given the radiologist's increasing role in the delivery of primary breast care.
2. The three World Health Organization (WHO)-classified primary nipple tumors are nipple adenoma, syringomatous tumor, and Paget disease.
3. The differential diagnosis for nipple tumors extends beyond the three WHO-classified primary nipple tumors and includes entities such as secondary involvement by DCIS, invasive carcinomas, squamous cell carcinoma, inflammatory breast cancer, papillary breast disease, and dermatopathologies.

TABLE OF CONTENTS/OUTLINE
Case-based tutorial of the WHO-classified primary nipple tumors: nipple adenoma, syringomatous tumor, and Paget disease. Review of companion cases with discussion of clinical and imaging findings, including mammography, ultrasound, and MR. Companion cases to included entities such as DCIS, papillary tumor, squamous cell carcinoma, invasive mammary carcinoma, inflammatory breast cancer, carbuncle, abscess. Selected unknown cases to test the radiologist's knowledge.
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TEACHING POINTS
Mammographically identified subtle architectural distortions not visible on ultrasound are routinely biopsied using stereotactic guidance. When patients return for biopsy, the lesion can be difficult to re-identify due to multiple reasons, such as small field of view, inadequate compression, and blind spots created by the stereo pair of images. This exhibit will discuss the issues faced in re-identifying subtle architectural distortion at the time of biopsy, other common problems in stereotactic biopsy, and how to address these challenges. After reviewing this presentation, participants will:

- Understand the process of stereotactic breast biopsy and how stereotactic lesion localization works
- Gain strategies to troubleshoot non-visualized lesions and other frequently encountered problems
- Understand factors affecting targeting errors

TABLE OF CONTENTS/OUTLINE
How stereotactic lesion localization works
Reasons for non-visualization of lesions
Approaches to address lesion non-visualization
Other frequently encountered problems such as the small breast, deep or posterior lesions, and superficial lesions and troubleshooting these problems.
MRI Guided Breast Biopsy: An Educational Review of Technique, Indications and Radiological-Pathological Correlation

All Day Room: BR Community, Learning Center

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TEACHING POINTS
To review the optimal MRI protocol and interventional techniques for MRI guided breast biopsy To understand the indications for MRI guided breast biopsy To review the underlying pathological -radiological correlation from MRI biopsy cases

TABLE OF CONTENTS/OUTLINE

MRI Biopsy Technique: Learn how to optimise MRI protocol for MRI guided biopsy Tips and tricks on patient positioning and approach for difficult lesions, including medial lesions, lesions close to pectoral muscle and lesions close to the skin Review of biopsy equipment, including biopsy devices, grid systems and available lesion detection software

MRI Biopsy Indication: Case-based approach reviewing indications for MRI guided biopsy, highlighting importance of careful selection of cases, and awareness of change in patient management resulting from MRI guided biopsy results

MRI Radiological-pathological correlation: Case based approach to review the radiological-pathological correlation of cases undergoing MRI guided breast biopsy including MRI appearances of focal lesions and non-mass like enhancement Pictorial review of the following pathogies identified on MRI with biopsy proven pathological confirmation: Invasive lobular and ductal carcinoma DCIS LCIS PASH Fibrocystic change Hamartoma Papilloma Fibroadenoma
Current Status and Clinical Pathway about Possible Supplemental Breast Cancer Screening Modalities for Women with Dense Breasts

Participants
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TEACHING POINTS
Digital mammography has been shown to be more sensitive than film-screen mammography for women with dense breasts, however, mammography still misses about 12-20% of all breast cancer. In the United States, recent legislative changes in many states now require radiologists to notify patients regarding breast density as well as the possible need for supplemental screening. Ethnicity, workforce, workflow, and resource for breast cancer screening in each country should be taken into account when each country considering supplemental breast cancer screening modality. The major teaching points of this exhibit are: Supplemental breast cancer screening modalities has been proposed to increase sensitivity and detection rates of early stage breast cancer among women with dense breasts. We should know the current status and clinical pathway about possible supplemental breast cancer screening modalities for women with dense breasts from point of view of population-based breast cancer screening program.

TABLE OF CONTENTS/OUTLINE
Introduction Morbidity and mortality of breast cancer Age-specific breast cancer incidence Mammography screening organization Assessment methods for breast density Possible supplemental breast cancer screening modalities Summary
Metaplastic Breast Carcinoma: Easy to Spot, Hard to Cure

All Day Room: BR Community, Learning Center

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TEACHING POINTS
1. Metaplastic Breast Carcinoma (MBC) has a distinctive mammographic appearance, one quite different from other triple negative/basal-type breast cancers. MBC presents as a large, dense breast mass, has the propensity for distant metastases in the absence of locoregional lymphadenopathy, and for recurrence after a shortened disease-free interval. 2. In MBC, it is important to utilize other imaging such as MRI or PET/CT to further characterize and stage (often large) local and distant disease. 3. It is also important to distinguish MBC from other causes of a large dense breast mass. This exhibit demonstrates various imaging and histological characteristics of the differential considerations such as sarcoma, phyllodes, hematoma/seroma, and invasive mammary carcinoma no special type (NST).

TABLE OF CONTENTS/OUTLINE
1. Histopathologic definition and classification of MBC
2. Clinical and imaging features of MBC. This is emphasized in the exhibit by showing multiple institutional case presentations of each subtype and their appearance characteristics on various imaging modalities and concordant histology.
3. DDx of MBC with various imaging and histological characteristics of other differential considerations to include: sarcoma, phyllodes, hematoma/seroma, and invasive mammary carcinoma NST, demonstrated in institutional case-based manner.
Diagnostic Performance of MRI versus Galactography in Women with Pathological Nipple Discharge: A Systematic Review and Meta-Analysis

All Day Room: BR Community, Learning Center

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PURPOSE
To perform a systematic review of the literature and perform a meta-analysis of the diagnostic accuracy of MRI in women with pathological nipple discharge in relation to that of galactography.

METHOD AND MATERIALS
No ethics committee approval was needed. A systematic literature search was performed (MEDLINE, EMBASE, WEB OF SCIENCE) for articles evaluating the diagnostic performance of MRI and galactography in patients with pathologic nipple discharge and with histologic verification or clinical follow up. Two independent readers selected eligible articles published until December 2015. The quality of studies was assessed using the QUADAS-2-tool. Data analyses were performed using the bivariate model.

RESULTS
Ten articles (921 patients) were analyzed showing low risk of bias and low concerns regarding applicability. Six of seven QUADAS-2 domains had 100% of studies with low risk of bias. The pooled sensitivity for any abnormality was significantly higher for MRI, with 92% (95% confidence interval [CI] 85%-96%) versus galactography, with 69% (95% CI: 59%-78%) (P<0.001). The pooled specificity was 76% (95% CI: 49%-92%) for MRI versus 39% (95% CI: 16%-69%) for galactography (P<0.001). The pooled sensitivity and specificity of MRI for cancer detection were 92% (95% CI: 74%-98%) and 97% (95% CI: 80%-100%), respectively.

CONCLUSION
Considering the high study quality, this meta-analysis demonstrated a higher diagnostic performance of MRI compared to that of galactography in patients with pathologic nipple discharge in the detection of any kind of lesions. Moreover, breast MRI confirmed its high sensitivity for cancer also in this clinical setting, combined with a very high specificity.

CLINICAL RELEVANCE/APPLICATION
In patients with pathologic nipple discharge, after negative mammography and ultrasound, MRI should be preferred to galactography.
Quantitative Analysis of Breast Tumor Vascularity Using Superb Micro-vascular Imaging (SMI) and Contrast-enhanced Ultrasound (CEUS)

All Day Room: BR Community, Learning Center

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Ok Hee Woo, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Angiogenesis plays a crucial role in tumor development, growth, and metastasis in breast cancers. Therefore, quantitative analysis of tumor vascularity with non-invasive radiological examination is essential to differentiate benign from malignant breast lesions, to monitor response to treatment, and to predict prognosis. Superb micro-vascular imaging (SMI) is a new generation of Doppler technique, specialized in demonstrating microvessels. Contrast-enhanced ultrasound (CEUS) has been used as a sensitive imaging tool for evaluation of tumor microcirculation and perfusion. In this exhibit, we will show how to analyze breast tumor vascularity quantitatively using SMI, and CEUS and to demonstrate their clinical implementation.

TABLE OF CONTENTS/OUTLINE
Significance of tumor angiogenesis in breast cancers Short history of radiological evaluation of breast tumor vascularity using ultrasound SMI and CEUS: Two up-to-date ultrasound techniques for assessment of tumor vascularity Imaging principles and application in breast lesions How to analyze breast tumor vascularity quantitatively : SMI - Vascular index : CEUS (Time intensity curve analysis) - peak intensity, time to peak, mean transit time, slope, area under the curve Potentials and limits 4. Discussion: Future work for quantitative analysis of breast tumor vascularity
Multimodality Imaging for Assessment of Vascularity in Breast Lesions: The Current Status and Future Potential

All Day Room: BR Community, Learning Center

Participants
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TEACHING POINTS
Assessment of tumor vascularity is essential in diagnosis of malignancy, treatment monitoring, and prediction of prognosis in breast lesions. Although pathological analysis is a direct method to determine the degrees of tumor vascularity in breast lesions, the ongoing development of imaging technology allows us to assess the vascularity indirectly with ease and reasonable accuracy. In this exhibit, we will show how to use the newest multimodality breast imaging for assessment of tumor vascularity - Superb Microvascular imaging (SMI), contrast-enhanced ultrasound (CEUS), low-dose CT, and dynamic MRI with computer-aided detection. In addition, we will demonstrate the advantages and pitfalls of each imaging modality and discuss the future potential.

TABLE OF CONTENTS/OUTLINE
The clinical impact of radiological assessment of tumor vascularity in breast lesions
The newest breast imaging modality for assessment of tumor vascularity: SMI, CEUS, low-dose CT, and dynamic MRI with computer-aided detection
Image acquisition
Quantitative and qualitative assessment of tumor vascularity
Clinical demonstration of multimodality approach to assess tumor vascularity and correlation with pathological analysis
Advantages and pitfalls
3. Discussion: Future potential of non-invasive radiological assessment of tumor vascularity
Colloid Carcinoma of the Breast: Review of Imaging Features with Pathologic Correlation in 34 Cases

All Day Room: BR Community, Learning Center

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TEACHING POINTS
To evaluate the role of mammography, ultrasonography and magnetic resonance in the diagnosis of mucinous carcinoma. To analyze the imaging features of the two main types of colloid carcinoma with the different imaging techniques. To correlate imaging features with pathologic findings.

TABLE OF CONTENTS/OUTLINE
Introduction. Prevalence of colloid tumors. Types of mucinous tumors and their typical and atypical imaging and pathologic features are discussed and illustrated. The role of mammography, ultrasonography and magnetic resonance is explained and illustrated. 34 cases diagnosed at our institution in the past years histologically confirmed by core biopsy or surgery are retrospectively reviewed. The imaging findings at mammography, ultrasonography and magnetic resonance, as well as their pathologic correlation are analyzed and illustrated. Diagnostic keys. Conclusions
New Electromagnetic Wave Technology in Localization of Non-palpable Breast Lesions that Require Excision: Our Institution's Experience with SAVI (Strut-Adjusted Volume Implant) Scout

All Day Room: BR Community, Learning Center

Participants
Veska Pandika, MD, Bryn Mawr, PA (Presenter) Nothing to Disclose
Emma L. Simpson, MD, Haverford, PA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To understand the methods and complications of localization of non-palpable breast lesions that require excision, with specific attention to the new SAVI Scout technology vs the current standard of care: fine wire and radioactive seed localization.
To share our radiologists' pearls and pitfalls in the learning process with this new localization technology.
To review the results of our experience with 31 SAVI Scout patients compared to our historical controls (seed excisions), with regards to positive margins, need for second operation for positive margins, and placement and operative localization accuracy.

TABLE OF CONTENTS/OUTLINE
A. Imaging findings of non-palpable breast lesions
B. Pros and cons of wire and radioactive seed localization
C. SAVI Scout:
   1. FDA approved in 2014
   2. Eliminates radiation by employing electromagnetic wave technology to determine the relative depth and direction of a reflective device placed percutaneously in the vicinity of a breast lesion under radiographic and/or ultrasonic guidance during a prior procedure
   3. Advantage: bypass nuclear regulation associated with the radioactive seed program
D. Our experience with 31 SAVI Scout patients
E. Final Conclusions: SAVI Scout is a welcome addition to our armamentarium for localization of non-palpable breast lesions that require excision
Will You Pass the Test: Radiologic and Pathologic Spectrum of Architectural Distortion on Mammography and Digital Breast Tomosynthesis

All Day Room: BR Community, Learning Center

Participants
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Elizabeth Lazarus, MD, Barrington, RI (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

* Architectural Distortion (AD) accounts for 12-45% of missed breast cancers.* AD, a distortion of breast parenchymal architecture without a definable mass, can be due to malignant lesions, such as invasive cancer or DCIS or to benign lesions such as radial scars or sclerosing adenosis.* The prevalence of AD on screening mammography is 6% of identified abnormalities, and is the most commonly missed abnormality.* 60% of biopsied ADs may be malignant and 80% of those are invasive, emphasizing the importance of detecting AD.* Digital breast tomosynthesis (DBT) may be better at detecting AD as well as eliminating false positives from overlapping tissue.* With DBT, cancer detection rate is increased and false-positive recall rate is decreased.* Our aim is to educate others about the radiologic and pathologic spectrum of AD, how to manage it, and determine concordance.

TABLE OF CONTENTS/OUTLINE

A quiz format will be utilized to:1. Review the range of appearances of AD on mammography and DBT as well as correlative imaging.2. Discuss the etiology and differential diagnosis for AD, including benign and malignant etiologies.3. Demonstrate pathologic entities that produce AD.4. Propose management algorithms for AD, including use of other modalities and biopsy, assessing concordance, and improving detection.
The Art of the Ductogram: Indications, Technique and Examples in Clinical Practice

All Day Room: BR Community, Learning Center

Participants
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Susan C. Harvey, MD, Lutherville, MD (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Ductography or galactography is a mammographic technique used to elucidate the source of intraductal lesions that cause unilateral bloody or clear nipple discharge. Pathology diagnosed by ductography is seen as intraductal filling defects and include both benign and malignant etiologies. The diagnostic quality of a ductogram is largely dependant on the experience and technique of the imager, which will be reviewed here.

TABLE OF CONTENTS/OUTLINE

Ductography indications Spontaneous unilateral bloody or clear nipple discharge Ductography technique Diagram of ductography Step-by-step photos demonstrating technique Benign intraductal examples with US and MRI correlates Papilloma Seroma Contrast extravasation Ductal inflammation Malignant intraductal examples with US and MRI correlates Intraductal carcinoma DCIS
Body CT and MR Studies: Don’t Forget the Breast, the Clue to Your Diagnosis Might be There!

All Day Room: BR Community, Learning Center

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Mona M. El Khoury, MD, Montreal, QC (Presenter) Nothing to Disclose
Maude Labelle, MD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Isabelle Trop, MD, MPH, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Julie David, MD, Quebec, QC (Abstract Co-Author) Nothing to Disclose
Lucie Lalonde, MD, Mount Royal, QC (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1-To review incidental findings found on CT of the chest or abdomen and body MR
2-To emphasize that a breast lesion found on a CT or MR examination may yield to the correct diagnosis and impact patient’s management and treatment
3-Incidental findings in the breast may be clinically relevant even if they are not related to the acute patient’s condition and deserve particular attention to exclude breast cancer.

TABLE OF CONTENTS/OUTLINE
We will present clinical cases to highlight the importance of looking carefully at the breasts to avoid missing pertinent findings mainly breast cancer

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Mona M. El Khoury, MD - 2014 Honored Educator
Isabelle Trop, MD, MPH - 2014 Honored Educator
Julie David, MD - 2014 Honored Educator
Lucie Lalonde, MD - 2014 Honored Educator
Axillary Lesions: Are You Managing Them Well?

All Day Room: BR Community, Learning Center

Participants
Pramod K. Gupta, MD, Plano, TX (Presenter) Nothing to Disclose
Soume D. Foshee, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Francisco García-Morales, MD, Plano, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Although lymphadenopathy is the most common disease entity in the axilla, many other disease processes also affect the axilla. The radiologists should be aware of these entities and manage them effectively. The purpose of this exhibit is: 1. To present various commonly encountered axillary lesions in challenging quiz format. 2. To discuss the salient features and enhance general understanding of these axillary processes to help radiologists to develop reasonable differential diagnosis and guide clinical management.

TABLE OF CONTENTS/OUTLINE

The cases will be presented in a quiz format. Salient features, differential diagnosis and management will be discussed at the end of each case. Following cases will be presented: Benign reactive lymph nodes Metastatic lymph nodes Lymphoma Silicon axillary lymphadenopathy Accessory breast tissue Lipoma Epidermal inclusion cyst Seroma Abscess Oil cysts Poland syndrome
Granulomatous Mastitis: A Case-based Pictorial Review of Imaging Manifestations and Pitfalls

All Day Room: BR Community, Learning Center

Awards
Identified for RadioGraphics

Participants
Cedric W. Pluguez-Turull, MD, San Antonio, TX (Presenter) Nothing to Disclose
Jennifer Nanyes, MD, San Antonio, TX (Abstract Co-Author) Nothing to Disclose
Cristina J. Quintero, MD, Bryn Mawr, PA (Abstract Co-Author) Nothing to Disclose
Hamza Alizai, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Kenneth Kist, MD, San Antonio, TX (Abstract Co-Author) Research Grant, Bayer AG Research Grant, Konica Minolta Group Research Grant, Toshiba Corporation Research Grant, Seno Medical Instruments, Inc
N. Carol Dombluth, MD, San Antonio, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is:1. Review the pathophysiology, epidemiology, clinical presentation, natural course and management considerations of granulomatous mastitis2. To present a case based approach towards making the diagnosis utilizing clinical presentation and characteristic imaging findings3. Discuss potential imaging pitfalls and mimics

TABLE OF CONTENTS/OUTLINE

• Mention the pathophysiology, epidemiology, clinical presentation and natural course of GM • Review of characteristic imaging findings of GM (Mammogram, Ultrasound and MR) • Present a case-based approach of biopsy proven GM emphasizing key features to lead the diagnosis • Discuss potential imaging pitfalls and other breast mimics (breast abscess, infective mastitis, inflammatory breast CA, etc.) • Briefly present current management strategies • Summary
Spectrum of Clustered Ring Enhancement (CRE) on Breast MRI: Malignancies and their Mimickers

All Day Room: BR Community, Learning Center

Participants
Sona A. Chikamane, MD, Boston, MA (Presenter) Nothing to Disclose
Aya Michaels, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Catherine S. Giess, MD, Wellesley, MA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Clustered ring enhancement (CRE) is an internal enhancement pattern on breast MRI described as thin rings of enhancement clustered together around ducts. The positive predictive value of this pattern reported in the literature ranges from 67-100% and the finding is now included in the updated ACR BI-RADS lexicon. Despite the high PPV, identifying the finding of clustered ring enhancement can be somewhat challenging, particularly when differentiating CRE from other internal enhancement patterns. The purpose of this exhibit is to: 1) provide examples of clustered ring enhancement with radiology and pathology correlation and 2) review benign and malignant causes of this pattern to help improve recognition and specificity.

TABLE OF CONTENTS/OUTLINE
1. Review the ACR BI-RADS definition of the finding and provide examples of clustered ring enhancement
2. Describe the proposed pathophysiology of clustered ring enhancement using radiology-pathology correlation
3. Differentiate clustered ring enhancement from the other BI-RADS descriptors of internal enhancement (i.e. clumped)
4. Provide case examples of malignant (invasive ductal carcinoma, ductal carcinoma in situ) and benign causes (sclerosing adenosis, benign breast tissue) of clustered ring enhancement with pathologic correlation.

Honored Educators
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Catherine S. Giess, MD - 2015 Honored Educator
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Certificate of Merit

Participants
Katharine D. Maglione, MD, New York, NY (Presenter) Nothing to Disclose
Jessica H. Hayward, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Bianca M. Carpentier, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Loretta M. Strachowski, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
- Digital breast tomosynthesis is now widespread in clinical practice, resulting in lesions seen best or only on tomosynthesis, necessitating biopsy capability for this relatively new imaging modality.
- Tomosynthesis-guided biopsy is best suited for certain types of lesions, such as architectural distortion, developing/focal asymmetries, masses, and amorphous calcifications. Tomosynthesis-guided biopsy is often successful at accessing far posterior lesions and in patients who cannot tolerate prone biopsy.
- Tomosynthesis-guided biopsy is technically different from prone stereotactic biopsy, with different equipment and procedural steps.
- Tomosynthesis is faster than prone stereotactic core biopsy.

TABLE OF CONTENTS/OUTLINE
I. When we use tomosynthesis-guided biopsy, including lesion and patient selection.
II. How we perform tomosynthesis-guided biopsy, including a step-by-step example with equipment and procedural review, with an emphasis on differences between tomosynthesis and prone stereotactic biopsies.
III. Trouble-shooting technical difficulties: case examples.
IV. Review of the literature: Compared to prone stereotactic core biopsy, tomosynthesis-guided biopsy is faster, requires less attempts at patient positioning, and less exposures for lesion localization, without an increase in complication rate.
Beyond BRCA: Current High Risk Screening Recommendations in the Era of Multigene Panel Genetic Testing

All Day Room: BR Community, Learning Center

Awards
Cum Laude

Participants
Wade C. Hedegard, MD, Rochester, NY (Presenter) Nothing to Disclose
Jessica Salamone, MS, Rochester, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. BRCA is not the whole story regarding hereditary breast cancer. Multigene panel testing of 25 or more genes is becoming increasingly common.
2. A general knowledge of the most common non-BRCA gene abnormalities and their associated risk of developing breast cancer is essential to providing appropriate up-to-date imaging.

TABLE OF CONTENTS/OUTLINE

Why genetics matters? Comprehensive value-added care & aiding in surgical decision making
High risk program combining genetics and risk assessment models
Supplemental high risk screening = annual mammography + annual MRI
BRCA is not the whole story.
Multigene panel testing exists (25+ genes tested) Anyone tested prior to 2014 may qualify to be retested for additional genes
NCCN management guidelines
Alphabet Soup Breast cancer genes and their associated risks
CHEK2, ATM and PALB2 = most common non-BRCA genes you need to know
Know the “Red Flags” of when to consider genetic testing
Diagnosed at an age < 45, any triple negative cancer, 2 or more breast or ovarian cancers in the same family
Personal or family history of colorectal, endometrial, melanoma, pancreatic, gastric and prostate cancer also matters
True or False: Top Genetic & Hereditary Breast Cancer Myths
Concordant or Discordant? Making Sense of the Breast Core Biopsy Pathology Alphabet Soup

Awards
Certificate of Merit

Participants
Dana Ataya, MD, Cleveland, OH (Presenter) Nothing to Disclose
Susan K. Miller, MD, Chagrin Falls, OH (Abstract Co-Author) Nothing to Disclose
Laura Dean, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
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Wendy M. Shaw, MD, Moreland Hls, OH (Abstract Co-Author) Nothing to Disclose
Laura B. Shepardson, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Alice S. Rim, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The various benign, high risk benign, and atypical breast pathologic diagnoses on core biopsy can be confusing. Appropriate knowledge of these diagnoses is imperative in appropriate determination of radiologic-pathologic concordance. The purpose of this exhibit is to present a series of challenging breast imaging cases with pathology core biopsy reports, in order to:
- improve the radiologist’s knowledge and confidence in interpreting the core biopsy reports
- improve the radiologist’s confidence in determining radiologic-pathologic concordance.

TABLE OF CONTENTS/OUTLINE

The cases will be presented in a quiz format. Review of the pathologic diagnoses (with images) on the core biopsy reports and detailed review of why the pathology is concordant or discordant will be highlighted after each case. The list of cases will include:

**Concordant cases:** apocrine metaplasia, stromal fibrosis, usual ductal hyperplasia, columnar cell hyperplasia, sclerosing adenosis, radial scar, angiolipoma, fibromatosis, PASH, ADH, FEA, ALH, LCIS.

**Discordant cases:** stromal fibrosis (invasive ductal carcinoma on excision), apocrine metaplasia and columnar cell hyperplasia (DCIS on subsequent core biopsy), fibroadenoma (phyllodes on excision), normal ducts (papilloma on excision), sclerosing adenosis (invasive carcinoma on excision).
TEACHING POINTS

The purpose of this exhibit is to review the imaging features of the lactating breast, including normal and abnormal findings. After viewing this presentation, the reader will gain a better understanding of the normal physiologic changes occurring with lactation, and the expected imaging manifestations on mammography, breast ultrasound, and MRI. We will also review the appropriate imaging management of breast symptoms in the lactating woman. We will provide pictorial examples and definitions of commonly encountered benign breast pathology in this population, including fibroadenoma, lactating adenoma, galactocele, mastitis, and abscess. The imaging manifestations of breast carcinomas and special considerations when performing biopsy of the lactating breast will also be reviewed.

TABLE OF CONTENTS/OUTLINE

Physiologic changes of lactation in the breast Normal appearance on breast imaging Management guidelines for breast symptoms in the lactating woman Common benign breast pathology and recommended management Malignancy in the lactating breast Special considerations for biopsy
Pregnancy Associated Breast Cancer: What the Radiologist Should Know?

All Day Room: BR Community, Learning Center

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Participants
Anubha Wadhwa, MD, Milwaukee, WI (Presenter) Nothing to Disclose

TEACHING POINTS

1. Discuss the clinical presentation of pregnancy associated breast cancer (PABC) and the challenges associated with its diagnosis.
2. Review the histopathology of PABC.
3. What are the imaging tests of choice in its diagnosis and its imaging features on mammography, ultrasound and MRI?
4. Discuss the available treatment options for this malignancy during pregnancy and during lactation.

TABLE OF CONTENTS/OUTLINE

2. Histopathology of PABC and how it differs from the usual breast malignancy and how it affects the treatment and prognosis.
3. Appropriate tests to be obtained in the diagnosis of this malignancy. The role of mammography in its diagnosis and its safety during pregnancy.
4. Imaging features on mammography, US and MRI. Review of the cases of PABC at our institution over the last 5 years and analysis of the histopathology and imaging features commonly seen at our institution.
5. Analyze some cases of missed PABC.
7. Prognosis of PABC.
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Participants
Chloe M. Chhor, MD, Brooklyn, NY (Presenter) Consultant, Siemens AG
Shimwoo Lee, New York, NY (Abstract Co-Author) Nothing to Disclose
Cecilia L. Mercado, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. Discuss the benefits and limitations of imaging mastectomy patients 2. Review the imaging approach for the evaluation of symptomatic patients after mastectomy 3. Illustrate the common imaging findings for benign and malignant causes of clinical symptoms in mastectomy patients

TABLE OF CONTENTS/OUTLINE
I. Locoregional recurrence after mastectomy
II. Benefits and limitations of imaging mastectomy patients
III. Approach to imaging of patients after mastectomy -- Literature review -- Imaging techniques/radiologic procedures used for evaluation -- Options for tissue diagnosis in cases with suspicious findings
IV. Case examples illustrating spectrum of imaging findings -- Benign causes -- Malignant causes
V. Summary
Accurate correlation of mammographic and sonographic findings first requires complete diagnostic work-up and combined assessment for mammography and adjunctive sonography to screen for breast cancer to improve the specificity. Lesion detection at sonography is improved by localizing breast lesions based on breast MR images and recognizing the possible differences in presentation of identical lesions at sonography and MR imaging. Mammographic-sonographic-breast MR imaging correlation is also of great value in diagnostic breast imaging. The major teaching points of this exhibit are:

1. Mammographic and sonographic location, size, shape, and margins should be concordant and carefully correlated to avoid errors.
2. Use of targeted sonography for identification of MR imaging detected breast lesions is challenging, but useful.

TABLE OF CONTENTS/OPTINE

1. Introduction
2. Mammographic-sonographic correlation
   - Location, Size, Masses, FAD, Architectural distortion, Calcifications
3. Breast MR imaging-sonographic correlation
   - Targeted sonography techniques, MR imaging-navigated sonography systems (real-time virtual sonography technique: RVS)
4. Mammographic-sonographic-breast MR imaging correlation
5. Pitfalls
6. Summary
Radioactive Seed Placement in Metastatic Axillary Lymph Nodes: Procedures and Pitfalls

All Day Room: BR Community, Learning Center

Participants
Gary J. Whitman, MD, Houston, TX (Presenter) Book contract, Cambridge University Press
Piyanoot Woodtichartpreecha, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Mark J. Dryden, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Dalliah M. Black, MD, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Aaron Jessop, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Basak E. Dogan, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Ultrasound-guided placement of radioactive iodine-125 seeds can be performed to localize clipped metastatic axillary lymph nodes prior to surgical excision. This exhibit reviews radioactive seed placement in clipped metastatic axillary lymph nodes and discusses common pitfalls, including failure to localize the appropriate lymph node and failure to surgically excise the appropriate lymph node.

TABLE OF CONTENTS/OUTLINE
A. Rationale for radioactive seed localized excision of clipped metastatic axillary lymph nodes.
B. Ultrasound-guided biopsy of suspicious axillary lymph nodes.
C. Ultrasound-guided clip placement in metastatic axillary lymph nodes.
D. Ultrasound-guided iodine-125 seed placement in metastatic axillary lymph nodes.
E. Specimen radiography following radioactive seed localized excision of clipped metastatic axillary lymph nodes.
The purpose of this exhibit is: To discuss guidelines in general and how they are made. To review breast cancer screening guidelines for average risk women from various organizations. Review the processes used. Review differing recommendations. To examine the potential impact these guidelines may have on patients and practices.

TABLE OF CONTENTS/OUTLINE

Discuss medical guidelines in general The IOM guideline process The national guideline clearinghouse (http://www.guideline.gov/) Discuss how the breast cancer screening guidelines were formed by a variety of organizations/panels. Members of the panel Process Evidence used in guidelines Weighting of benefits and harms Review consensus and differing recommendations regarding breast cancer screening developed by the following panels: US Preventive Services Task Force American Cancer Society National Comprehensive Cancer Network Canadian Task Force on Preventive Health Care European Society for Medical Oncology American Congress of Obstetricians and Gynecologists American College of Radiology/Society of Breast Imaging Examine the impact guidelines may have on patients and practice patterns.
TEACHING POINTS

1. Contrast-enhanced spectral mammography (CESM) is a new tool for breast cancer detection that uses contrast to identify areas of increased blood flow.
2. CESM uses a dual energy technique that results in a low energy image that looks like a conventional mammogram and recombined image that highlights areas of enhancement.
3. No formal CESM lexicon exists yet, but reporting should address low energy and recombined findings.
4. Understanding the spectrum of negative, benign, and malignant findings on both images is important for image interpretation, reporting, and management.

TABLE OF CONTENTS/OUTLINE

1. Background of CESM: What it is, how it works, and preliminary performance data
2. How to evaluate and report a CESM study using low energy and recombined images
3. Review appearance of normal exams, including normal tissue enhancement patterns
4. Review how to interpret and manage findings of mass, calcifications, and architectural distortion on low energy CESM with and without associated enhancement
5. Review how to interpret and manage non-mass enhancement, mass, and ring enhancement on recombined CESM in the absence of a mammographic finding
Awards
Cum Laude

Participants
Kathleen R. Gundry, MD, Atlanta, GA (Presenter) Nothing to Disclose

TEACHING POINTS
This purpose of this presentation is:-To review data on Breast Imaging malpractice cases- To become aware of unavoidable causes of missed breast cancers- To understand the role that mammographic technique plays in detecting breast cancer- To gain knowledge about the influence of lack of perception, misinterpretation and mismanagement on cancer detection

TABLE OF CONTENTS/OUTLINE
1. Breast Imaging malpractice case data? a. Who gets sued? b. What is the chief complaint in breast imaging malpractice suits?
2. First steps in reading a mammogram a. Review the history b. What did prior breast cancer look like. Be aware of recurrence c. Review last report and images for previous findings
4. Avoidable causes of missed breast cancer a. Technique- cannot detect what is not included on the film b. Lack of perception- the cancer is not seen c. Misinterpretation- the cancer is seen, but not identified as suspicious d. Mismanagement- the suspicious finding is not dealt with appropriately
To Biopsy Axillary Lymph Nodes or Not To Biopsy: An Algorithm for Determining if Image Guided Axillary Lymph Node Biopsy Would Benefit the Patient

All Day Room: BR Community, Learning Center

Participants
Kathleen R. Gundry, MD, Atlanta, GA (Presenter) Nothing to Disclose
Anna I. Holbrook, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Mark R. Green, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The learner will:
- Understand how surgical management of axillary Lymph nodes (LN) has changed and the affected on the radiologist’s approach to the abnormal lymph node.
- Learn how LN can be evaluated with sonography to service the patient and the clinician.
- Understand and practice how to evaluate LN for malignant potential.
- Master a practical algorithm to manage axillary LN seen on sonography.

TABLE OF CONTENTS/OUTLINE
1. Changes in LN management
   a. Impact of ultrasound biopsy on clinical management
   b. New surgical protocol derived from American College of Surgeons Oncology Group Z0011 trial
   c. The effect on Radiologist’s management of abnormal lymph nodes seen on sonography
   b. Effect on patients
2. How to evaluate LN for malignant potential
   a. Evaluate LN based on widely accepted criteria of cortical thickness, shape, hilar appearance, margin irregularity and size
   b. Review images of these criteria to understand how all the criteria contribute to an assessment of malignant potential of a LN
   c. Practice evaluating LN with a self-assessment test to reinforce concepts presented
3. Learn the algorithm to determine which LN to biopsy by combining:
   a. Clinical information - Prior surgery, distant metastasis
   b. Size of the primary lesion
   c. Rating of malignant potential of the LN
   d. Number of abnormal LN
Axillary Lymph Node Disorders - Beyond Breast Tumor Metastasis

All Day Room: BR Community, Learning Center

Awards
Certificate of Merit

Participants
Juliana H. Catani, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Flavia T. Horigome, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marco A. Costenaro, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Vera Christina C. Ferreira, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Nestor Barros, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: Review the multimodality imaging aspects in axillary node evaluation Correlate the imaging aspects - size, cortical thickness, density, echogenicity - with nodal disease pathophysiology Compare the imaging aspects encountered when evaluating axillary lymphadenopathy with breast tumor metastasis Illustrate with breast and non-breast tumor metastasis diseases, also with inflammatory / infectious node reaction.

TABLE OF CONTENTS/OUTLINE
Brief axillary anatomy review Imaging aspects of axillary lymphadenopathy and its pathophysiology Illustration of axillary lymphadenopathy cases: Breast tumor metastasis Non-breast tumor metastasis Infectious and inflammatory diseases Systemic diseases Other causes of axillary node disease
If You Don’t See It, Is It Really There? Case-based Multimodality Review of Technical and Operator Pitfalls Resulting in Missed Breast Cancers

Awards
Certificate of Merit

Participants
Wendy Tu, MD, Ottawa, ON (Abstract Co-Author) Nothing to Disclose
Raman Verma, MD, Ottawa, ON (Presenter) Nothing to Disclose
Jean M. Seely, MD, Ottawa, ON (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Ensuring proper technique is vital to detecting and diagnosing breast cancer. This exhibit will:
1) Review proper mammographic, ultrasound and breast MRI technique
2) Review common and uncommon technical and operator pitfalls in mammography, ultrasound and breast MRI that result in missed cancers.

TABLE OF CONTENTS/OUTLINE
Following a brief review of proper positioning and technique, this exhibit will illustrate the following multimodality examples:
1) Mammography: a) Real-life examples of why positioning matters with special attention on how to evaluate for insufficient tissue (screening and diagnostic) b) Breast compression and motion artifact
2) Ultrasound: a. Depth, focal zone and adequate grayscale b. Probe selection c. Incorrect imaging correlation
3) Breast MRI: a. Subtraction errors b. IV contrast administration c. Field of view d. Motion artifact e. Common blind spots
Breast Implant Associated Anaplastic Large Cell Lymphoma: A Comprehensive Review of the Etiology, Pathophysiology, Imaging Features and Pitfalls in Diagnosis—Why a Known Sequela of Breast Implants Is the Best-Kept Secret

All Day Room: BR Community, Learning Center

Participants
Lauren R. Kriger, DO, Morristown, NJ (Presenter) Nothing to Disclose
Anh V. Ngo, MD, Morristown, NJ (Abstract Co-Author) Nothing to Disclose
Gunja P. Parikh, MD, Morristown, NJ (Abstract Co-Author) Nothing to Disclose
Mary T. O’Connor, MD, Summit, NJ (Abstract Co-Author) Nothing to Disclose
Benjamin M. Schneider, MD, Westfield, NJ (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Learn and understand the physico-chemical characteristics of textured breast implants, the subsequent host response, and its association with BIA-ALCL.
2. Discuss the natural history of said host response and understand the pathophysiology by which BIA-ALCL develops.
3. Recognize clinical and radiologic findings of BIA-ALCL.
4. Examine the radiologist’s role in recognizing and diagnosing BIA-ALCL, including potential pitfalls in diagnosis.
5. Discuss the appropriate work-up, treatment, surveillance, and prognosis of BIA-ALCL.

TABLE OF CONTENTS/OUTLINE
After completing this educational exhibit, the reader will be able to recognize the multimodality appearance of breast implant associated anaplastic large cell lymphoma. Furthermore, the reader should be able to describe the pathophysiology and natural history of BIA-ALCL and understand the various clinical presentations, appropriate work-up, follow-up, treatment options, and prognosis. I. Review of breast anatomy and the normal imaging appearance of both silicone and saline implants outside of and within the breast. II. Overview of silicone and saline implants, both textured and smooth. III. Overview of the physico-chemical characteristics of textured breast implants, the subsequent host response, and their association with Breast implant associated-anaplastic large cell lymphoma. IV. Recognize clinical, radiologic, and histologic/cytologic findings of BIA-ALCL. V. Further examine the radiologist’s role in recognizing and diagnosing BIA-ALCL.
Participants
Phoebe E. Freer, MD, Salt Lake City, UT (Presenter) Nothing to Disclose
Matthew Stein, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Nicole S. Winkler, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Matthew B. Morgan, MD, Sandy, UT (Abstract Co-Author) Consultant, Reed Elsevier
Anna K. McGow, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Laurie L. Fajardo, MD, MBA, Park City, UT (Abstract Co-Author) Consultant, Hologic, Inc; Scientific Advisory Board, Hologic, Inc; Consultant, Koninklijke Philips NV; Advisory Board, Koninklijke Philips NV; Consultant, Siemens AG; Consultant, FUJIFILM Holdings Corporation; Advisory Board, Galena Biopharma, Inc
Maryam Rezvani, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Scott Harada, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose

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

Honored Educators
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Maryam Rezvani, MD - 2015 Honored Educator
Breast Tomosynthesis Reading Session: Siemens Healthineers Vendor Workshop
Sunday, Nov. 27 10:15AM - 11:25AM Room: Booth 5534

Participants

PARTICIPANTS
Maria Bernathova, Vienna, Austria

PARTICIPANTS
During this hands-on workshop you will learn to evaluate 2D mammography and 3D Breast Tomosynthesis. An expert tutor will lead you through cases that will both fascinate and confound you! All cases have been acquired with Siemens Mammatom Inspiration and are displayed on syngo.Breast Care workplaces so you will also become familiar with the image quality and ease of use of our systems. Speakers: Maria Bernathova Vienna, Austria

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Participants

PROGRAM INFORMATION

You are invited to our self-guided reading sessions. With syngo Breast Care workstations configured especially to allow you to work at your own place at a time that suits you! A series of breast tomosynthesis cases presented as problem cases with a solution enables you to develop and test your tomosynthesis reading skills.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Participants

PARTICIPANTS
Dr. Alejandro Tejerina

PROGRAM INFORMATION
A 60 minute hands-on workshop: Drawing on a breadth of experience, faculty presents a seasoned clinical perspective with the Affirm™ Prone Biopsy System, which includes comparison of tomosynthesis guided breast biopsy to stereotactic guided biopsy. The lecture will be followed by a hands-on case-based demonstration of the Hologic 3D™ image guided breast biopsy procedure using the Affirm™ Prone Biopsy System. (12 Attendees per session) (Affirm™ Prone Biopsy System)

Registration
http://www.hologic.com/rsna-hologic-workshop-sessions
Automated Breast Volume Scanner (ABVS) Self-guided Reading Sessions: Siemens Healthineers Vendor Workshop

Sunday, Nov. 27 10:30AM - 5:00PM Room: Booth 5534

Participants

PROGRAM INFORMATION

With syngo.Ultrasound Breast Analysis (sUSBA) Software, self guided reading sessions with real clinical cases will enable you to become familiar with the coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
**PURPOSE**

Three-dimensional functional infrared imaging (3DIRI) has been shown before to provide high accuracy risk assessment for the likelihood of breast cancer based on multiparametric evaluation of metabolic imaging biomarkers. In this prospective, blind study, of high risk women, 3DIRI is added twice yearly to a screening program which includes annual breast MRI and breast ultrasound or mammography surveillance. This study evaluates the diagnostic accuracy of 3DIRI’s risk assessment in the screening program and population of high risk women.

**METHOD AND MATERIALS**

Following IRB approval, 226 female at high risk for breast cancer due to genetic predisposition, mainly known carriers of BRCA 1/2 mutation signed informed consent for this study. They underwent one, two or three rounds of screening during 24 months. Screening included 3DIRI scan and MRI or breast Ultrasound or Mammography (FFDM). All examinations were read by one of 5 breast radiologists. Women with a negative screening mammography or ultrasound, but positive 3DIRI’s risk assessment score (e.g. likelihood for cancer), were referred to MRI. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were analyzed.

**RESULTS**

226 women completed one, two or three rounds of screening for a total of 378 valid 3DIRI examinations over a period of two years. In 8 women a total of 8 histology confirmed cancers were detected. 3DIRI’s risk assessment was positive (likelihood for cancer) in seven of these women, yielding a sensitivity, specificity, PPV and NPV of 87.5%, 84.32%, 10.77% and 99.68% respectively. In three women, cancer was missed by mammography and ultrasound, however, correctly classified as suspicious by 3DIRI and was detected by a subsequent MRI.

**CONCLUSION**

3DIRI can provide risk assessment for the likelihood of cancer with high accuracy in a population of women that are at high risk for breast cancer. Additional studies are necessary to evaluate its clinical utilization as adjunct to mammography in women that are at high risk for breast cancer.

**CLINICAL RELEVANCE/APPLICATION**

1. A novel imaging system for assessing the likelihood of breast cancer was developed with high efficacy for correctly classified women with breast cancer.
2. Assessing the likelihood for breast cancer non-invasively can assist in risk-stratified screening programs.
Participants  
Suzan Vreemann, MSc, Nijmegen, Netherlands (Presenter) Nothing to Disclose  
Jan Van Zelst, MD, Nijmegen, Netherlands (Abstract Co-Author) Nothing to Disclose  
Alber Geubner-Merida, PhD, Nijmegen, Netherlands (Abstract Co-Author) Nothing to Disclose  
Nico Kanssmeijer, PhD, Nijmegen, Netherlands (Abstract Co-Author) Shareholder, Matakina Technology Limited Consultant, QView Medical, Inc Shareholder, QView Medical, Inc Director, ScreenPoint Medical BV Shareholder, ScreenPoint Medical BV  
Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (Abstract Co-Author) Research agreement; Siemens AG; Research agreement, Seno Medical Instruments, Inc

**PURPOSE**

Women at increased risk for breast cancer are regularly screened with MRI. In the Netherlands, guidelines state that supplemental mammography is recommended from the age of 30 in these women. The purpose of this study is to investigate the added value of mammography when breast MRI is available.

**METHOD AND MATERIALS**

An IRB approved, retrospective review of our intermediate and high risk breast cancer screening program was performed, analyzing 9582 screening breast MRI examinations and 6555 screening mammograms from 2776 women screened in the period from January 2003 to January 2014. Screening indication and age were obtained from patient records. These data were linked to the Netherlands Cancer Registry to identify all breast cancers. Of the cancers identified, imaging records were evaluated for mode and modality of detection.

**RESULTS**

In total 179 cancers were identified, of which 137 cancers were screen detected. Thirteen out of 137 were detected by mammography alone (detection rate of 2/1000 screening mammograms). Of those, eight (62%) were found to be ductal carcinoma in situ (DCIS). The median age at detection was 55 ± 9.84 years. Twelve (92%) of the breast cancers detected with mammography alone were detected above the age of 40. Three (23%) were detected in BRCA mutation carriers (5% of all screen detected cancers in BRCA mutation carriers). Two of those cancers were diagnosed as DCIS in women above the age of 50.

**CONCLUSION**

The added value of mammography in high risk screening is very limited: only 13/137 (9%) of the screen detected cancers were detected by mammography alone and most are DCIS. Mammography is especially questionable in women under the age of 40 and in BRCA mutation carriers. Consequently, the age to start mammography in intermediate and high risk screening needs to be reconsidered.

**CLINICAL RELEVANCE/APPLICATION**

There is no ground for mammography on top of MRI for early detection of breast cancer in women at increased risk below the age of 40. In older women the added value is still very limited.

SSA01-04 Interobserver Variability in Detection of Architectural Distortion: Comparison of Digital Mammography and Digital Breast Tomosynthesis

Sunday, Nov. 27 11:15AM - 11:25AM Room: Arie Crown Theater

Awards

Trainee Research Prize - Fellow

Participants

Elizabeth H. Dibble, MD, Providence, RI (Presenter) Nothing to Disclose

Ana P. Lourenco, MD, Providence, RI (Abstract Co-Author) Nothing to Disclose

Grayson L. Baird, PhD, Providence, RI (Abstract Co-Author) Nothing to Disclose

Robert C. Ward, MD, Providence, RI (Abstract Co-Author) Nothing to Disclose

Arthur S. Maynard III, MD, Providence, RI (Abstract Co-Author) Nothing to Disclose

Martha B. Mainiero, MD, Providence, RI (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To compare interobserver variability in detecting architectural distortion (AD) on digital mammography (DM) and digital breast tomosynthesis (DBT).

**METHOD AND MATERIALS**

IRB-approved, HIPAA compliant retrospective search of radiology database at a tertiary breast center for "AD" or "possible AD" on screening from 3/5/12-11/27/13. Controls were matched for age, side of prior malignancy, side of new malignancy on presented mammogram, side of prior surgery, and date of mammogram when possible. Patient demographics, imaging findings, pathology findings, and follow-up imaging results were recorded. 2 breast radiologists and 2 breast imaging fellows blinded to outcomes independently reviewed images of 2 patient groups in 4 sessions: Group A DM only, Group B DBT only, then after a 1 month interval Group A DBT only, Group B DM only. For each breast, readers recorded presence or absence of AD and confidence in interpretation on a scale of 1-4. Agreement was examined using weighted Kappa. Differences in confidence between DBT vs DM and attendings vs fellows were examined using generalized mixed modeling with sandwich estimation. Agreement was examined for each breast, not each patient; outcomes are examined by breast but differences between breasts are not anticipated. Unilateral cases were removed (n=4).

**RESULTS**

59 patients with AD and 59 controls were identified. Mean age was 58.9 (range 42-86) and 57.5 (range 41-77), respectively. 79.7%(47/59) of patients with AD and 78.0%(46/59) of controls had heterogeneously or extremely dense breasts. 23.7%(14/59) of patients with AD and 25.4%(15/59) of controls had prior surgery. DM interobserver variability was 0.53 and 0.57 for right and left breasts, respectively. DBT interobserver variability was 0.72 and 0.69 for right and left breasts, respectively. Agreement was better for DBT than DM; confidence was higher with DBT, p<.001 (Table 1).
CONCLUSION

DBT decreases interobserver variability and increases reader confidence in the detection of AD.

CLINICAL RELEVANCE/APPLICATION

DBT decreases interobserver variability and increases reader confidence in the detection of AD. This may lead to improved detection of this subtle manifestation of breast cancer.

SSA01-05  Concordance of Interpretations of Multi-modality Breast Cancer Screening in Women with Dense Breasts

Sunday, Nov. 27 11:25AM - 11:35AM Room: Arie Crown Theater

Participants
Janie M. Lee, MD, Bellevue, WA (Presenter) Research Grant, General Electric Company
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Daniel S. Hippe, MS, Seattle, WA (Abstract Co-Author) Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company
Christoph I. Lee, MD, Los Angeles, CA (Abstract Co-Author) Research Grant, General Electric Company
Habib Rahbar, MD, Seattle, WA (Abstract Co-Author) Research Grant, General Electric Company
Constance D. Lehman, MD, PhD, Boston, MA (Abstract Co-Author) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company
John R. Scheel, MD, PhD, Seattle, WA (Abstract Co-Author) Research support, General Electric Company

PURPOSE

To compare concordance of interpretations for digital mammography (2D) and digital breast tomosynthesis (3D), without and with automated whole breast ultrasound (ABUS) for screening women with dense breasts and at intermediate to high risk of developing breast cancer.

METHOD AND MATERIALS

This study was HIPAA compliant and IRB-approved. All women received multimodality screening with 2D, 3D, and ABUS. Routine 2D and 3D views were obtained. The 3D examination consisted of two-view tomosynthesis and synthetic 2D images of each breast. 2D and 3D examinations were interpreted by independent readers, with initial BI-RADS assessment (Categories 0, 1, or 2) recorded. Each reader then interpreted the ABUS examination, and provided combined 2D+ABUS or 3D+ABUS assessments. For examinations with positive results (BI-RADS 0), recalled lesions underwent further evaluation with diagnostic 2D views, hand-held breast ultrasound, or both. The final BI-RADS assessment was recorded. Lesion location, characteristics, and pathology results (for biopsied lesions) were recorded. Biopsy recommendation rates were compared using Fisher exact tests.

RESULTS

Of 121 women, mean age was 54 years (range 26-81 years). Forty-three women (36%) had a family history of breast cancer, 25 (21%) had a personal history of breast cancer, and 53 (44%) had both. For 2D and 3D alone, the recall rates were 5.0% (6/121) and 3.3% (4/121), respectively. Two women (25%) had lesions recalled by both readers while 6 women (75%) had lesions recalled by only one reader. For combined 2D+ABUS and 3D+ABUS interpretations, the recall rates were 13% (16/121) and 11% (13/121), respectively. Of women recalled, five (21%) had lesions recalled by both readers; the remaining 19 women (79%) had lesions recalled by only one reader. The biopsy recommendation rate tended to be higher for lesions recalled by both readers (3/5, 60%) than for lesions recalled by only one reader (3/19, 16%), p=0.078. Of 6 biopsies performed, 1 had malignant and 5 had benign pathology results.

CONCLUSION

For multimodality screening with two readers for each woman, the majority of recalls were seen only by one reader. There was a trend towards a higher biopsy recommendation rate for lesions recalled by both readers.

CLINICAL RELEVANCE/APPLICATION

When adopting a new screening modality, double reading may reduce false-positive recalls during the "learning curve" phase.

SSA01-06  The Efficacy of 5-Year Consecutive Ultrasound (US) Surveillance for Detection of Axillary Lymph Node Recurrence in Breast Cancer Patients Treated with Sentinel Lymph Node Biopsy (SLNB)

Sunday, Nov. 27 11:35AM - 11:45AM Room: Arie Crown Theater

Awards

Student Travel Stipend Award

Participants
Bo Ra Kwon, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Jung Min Chang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
So Min Lee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sung Ui Shin, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Su Hyun Lee, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Nariya Cho, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Woo Kyung Moon, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE

Screening the axilla remains elective in ultrasound (US) screening for breast cancer and the efficacy of screening US for axillary recurrence in breast cancer patients treated with sentinel lymph node biopsy (SLNB) is unclear. The purpose of this study was to determine the efficacy of screening US in breast cancer patient treated with SLNB for evaluation of recurrences in breasts and axillae.

METHOD AND MATERIALS

Screening the axilla remains elective in ultrasound (US) screening for breast cancer and the efficacy of screening US for axillary recurrence in breast cancer patients treated with sentinel lymph node biopsy (SLNB) is unclear. The purpose of this study was to determine the efficacy of screening US in breast cancer patient treated with SLNB for evaluation of recurrences in breasts and axillae.
A retrospective chart review was performed on 367 consecutive patients who were treated with mastectomy or breast conserving surgery and SLNB between January and June 2011. Among these, 303 patients who received annual follow-up screening during 5 years were included. Whole breast ultrasounds including both breasts, excision sites, and axillae were performed and interpreted by expert breast radiologists with mammographic information. The cancer detection rate, recall rate, and positive predictive value (PPV3) of biopsies in breasts and axillae were calculated separately on the basis of pathology or follow-up data.

RESULTS
A total 303 patients underwent 2045 screening US combined with MG during 5-year follow-up period, 12 had recurrences (5.87 per 1,000 cases) including one axillary recurrence (0.49 per 1,000 cases), and 8 occurred within the third and fourth year and occurred in the fourth and fifth year. Among recurred breast cancers, 8 breast lesions were detected by combined US and MG with 5-year accumulated cancer detection rate of 3.91 per 1,000 cases. Axillary recurrence was detected on chest CT scan by minimal size change, not by US. During the period, 244 cases were recalled for breast (11.9%), and 33 cases for axillary lesion (1.6%), and US-guided biopsy was performed in 38 breasts and 10 axillary findings, respectively. The PPV3 for breast was 26.3%, and 0% for axilla.

CONCLUSION
Screening US combined with MG detected 3.91-recurred cancers per 1,000 cases for 5-year follow-up period in breast cancer patients treated with SNLB. Axillary recurrence was very rare compared to in-breast recurrence and screening the axilla was not helpful for detecting axillary recurrence, although the recall rate is lower than that of breast lesions.

CLINICAL RELEVANCE/APPLICATION
Our study supports the benefit of screening axillae in patient treated with SNLB is minimal, even though the recall rate is not as high as screening breasts.

SSA01-07 Performance Metrics of Screening Tomosynthesis: Analysis by Patient Age and Baseline versus Incidence Exam

Sunday, Nov. 27 11:45AM - 11:55AM Room: Arie Crown Theater

Participants
Liane E. Philpotts, MD, New Haven, CT (Presenter) Nothing to Disclose
Xiao Wu, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Madhavi Raghu, MD, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Howard P. Forman, MD, New Haven, CT (Abstract Co-Author) Nothing to Disclose

PURPOSE
Mammographic screening is criticized due to the imbalance of false positives with true positive cancer detection, particularly in younger women undergoing baseline exams when cancer incidence is lower. Digital breast tomosynthesis (DBT) has lower RR and higher cancer detection rates (CDR) than 2D mammography. The purpose of this study was to examine the performance metrics of screening DBT by patient age and baseline versus incidence screening.

METHOD AND MATERIALS
A IRB-approved audit of the breast imaging electronic database (PenRad) was performed to identify all DBT screening exams over 4-years at our main hospital and 2 satellite offices (total 46,140 exams). The data was sorted by patient age in 5-yr intervals: 40-44, 45-49, ... 75-79, 80+. True positive, false positive, true negative, and false negative cases were identified and overall specificity and accuracy calculated. The data for baselines was analyzed separately from incidence exams. Statistical analyses performed included Chi square, student t and correlation tests.

RESULTS
The overall sensitivity, specificity, and accuracy of tomosynthesis screening in all age groups was very high. There was no significant correlation found between sensitivity and age. Sensitivity in 40-44 (86.4%) was higher than in the 45-49 group (82.8%). Specificity and overall accuracy increased with age, ranging from 88.7% in 40-44, to 96% in the oldest groups. When comparing baseline versus subsequent mammography, metrics were significantly worse (p<0.0001). Subsequent mammography had higher accuracy than baseline in all age groups except 80+. Specifically, RR in baseline 40-44 (20%) was actually lower than other groups including 45-49 (23%) and 50-54 (27%) (p=0.02). The overall accuracy for baseline exams decreased with age significantly with the best accuracy found in the 40-44 (80%) and the lowest in the 70-74 group (65%) (p=0.05). Importantly, when only incidence exams were assessed, there were no significant differences in screening outcomes between the 40-44 and the 45-50 groups (p=0.225).

CONCLUSION
Tomosynthesis screening yields excellent results in all age groups. Although accuracy is slightly lower in younger women, this effect is erased once non-baseline exams are compared.

CLINICAL RELEVANCE/APPLICATION
Screening with DBT performs at a high level and with similar accuracy between age groups such that younger women should not be deterred from undergoing screening.

SSA01-08 Predictors of Surveillance Mammography Outcomes in Women with a Personal History of Breast Cancer

Sunday, Nov. 27 11:55AM - 12:05PM Room: Arie Crown Theater

Participants
Kathryn Lowry, MD, Boston, MA (Presenter) Nothing to Disclose
Lior Braunstein, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Konstantinos Economopoulos, MD, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Laura Salama, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Constance D. Lehman, MD, PhD, Boston, MA (Abstract Co-Author) Research Grant, General Electric Company; Medical Advisory
Women with a personal history of breast cancer who survive their initial cancer face risk for second breast cancers, including subsequent ipsilateral breast tumor recurrence (IBTR) and contralateral breast cancers. The purpose of this study was to identify predictors of poor mammography surveillance outcomes based on clinicopathologic features.

**METHOD AND MATERIALS**

This study was HIPAA compliant and IRB approved. We performed a retrospective chart analysis on a cohort of women with American Joint Committee on Cancer (AJCC) Stage I or II invasive breast cancer and subsequent local recurrence or contralateral breast cancer diagnosed from 1997-2014. Information on ER, PR, HER2 status and histologic grade of primary breast cancer (PBC) was used to approximate biologic subtype (Luminal A, Luminal B, Luminal B-HER2, HER2, and Triple Negative subtypes). Poor surveillance outcome was defined as second breast cancers which were not detected by screening mammography, including interval cancers (diagnosed within 12 months of a negative screening mammogram) or clinically detected cancers diagnosed without a screening mammogram within the past year. Chi square statistics and logistic regression were performed to identify predictors of poor mammography surveillance outcome, including patient demographics, PBC characteristics, systemic treatment, breast density, and time to second cancer diagnosis.

**RESULTS**

The final cohort included 164 women with IBTR (n=65) or contralateral cancer (n=99). Of these, 124 second cancers were detected by surveillance mammography, and 40 were detected by breast symptoms. On univariate analysis, poor surveillance outcome was associated with age <50 years at primary breast cancer diagnosis (p<0.0001), PBC AJCC stage II (p=0.007), and heterogeneously or extremely dense breasts (p=0.04). On multivariate analysis, age <50 years at PBC diagnosis remained the only significant predictor of poor surveillance outcome (p=0.001).

**CONCLUSION**

Women diagnosed with PBC before the age of 50 are at risk of poor surveillance mammography outcomes, and may be appropriate candidates for more intensive clinical and imaging surveillance.

**CLINICAL RELEVANCE/APPLICATION**

Women with primary breast cancer diagnosed before age 50 are less likely to have second events detected by surveillance mammography and may be an important population for more intensive surveillance.
Breast Imaging (Ultrasound Diagnostics)

Sunday, Nov. 27 10:45AM - 12:15PM Room: N228

SSA02-01 Comparison of Mammography, Digital Breast Tomosynthesis, Automated Breast Ultrasound, Magnetic Resonance Imaging in Evaluation of Residual Tumor after Neoadjuvant Chemotherapy

Participants
Wendie A. Berg, MD, PhD, Pittsburgh, PA (Moderator) Nothing to Disclose
Catherine S. Giess, MD, Wellesley, MA (Moderator) Nothing to Disclose

METHOD AND MATERIALS
Thirty-four women (age range, 40-68 years; mean age, 49 years) with 35 stage II-III invasive breast cancer undergoing NAC and mastectomy were enrolled from April 2015 to March 2016. Histopathological verification was available for all patients. The longest diameter of residual tumor measured with MG, DBT, ABUS and MRI has been compared with the residual invasive tumor size at pathologic evaluation. Mean differences (MD) in tumor size between measurement by radiologist and pathological size were evaluated. Statistical analysis was performed using intraclass correlation coefficients (ICC) and marginal homogeneity test. Receiver operating characteristics (ROC) analysis was used to evaluate the diagnostic performance of MG, DBT, ABUS, and MRI for predicting pathologic complete response (pCR).

RESULTS
The ICC values between predicted tumor size and pathologic size were 0.69 for MG, 0.78 for DBT, 0.85 for MRI. MD between MG, DBT, ABUS, MRI and pathology were 15.2mm, 10.8mm, 14.0mm and 10.1mm, respectively. A discrepancy limited in the interval from -5mm to +5 mm compared with the pathologic size was observed in 31.4%, 48.6%, 28.6% and 54.3% of the patients with MG, DBT, ABUS and MRI, respectively. The discrepancy between MRI and pathologic size was statistical different from that of MG and ABUS (P=0.043 and 0.0091, respectively), but not different from that of DBT. Eight of 35 (22.9%) patients showed pCR and 27 (77.1%) showed nonpathologic CR (npCR). For predicting pCR, area under the ROC curve (AUC) for MG, DBT, ABUS and MRI was 0.90, 0.83, 0.77, and 0.92, respectively (P= not significant).

CONCLUSION
Prediction of residual tumor size on MRI and DBT was better correlated with pathology than that on MG and ABUS. Thus, breast MRI and DBT allowed more accurate assessment of residual tumor extent in breast cancer patients after neoadjuvant chemotherapy (NAC).

Clinical Relevance/Application
Breast MRI and DBT provide more accurate assessment of residual tumor extent in breast cancer after NAC. Thus, MRI and DBT can be a useful tool in planning an effective surgical treatment.

SSA02-02 Comparison of Automated Volume Breast Ultrasound to Hand Held Ultrasound for Diagnostic Breast Ultrasound Work-Up

Participants
Richard G. Barr, MD, PhD, Youngstown, OH (Presenter) Consultant, Siemens AG; Consultant, Koninklijke Philips NV; Research Grant, Siemens AG; Research Grant, SuperSonic Imagine; Speakers Bureau, Koninklijke Philips NV; Research Grant, Bracco Group; Speakers Bureau, Siemens AG; Consultant, Toshiba Corporation; Research Grant, Esaote SpA; Research Grant, B and K Ultrasound; Research Grant, Hitachi Aloka Ultrasound
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Carmine Tinelli, MD, MSC, Pavia, Italy (Abstract Co-Author) Nothing to Disclose
**SSA02-03 Utility of Ultrasound Evaluation of Symptomatic Patients with Fatty Replaced Breast Tissue with a Negative Mammogram**

**Sunday, Nov. 27 11:05AM - 11:15AM Room: N228**

**Participants**

Jose M. Net, MD, Miami, FL (Presenter) Nothing to Disclose  
James Henderson, MD, Miami, FL (Abstract Co-Author) Nothing to Disclose  
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Fernando Collado-Mesa, MD, Miami, FL (Abstract Co-Author) Nothing to Disclose  
Monica M. Yepes, MD, Miami, FL (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

This study was conducted to assess the utility of ultrasound evaluating breast pain or a palpable abnormality in patients with fatty replaced breast tissue in the setting of a negative mammogram.

**METHOD AND MATERIALS**

We retrospectively reviewed 7180 patient charts of patients who underwent ultrasound evaluation between 1/01/2008 to 12/31/2010. Those who underwent both mammographic and concurrent sonographic evaluation for breast pain and/or palpable abnormality with fatty replaced breast tissue in the setting of a negative mammogram were included in the study. Medical records were reviewed to determine presence or absence of sonographic correlate of patient symptoms, need for biopsy, and final pathology. Those cases with reported positive ultrasound findings were reviewed by a fellowship trained board certified breast imagers. Patients with a history of breast cancer or with axillary complaints were excluded from the study.

**RESULTS**

161 patients with fatty replaced breasts underwent mammographic and concurrent sonographic evaluation in the setting of a negative mammogram for the work-up of pain and/or palpable abnormality. No cancer was identified in any of the 161 patients. 78 ultrasounds were performed for pain and 83 for a palpable abnormality. There were 156 negative ultrasounds (96%) and 5 ultrasounds (4%) demonstrating 1 lipoma, 1 normal lymph node, 1 inclusion cyst, 1 heterogeneous area characterized as fat necrosis given history of trauma which resolved on follow up and 1 patient lost to follow-up. None of the patients with ultrasound correlates to symptomatic area of concern warranted biopsy.

**CONCLUSION**

In patients with fatty replaced breast tissue and a negative mammogram presenting with breast pain and/or a palpable abnormality, ultrasound did not yield any cancer detection.

**CLINICAL RELEVANCE/APPLICATION**

Ultrasound may not be required in patients with fatty replaced breasts who present with pain or a palpable abnormality within the breast in the setting of a negative mammogram.
CONCLUSION

UST of 87%.

fibroadenomas for a total of 8 false positives, compared to 55 true positives. This resulted in positive predictive values (PPV) for

0.25) to (DS,DA) = (0.075, -0.2) and yielding 3 false positives in the form of cysts and 5 false positives in the form of

RESULTS

evaluated (Figure 1C).

and the results plotted on a scatter plot. A cut line was chosen for which no cancers were missed and the resulting false positives

respectively. The three parameters were combined into two parameters via the formula: DS = SS + REF/20; DA = AT + REF/20

from visual inspection of the reflection images to yield values of REF = -1, 0 and 1 for sharp, indistinct and irregular margins

radial profiles (Figure 1B) which were used to estimate the relative SS and AT of each mass. A tumor margin assessment was made

ROI ellipse (Figure 1A), for which 10 progressive peri-mass and 10 intra-mass ellipses were generated by an algorithm to create

scans. Each mass was characterized using the TriAD approach: The masses were outlined by an experienced radiologist using an

reflection images and quantitative sound speed (SS=m/sec) and attenuation (AT=dB/cm/MHz) images were generated from UST

PURPOSE

To prospectively investigate the effect of Superb Micro-Vascular Imaging (SMI) in distinguishing benign from malignant solid breast

masses by comparing with contrast-enhanced ultrasound (CEUS).

METHOD AND MATERIALS

Forty female patients who underwent US-guided core needle biopsy for 40 suspicious breast masses and gave written informed consent to this investigation were finally included. Before the biopsy, SMI and CEUS examinations were done in all patients using Aplio 500 US equipment (Toshiba Medical Systems Corporation, Japan) and Sonovue contrast agent (Bracco, Italy). Both quantitative and qualitative parameters were evaluated in SMI (vascular index-%area of vessel signal in the total lesion; qualitative parameters including morphology and distribution of vessels and presence of penetrating vessel) and CEUS (time intensity curve analysis-peak intensity[PI], time to peak[TPP], mean transit time, slope, area under the curve[AUC]; qualitative parameters including degree, margin, and order of enhancement and the presence of internal homogeneity, penetrating vessel, and perfusion defect). Each parameter was compared between benign and malignant masses using student’s T-test and chi-square test. The diagnostic performance of SMI and CEUS was analyzed and compared using logistic regression and the receiver operating characteristic curve (ROC) analysis.

RESULTS

Twenty-four masses were benign and 16 were malignant. On SMI, malignant masses showed higher vascular index (P<.001), more frequently branching/shunting vessel (P=.047), central vascularity (P=.027), and penetrating vessels (P=.002). On CEUS, malignant masses demonstrated higher PI (P=.073) and AUC (P=.057), lower TTP (P=.092), more frequent hyperenhancement (P=.061), centripetal enhancement (P=.022), penetrating vessel (P=.053), and perfusion defect (P=.018). The area under the ROC curve of SMI and CEUS was 0.857 and 0.898, which was statistically equivalent (P=.475).

CONCLUSION

SMI is a valuable Doppler technique in distinguishing benign from malignant solid breast masses and its diagnostic performance was equivalent to CEUS.

CLINICAL RELEVANCE/APPLICATION

SMI is a very useful Doppler technique in distinguishing benign from malignant masses at breast US without the use of contrast agent in clinical setting.

SSA02-05 Improving Specificity of Whole Breast Ultrasound using Tomographic Techniques

Sunday, Nov. 27 11:25AM - 11:35AM Room: N228

Participants

Neb Duric, PhD, Detroit, MI (Abstract Co-Author) Officer, Delphinus Medical Technologies, Inc
Peter J. Littrup, MD, Providence, RI (Presenter) Founder, CryoMedix, LLC; Research Grant, Gall Medical Ltd; Research Grant, Endo International plc; Consultant, Delphinus Medical Technologies, Inc
Rachel F. Brem, MD, Washington, DC (Abstract Co-Author) Board of Directors, iCAD, Inc; Board of Directors, Dilon Technologies LLC; Stock options, iCAD, Inc; Stockholder, Dilon Technologies LLC; Consultant, U-Systems, Inc; Consultant, Dilon Technologies LLC; Consultant, Dune Medical Devices Ltd
Mary W. Yamashita, MD, Los Angeles, CA (Abstract Co-Author) Research Grant, Delphinus Medical Technologies, Inc

PURPOSE

Ultrasound is a sensitive modality with a limited specificity for breast cancer. Ultrasound tomography (UST) is an emerging whole breast imaging modality that combines reflection, attenuation and speed of sound imaging, to support “triple acoustic detection” (TriAD). The purpose of this study is to determine UST’s specificity utilizing the TriAD approach.

METHOD AND MATERIALS

This HIPAA compliant, IRB approved trial accrued 167 patients with breast masses identified by standard imaging. Sequential reflection images and quantitative sound speed (SS=m/sec) and attenuation (AT=dB/cm/MHz) images were generated from UST scans. Each mass was characterized using the TriAD approach: The masses were outlined by an experienced radiologist using an ROI ellipse (Figure 1A), for which 10 progressive peri-mass and 10 intra-mass ellipses were generated by an algorithm to create radial profiles (Figure 1B) which were used to estimate the relative SS and AT of each mass. A tumor margin assessment was made from visual inspection of the reflection images to yield values of REF = -1, 0 and 1 for sharp, indistinct and irregular margins respectively. The three parameters were then combined into two parameters via the formula: DS = SS + REF/20; DA = AT + REF/20 and the results plotted on a scatter plot. A cut line was chosen for which no cancers were missed and the resulting false positives evaluated (Figure 1C).

RESULTS

55 cancers, 71 fibroadenomas, and 41 cysts were found. Their resulting values of DS and DA are shown in the form of a scatter plot (Figure 1C) with DS plotted horizontally and DA vertically. The cutline shows threshold values running from (DS,DA) = (-0.025, 0.25) to (DS,DA) = (0.075, -0.2) and yielding 3 false positives in the form of cysts and 5 false positives in the form of fibroadenomas for a total of 8 false positives, compared to 55 true positives. This resulted in positive predictive values (PPV) for UST of 87%.
The addition of TriAD lesion characterization, using UST, demonstrates a PPV of 87%. This is higher than the reported 20-25% PPV for ultrasound guided breast biopsy and has the potential to decrease the number of false positive breast biopsies for breast masses.

**CLINICAL RELEVANCE/APPLICATION**

Whole breast UST demonstrates a significant difference in the quantitative evaluations of cancer and benign masses which may allow for fewer biopsies of benign masses.

**SSA02-06** **Identification and Biopsy of Sentinel Lymph Nodes using Intradermal Microbubbles and Contrast-enhanced Ultrasound (CEUS) in Pre-operative Breast Cancer Patients: The Experience of a National Collaborative Working Group**

**Participants**

Karina Cox, MBBS, Maidstone, United Kingdom (Presenter) Nothing to Disclose  
Nisha Sharma, MBChB, Leeds, United Kingdom (Abstract Co-Author) Nothing to Disclose  
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Jennifer Weeks, Maidstone, United Kingdom (Abstract Co-Author) Nothing to Disclose  
Philippa Mills, MD, Maidstone, United Kingdom (Abstract Co-Author) Nothing to Disclose  
Ali R. Sever, MD, Maidstone, United Kingdom (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

At Maidstone Hospital Breast Clinic (MHBC), sentinel lymph nodes (SLN) are routinely biopsied in patients with newly diagnosed breast cancer and a normal grey-scale axillary ultrasound. The technique has been adopted by other Breast Units who now work collaboratively (UK Microbubble Working Group) and herein present their early experience.

**METHOD AND MATERIALS**

Data was collated from 4 Breast Units across the UK. Between 2010 and 2015: retrospective data was collected on 376 patients from Unit 1 and 122 patients from Unit 2, prospective data was collected on 64, mainly screen detected, breast cancer patients from Unit 3 and 48 patients from Unit 4. All patients were newly diagnosed with breast cancer, clinically lymph node (LN) negative and had SLN identified and core biopsied +/- fine needle aspiration (FNA) using intradermal microbubbles and CEUS.

**RESULTS**

Sentinel LN were identified and successfully biopsied (LN tissue retrieved) in 78% (Unit 1), 77% (Unit 2), 89% (Unit 3) and 79% (Unit 4) of patients with invasive breast cancer undergoing primary surgery. The sensitivities of the technique as a test to identify SLN metastases were; 53%, 46%, 62% and 45% respectively. The specificities were, 98%, 100%, 100% and 96% respectively. The negative predictive values were, 85%, 77%, 91% and 81% respectively. The prevalence of LN metastases in these populations were, 29%, 35%, 21% and 29% respectively. The post-test probabilities that given a benign biopsy the patient had SLN metastases were, 16%, 22%, 9% and 19% respectively.

**CONCLUSION**

The results represent 4 Breast Units around the UK serving different patient populations with heterogeneous data collection and some variation in the use of the technique. Nevertheless, the data show that CEUS guided SLN biopsy can be readily incorporated into a diagnostic pathway for breast cancer. The sensitivities of the test were all within the previously published confidence intervals for MHBC. Further work should be undertaken to consolidate a standardised approach for the use of CEUS guided SLN biopsy in the breast clinic to establish the foundations for a clinical trial. There may be patients, with a benign core/ FNA SLN biopsy, in whom it is appropriate to completely omit axillary surgery.

**CLINICAL RELEVANCE/APPLICATION**

This collaborative work establishes the foundation for a clinical trial as some patients may be able to avoid axillary surgery completely.

**SSA02-07** **Assessment of Shear Wave Elastography in the Ultrasonic Diagnosis of Breast Cancer in Chinese Patients: The BE3 Multicenter Study of 2262 Masses**

**Participants**

Xi Lin, Guangzhou, China (Presenter) Nothing to Disclose  
Ya-Ling Chen, Shanghai, China (Abstract Co-Author) Nothing to Disclose  
Anhua Li, Guangzhou, China (Abstract Co-Author) Nothing to Disclose  
Cai Chang, Shanghai, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To gather elastic information of breast masses based on Chinese population, and to determine the added value of SWE in the characterization of breast masses as compared to conventional US alone.

**METHOD AND MATERIALS**

From June 2014 to June 2015, 2262 patients consented to repeat standard breast US supplemented by quantitative SW elastographic examination in this prospective multicenter study. Features and assessments of B-mode BI-RADS and qualitative and quantitative SWE were recorded. The final diagnosis for each lesion in which biopsy was recommended was derived from histopathologic results. There were 2262 masses analyzable:152 BI-RADS category 2 masses were assumed to be benign; reference standard was available for 2110 category 3 or higher lesions. Considering BI-RADS category 4a or higher as test positive for malignancy, effect of SW elastographic features on area under the receiver operating characteristic curve (AUC), sensitivity, and specificity after reclassifying category 3 and 4a masses was determined.
RESULTS
Of these 2262 patients, 1509 lesions were benign and 752 were malignant. If the BI-RADS test was considered to be Test>0 for BI-RADS 4 and 5 and Test <0 for BI-RADS 2 and 3, the accuracy, sensitivity, specificity were 69.0%, 97.5% and 54.8% respectively. Among qualitative SWE variables, SWE Homogeneity, SWE Shape and SWE Rim pattern and Emax, Emean, Eratio and ESD were significantly increasing the AUC (no overlap of 95%CI). And the best variable to add BI-RADS classification to improve the AUC for breast US was Emax. By using a new reclassification rule, the malignancy rates were higher than 2% in BI-RADS 3 stiffer than 50 kPa, which could advocate for their upgrade to biopsy. Meanwhile, the malignancy rates were lower than 10% in BI-RADS 4 and less than or equal to 40 kPa, which could advocate for their downgrade to follow-up.

CONCLUSION
Quantitative and qualitative SWE features of Chinese population had been demonstrated well in this study. The importance of maximum stiffness on SWE was confirmed in the improvement of US performances in breast lesion characterization. By combining SWE to US, we could decrease the number of false positives of US in the sub-group of low-suspicion masses and avoid unnecessary biopsy.

CLINICAL RELEVANCE/APPLICATION
Combining SWE to US could decrease the number of false positives of US in the sub-group of low-suspicion masses and avoid unnecessary biopsy.

SSA02-08 The Comparison of Elastography and Apparent Diffusion Coefficient (ADC) Values of Solid Breast Lesions Benign Versus Malignant

Sunday, Nov. 27 11:55AM - 12:05PM Room: N228

Participants
Turkan Uz Ikizceli, Istanbul, Turkey (Presenter) Nothing to Disclose
Nurdan Gocgun, Istanbul, Turkey (Abstract Co-Author) Nothing to Disclose
Okses I. Karahan, MO, Istanbul, Turkey (Abstract Co-Author) Nothing to Disclose
Yildiray Savas, MD, Istanbul, Turkey (Abstract Co-Author) Nothing to Disclose
Gokce Gulsen, Istanbul, Turkey (Abstract Co-Author) Nothing to Disclose

PURPOSE
The purpose of this study is to compare elastography and the result of DWI-ADC values in terms of the discrimination of the solid breast lesions as benign versus malignant.

METHOD AND MATERIALS
This study was approved by Human Subjects Institutional Review Board. All patients gave informed consent. US and real-time Strain Ultrasound Elastography were performed in 71 women (mean age, 46.1±13.4 years; age range, 19-80 years), who had breast lesions greater than 1cm in diameter (29 benign, 42 malignant; confirmed by cytology/histology) evaluated prospectively. Elastography index (cutoff value is used 4.2) and scoring designed by Itoh et al. (Tsukuba elasticity score; 1-3 is considered to be benign, 4-5 is considered to be malignant) is obtained. All patients were assessed by DWI sequence and ADC value of each lesion was calculated from the ADC maps done using five b values 0, 125, 250, 375, and 500 s/mm2. Results of the two techniques were compared the sensitivity and specificity according to the gold standard histopathology results.

RESULTS
As a result of histopathology; 42 of the 71 solid breast lesions were malignant and 29 were benign. Elastography scoring has one false negative and 3 false positives and sensitivity and specificity were 93.1% and 96.2%, respectively. Elastography index has 2 false negatives, 2 false positives; sensitivity and specificity were 95.4% and 95.2%, respectively. As a comparison of ADC values and gold standard histopathology, we find a strong correlation of 100% between them. DWI-ADC values showed no false positive nor false negative results. The cutoff value of ADC is obtained with ROC curve of 0.71x10-3 mm²/s. The 29 benign lesions of histopathology are above the ADC cutoff and 42 of malign lesions of histopathology are below; and both the specificity and sensitivity of ADC were 100%.

CONCLUSION
When we compared the ADC results obtained by maximum b values of 500 s/mm²; the strong correlation is found (p < 0.0001). ADC has a prominent lesion characterization of solid breast lesions and superior to elastography in terms of benign and malignant discrimination. Also elastography provides specific benefits and plays an important role in the diagnosis of solid breast lesions.

CLINICAL RELEVANCE/APPLICATION
ADC has a prominent lesion characterization of solid breast lesions and superior to elastography in terms of benign and malignant discrimination.

SSA02-09 Prediction of Pathological Complete Response (pCR) to Neoadjuvant Chemotherapy (NACT) Comparing Greyscale Ultrasound (US), Shear Wave Elastography (SWE) and MRI

Sunday, Nov. 27 12:05PM - 12:15PM Room: N228

Participants
Andrew Evans, MRCP, FRCR, Dundee, United Kingdom (Presenter) Research Grant, SuperSonic Imagine; Speakers Bureau, SuperSonic imagine
Patsy Wherehan, MS, Dundee, United Kingdom (Abstract Co-Author) Research Grant, Siemens AG
Alastair Thompson, Houston, TX (Abstract Co-Author) Nothing to Disclose
Colin Purdie, MBChB, PhD, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Shelley Waugh, PhD, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Lee Jordan, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Jane Macaskill, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Sarah J. Vinnicombe, MRCP, FRCR, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
PURPOSE
Pathological complete response (pCR) is increasingly common after neoadjuvant chemotherapy (NACT) for invasive breast cancer. Early prediction of pCR may influence planned surgical approaches in the breast and axilla. The aim of this project is to assess the value of interim SWE and US after 3 cycles in predicting pCR after 6 cycles of NACT and to compare performance of these parameters with MRI using RECIST criteria.

METHOD AND MATERIALS
51 patients with primary, operable breast cancer receiving NACT were recruited into a study which included baseline and interim US and SWE examinations. 4 shear wave images were performed in 2 orthogonal planes and quantitative data extracted prospectively. Maximum greyscale US diameter was measured. We compared three parameters with the binary outcome of presence or absence of pCR: 1. Mean elasticity at interim scan greater or less than 50 kPa (a threshold previously validated for benign-malignant differentiation); 2. Percentage stiffness reduction; 3. Percentage diameter reduction at interim US scan compared with pretreatment. Interim MRI response using RECIST criteria was available for 42(82%) women. The Chi square test was used to ascertain the significance of differences.

RESULTS
Mean stiffness at baseline was 148 kPa. pCR occurred in 13 of 51 (25%) women. pCR was seen in 8 of 10(80%) women where masses had an interim stiffness value of <50kPa, compared to 5 of 41(12%) of women whose masses had an interim stiffness value of ≥50kPa, p<0.0001. with a sensitivity (sens) 62%, specificity (spec) 95%, PPV 80% and NPV 88% respectively. Percentage reduction in stiffness was the next best performance parameter (sens 53% spec 94%, p=0.0002) followed by % reduction in US diameter (sens 47%, spec 88%, p=0.007). MRI performance using RECIST criteria was sens 55% and spec 74%, p=0.08).

CONCLUSION
SWE stiffness less than 50 kPa after 3 cycles of NACT is strongly associated with pCR after 6 cycles of NACT and this parameter outperforms percentage reduction in stiffness, US diameter and MRI using RECIST criteria.

CLINICAL RELEVANCE/APPLICATION
SWE shows promise as a method of interim prediction of response in women with breast cancer treated with NACT and could be used to inform surgical decision making, allowing earlier discussion regarding breast conserving or oncoplastic options.
Program Information

This one-hour workshop led by a Peer Educator will introduce GE's SenoBright™ contrast-enhanced spectral mammography (CESM) technology that helps answer cases with inconclusive mammogram and ultrasound findings. Attendees will: Learn the unique features of GE's dual-energy acquisition | Understand how CESM exams are acquired on the SenoClaire™ system | Review clinical cases on the Seno Iris™ Workstation software during physician guided hands-on exam interpretation.

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop/event-summary-b904d22132614dc2b7633ee3b34f22de.aspx
Participants

PARTICIPANTS

Mariana Solari, Chicago, Illinois, USA

PROGRAM INFORMATION

Under the guidance of a breast imaging expert you will develop your skills in the interpretation of 3D breast ultrasound acquired with the ACUSON S2000™ Automated Breast Volume Scanner (ABVS), HELX Evolution with Touch Control and displayed on workstations equipped with syngo.Ultrasound Breast Analysis (sUSBA) Software. Active participation in real clinical cases will enable you to become familiar with the coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
The Phenomenon of Ambiguous Location on Tomosynthesis: Contributing Factors and Practical Solutions: Hologic Vendor Workshop

Sunday, Nov. 27 12:00PM - 1:15PM Room: Booth 5521

Participants

PARTICIPANTS

Dr. Linda Greer

PROGRAM INFORMATION

An advanced 75 minute hands-on workshop: Clinical Insights exploring day-to-day location dilemmas associated with tomosynthesis imaging. Subsequent to a brief lecture, participants will review and score challenging cases. A Faculty led review with practical solutions and correlate ancillary imaging results will follow. (24 Attendees per session) (Hologic Selenia® Dimensions® system with C-View™ software).

Registration

http://www.hologic.com/rsna-hologic-workshop-sessions
PURPOSE
The benefits versus harms of breast cancer screening for women under the age of 50 has been the subject of intense debate. New guidelines from the American Cancer Society suggest screening should begin at age 45 and women of ages 40-44 should have the opportunity to begin screening. In this study, we investigate if the addition of tomosynthesis to mammography could improve screening performance outcomes for women under the age of 50.

METHOD AND MATERIALS
Screening performance data was collected from a network of community based screening centers from January 1, 2015 to December 31, 2015. Data for women under 50 years of age from 65,457 screening exams (45,320 mammography exams and 20,137 tomosynthesis plus mammography exams) were evaluated. Women screened with tomosynthesis plus mammography paid an out-of-pocket fee. Screening performance parameters including recall rate, cancer detection rate and invasive cancer detection rate were investigated. Chi square test was performed.

RESULTS
Rates per 1000 women screened are presented. Recall rates were 115 for mammography alone and 108 for tomosynthesis plus mammography; difference 7 (p=0.013). Cancer detection rates were 2.1 for mammography compared to 3.1 with the addition of tomosynthesis; difference 1.0 (p =0.021). Invasive cancer detection rates improved from 1.2 to 1.8 with the addition of tomosynthesis; difference 0.8 (p=0.014). This represented a relative increase in invasive cancer detection of 67%. The positive predictive value for recall increased from 1.8% to 2.8% with the addition of tomosynthesis.

CONCLUSION
The addition of tomosynthesis to mammography significantly improved recall rates, cancer detection and invasive cancer detection for women under the age of 50. The results confirm that improvements observed with tomosynthesis screening in the general screening population are also observed for the subgroup of women under the age of 50.

CLINICAL RELEVANCE/APPLICATION
For women less than 50 years of age, the addition of tomosynthesis to mammography provides improved screening performance with significantly lower recall rates and higher invasive cancer detection.

PURPOSE
We previously reported a new digital breast tomosynthesis (DBT) finding, "Milky Way sign (MWS)", as microcalcifications overlying non-calcified band-like density. The purpose of this study was to describe frequencies and imaging findings associated with MWS, and to examine the predictive value of MWS for malignancy.

METHOD AND MATERIALS
We reviewed all stereotactic core biopsies of suspicious calcifications at our institution from 1/1/2015 to 12/31/2015, identifying 124 calcification lesions, including 20 cancers (2 IDC, 5 IDC-HDCIS, 13 DCIS) and 104 benign lesions (23 high-risk, 81 benign), in 116 patients undergoing both 2D mammogram and DBT before biopsies. 2 radiologists evaluated images for the presence of MWS, local breast density within 1 cm surrounding the calcifications, calcification morphology and distribution. The predictive value for malignancy was assessed using Chi square test and multivariate logistic analysis.
Impact of High Animal Fat Diet on the Development of Mammary Cancers in a Transgenic Mouse Model of Breast Cancer based on Magnetic Resonance Imaging and Histology

**PURPOSE**

Epidemiological studies demonstrate a significant increase in breast and other cancer risk due to effects of the Western diet. More direct information from in vivo studies is needed to improve understanding of the influence of the Western diet on pre-neoplastic changes, in situ cancers, and invasive breast cancers. Due to lack of spatial resolution and contrast, imaging modalities, e.g., CT or US, have not been adequate to monitor neoplastic changes during early stage breast cancer progression in mouse models. Previous work from this laboratory demonstrated that MRI reliably detects early murine mammary cancers, differentiating in situ from invasive cancer. Based on this, we used MRI to evaluate the impact of dietary fat on mammary cancer development in a transgenic mouse model of human breast cancer.

**METHOD AND MATERIALS**

Virgin female C3(1)SV40Tag mice (n=16) were weaned at 3 wks of age. At 4 wks of age, mice were assigned to either a control low fat diet (CD) group (n=8, 3.7 kcal/g; 17.2% kcal from fat) or a high animal fat diet (HAFD) group (n=8, 5.3 kcal/g; 60% kcal from pig fat). After 8 wks on the diets, fast spin echo images of inguinal mammary glands were acquired at 9.4T from all 16 mice at 12 time points. Images were then correlated with histology.

**RESULTS**

An average of 1.25±1.16 invasive cancers per mouse (a total of 10) were found in CD, compared to an average of 3.88±1.03 invasive cancers per mouse (a total of 31) in HAFD; this difference was statistically significant (p<0.007). Average tumor volume was significantly higher in HAFD (0.53±0.45 mm³) compared to CD (0.20±0.08 mm³, p<0.02). The volume of the largest tumor was significantly higher in HAFD (0.53±0.45 mm³) compared to CD (0.20±0.08 mm³, p<0.02). The volume of the largest tumor was significantly higher in HAFD compared to CD (0.53±0.45 mm³ vs 0.20±0.08 mm³). Visual inspection suggested that HAFD mice, compared to CD mice, had denser parenchyma, more irregular and dilated ducts, dilated blood vessels, and increased invasion, indicative of aggressive cancers.

**CONCLUSION**

MRI and histological studies of a transgenic mouse model of human triple-negative breast cancer demonstrate that mice on a HAFD diet develop larger and more invasive cancers.

**CLINICAL RELEVANCE/APPLICATION**

This work is the first step towards using MRI to improve understanding of the effect of diet on mammary/breast cancer risk and guide development of methods that reduce risk.
PURPOSE
The American College of Radiology (ACR) Appropriateness Criteria provide strong support for diagnostic mammography as the initial exam in the symptomatic male > 25 years of age, but are less clear in the role of ultrasound (US) in this clinical setting. We evaluated the impact of US after diagnostic mammography in a large population of symptomatic male patients.

METHOD AND MATERIALS
In this retrospective IRB approved study 399 cases in 360 male patients > 25 years of age, presenting for imaging of an area of focal clinical concern were identified in a large structured reporting breast imaging database from 3/2006 to 3/2015. Each breast with > 1 focal area of clinical concern was designated as a case. Outcomes were determined by imaging, biopsy, or any pathology in our hospital tumor registry within a minimum of 12 months follow up. Performance measures were defined according to the ACR BI-RADS Atlas, Fifth Edition.

RESULTS
Of 360 patients (mean age = 52.5, range 25-96), 332 (92.2%) were assessed as BIRADS 1 or 2, 10 (3.8%) as BIRADS 3, and 18 (5.0%) as BIRADS 4 or 5 by mammography. 15 cancers were diagnosed, for a cancer detection rate of 41.7 per 1000 (10 IDC, 1 ILC, 4 DCIS). Performance metrics of mammography were: sensitivity 100%, specificity 99.2%, positive predictive value 83.3%, and negative predictive value 100%. Of the 278/399 (69.7%) cases evaluated with US after mammography, no additional cancers were identified. Of 9 cases with negative imaging assessment which underwent biopsy based on clinical assessment, no cancers were diagnosed (2 gynecomastia, 1 fat necrosis, 1 angiolipoma, 1 fibrosis, 1 lipoma, 2 foreign body reactions, 1 papilloma).

CONCLUSION
Our findings support the ACR guidelines supporting mammography as the primary diagnostic tool in the symptomatic male patient > 25 years of age. Mammography alone identified all cancers and supported clinical follow up rather than biopsy in a large percentage of patients. Our findings do not support the added value of US as an initial examination in this clinical setting. Clinical surveillance rather than biopsy may be a safe alternative in male patients with negative, benign or probably benign imaging findings.

CLINICAL RELEVANCE/APPLICATION
Mammography is highly accurate in the evaluation of symptomatic male patients, identifying the cancer and avoiding unnecessary biopsy. Ultrasound may be more useful as a method to guide biopsy.

BR220-SD-SUAS Breast Cancer Risk Prediction with Density Independent Texture Features

METHOD AND MATERIALS
From the Dutch breast cancer screening program we collected 394 cancers and 1182 age matched healthy controls. To obtain mammograms without signs of cancerous tissue, we took the contralateral mammograms. For each image breast density was computed using automated software. Texture features were automatically learned from the data by means of techniques that are commonly used in deep learning. In the initial matching, breast density was on average higher in the cases than in the controls, as breast density is associated with breast cancer risk. Texture features and scores learned on this set (Td) are determined to be correlated to density. In order to obtain density independent features and scores (Ti) we balanced breast density over the cases and controls by performing a matching based on breast density. Non-matching cases and controls were excluded during training; in the testing phase all images were scored. We trained and tested Td and Ti to separate between cancers and controls with 5-fold cross-validation. We compared the performance of Td and Ti in terms of predictive power.

RESULTS
Spearman’s rank correlation between density and Td was 0.81 (0.79-0.83). The density adjusted odds ratios for breast cancer were 1.15 (0.81-1.65), 1.40 (0.98-2.00), and 1.39 (0.92-2.09) for quartile 2-4 respectively, relative to quartile 1. For Ti the correlation with density was 0.00 (−0.06 to 0.05). The odds ratios were 1.15 (0.82-1.62), 1.33 (0.96-1.86), and 1.45 (1.05-2.01). The AUC for separating cancers from controls was 0.539 (0.506-0.572).

CONCLUSION
We developed a method for generating density independent texture features and scores. The obtained texture scores were significantly associated with breast cancer risk.

CLINICAL RELEVANCE/APPLICATION
The obtained density independent texture features may enhance breast cancer risk models beyond breast density, and as such offer opportunities to further optimize personalized breast cancer screening.

BR101-ED-SUAS Abbreviated MRI (AB-MRI) of the Breast: Case-based Review of the Literature

METHOD AND MATERIALS
In this work we investigate a method to generate deep learning texture features that are independent of breast density. Yet, in several studies, strong correlation between both types of features is an issue. In personalized breast cancer screening stratification is commonly based on breast density. It has been suggested though, that breast density is a too coarse descriptor for breast cancer risk. Several authors have developed texture features that are potentially more predictive of breast cancer. In this work we investigate a method to generate deep learning texture features that are independent of breast density.

RESULTS
In this retrospective IRB approved study 399 cases in 360 male patients > 25 years of age, presenting for imaging of an area of focal clinical concern were identified in a large structured reporting breast imaging database from 3/2006 to 3/2015. Each breast with > 1 focal area of clinical concern was designated as a case. Outcomes were determined by imaging, biopsy, or any pathology in our hospital tumor registry within a minimum of 12 months follow up. Performance measures were defined according to the ACR BI-RADS Atlas, Fifth Edition.

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CONCLUSION
Our findings support the ACR guidelines supporting mammography as the primary diagnostic tool in the symptomatic male patient > 25 years of age. Mammography alone identified all cancers and supported clinical follow up rather than biopsy in a large percentage of patients. Our findings do not support the added value of US as an initial examination in this clinical setting. Clinical surveillance rather than biopsy may be a safe alternative in male patients with negative, benign or probably benign imaging findings.

CLINICAL RELEVANCE/APPLICATION
Mammography is highly accurate in the evaluation of symptomatic male patients, identifying the cancer and avoiding unnecessary biopsy. Ultrasound may be more useful as a method to guide biopsy.

BR220-SD-SUAS Breast Cancer Risk Prediction with Density Independent Texture Features

RESULTS
Of 360 patients (mean age = 52.5, range 25-96), 332 (92.2%) were assessed as BIRADS 1 or 2, 10 (3.8%) as BIRADS 3, and 18 (5.0%) as BIRADS 4 or 5 by mammography. 15 cancers were diagnosed, for a cancer detection rate of 41.7 per 1000 (10 IDC, 1 ILC, 4 DCIS). Performance metrics of mammography were: sensitivity 100%, specificity 99.2%, positive predictive value 83.3%, and negative predictive value 100%. Of the 278/399 (69.7%) cases evaluated with US after mammography, no additional cancers were identified. Of 9 cases with negative imaging assessment which underwent biopsy based on clinical assessment, no cancers were diagnosed (2 gynecomastia, 1 fat necrosis, 1 angiolipoma, 1 fibrosis, 1 lipoma, 2 foreign body reactions, 1 papilloma).

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CLINICAL RELEVANCE/APPLICATION
Mammography is highly accurate in the evaluation of symptomatic male patients, identifying the cancer and avoiding unnecessary biopsy. Ultrasound may be more useful as a method to guide biopsy.
Abbreviated MRI can accurately diagnose invasive cancers and high-grade DCIS, and allows for a less costly, better-tolerated exam. First post-contrast subtraction images have higher sensitivity than MIPs. Further work needed on protocols, including T2-weighted and diffusion weighted imaging.

**TABLE OF CONTENTS/OUTLINE**

Introduction Review of MRI in screening high risk women Advantages of MRI over other screening modalities Current MRI screening limitations AB-MRI may allow for sensitive screening test in broader pool (i.e., intermediate risk) Theory behind AB-MRI: exploits fast initial uptake in malignancy Advantages of AB-MRI: decreased cost, less time AB-MRI is experimental, but increasing number of studies

**Purpose:**
to review literature on AB-MRI, familiarize radiologists with potential AB-MRI protocols, and show case based examples of AB-MRI Literature review Specific AB-MRI protocols and pros/cons Missed cancers on AB-MRI/known pitfalls? Evaluating benign lesions Cases: Invasive cancer MIP vs first post-contrast subtraction imaging Challenging cases: NME with slow initial enhancement Axillary lesion Marked BPE Biopsy clip Role of T2 imaging: Increased reader confidence Benign lesions Additional pearls/pitfalls Future Directions/Summary

**BR175-ED-SUA7**

**Molecular Biology and "Radiomics": What the Breast Imager Needs to Know**

Station #7

**Participants**
Elizabeth S. McDonald, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Despina Kontos, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Emily F. Conant, MD, Philadelphia, PA (Abstract Co-Author) Consultant, Hologic, Inc; Consultant, Siemens AG

**TEACHING POINTS**

This exhibit will: 1) Review cellular biology of normal breast tissue. 2) Discuss molecular classifications of breast cancer. 3) Describe the role of "radiomics" in precision medicine.

**TABLE OF CONTENTS/OUTLINE**

1. Review of normal breast histology.
2. Case based examples of breast cancers stratified by immunohistochemical and molecular subtypes emphasizing common presentations on: a) Mammography b) Ultrasound c) MRI. Case based examples of breast cancer image analysis using multi-parametric morphologic and functional information to predict tumor behavior.
3. Discuss the current use of radiomics for response prediction and prognosis in breast cancer.
3D ABUS: Hands-on Workshop: GE Vendor Workshop
Sunday, Nov. 27 1:00PM - 2:00PM Room: Booth 5528

Participants

PARTICIPANTS
Susan Roux, MD

PROGRAM INFORMATION
This one-hour workshop led by a Peer Educator will introduce 3D Automated Breast Ultrasound (ABUS) interpretation, including how to navigate the coronal plane to efficiently highlight potential abnormalities and streamline the screening workflow. Attendees will:

- Learn how 3D ABUS screening helps increase cancer detection in women with Dense Breast Tissue
- See how quickly whole breast image volumes are acquired on the Invenia™ ABUS Scan Station
- Review clinical cases on the Invenia™ABUS Workstation during physician guided hands-on exam interpretation.

Registration
http://ge.cvent.com/events/ge-breast-health-advantage-workshop/event-summary-b904d22132614dc2b7633ee3b34f22de.aspx
Morphology of Breast Cancer Uptake on Dedicated Breast PET versus Conventional Whole Body PET

**PURPOSE**
To evaluate differences between high-resolution dedicated breast PET (dbPET) and conventional whole body PET (WB-PET) in tumor uptake morphology and image quality, with comparison to dynamic contrast enhanced breast MRI (CE-MRI).

**METHOD AND MATERIALS**
We performed a retrospective study of 35 patients with invasive breast cancer undergoing 18F-fluorodeoxyglucose (FDG) dbPET, FDG WB-PET/CT, and CE-MRI before treatment. Four readers (2 breast radiologists and 2 nuclear medicine physicians) independently evaluated dbPET, WB-PET, and CE-MRI images of unilateral affected breasts, classifying index tumor appearance and scoring image quality. All data were treated as bivariate data for analysis (oval/round or irregular shape, smooth or not-smooth margin, heterogeneous or homogenous internal pattern, presence or absence of similarity to CE-MRI, sharp or blurry image, positive or negative for artifacts/noise, and high or low signal to noise [S/N]). Final categories were determined on all readers’ judgements by majority rule. McNemar test was performed to compare the results between dbPET and WB-PET.

**RESULTS**
Tumors more frequently had irregular shapes (51% vs. 6%, p<0.01), not-smooth margins (66% vs. 3%, p<0.01), and heterogeneous internal uptake (77% vs. 6%, p<0.01) on dbPET than on WB-PET. There was rim uptake in 29% cases on dbPET, but in no cases on WB-PET (p<0.01). A similar tumor appearance to CE-MRI was observed more frequently on dbPET than on WB-PET in shape (94% vs. 46%, p<0.01), margin (86% vs. 3%, p<0.01), and internal pattern (80% vs. 6%, p<0.01). Intratumoral distribution of uptake was similar to intratumoral distribution of CE-MRI signal enhancement ratio in 83% on dbPET and in 31% on WB-PET (p<0.01). There was a significant difference between dbPET and WB-PET in image sharpness (94% vs. 20%, p<0.01), but not in artifacts/noise (none to limited in 100% vs. 94%, p=0.48) and in S/N (high in all on both).

**CONCLUSION**
dbPET may visualize more detailed morphology of tumor uptake with almost equivalent image quality compared to WB-PET, which potentially allows deeper understanding of tumoral functional structures and a detailed multimodality approach comparing with MRI.

**CLINICAL RELEVANCE/APPLICATION**
High-resolution dedicated breast PET can visualize detailed morphology of tumor uptake, and potentially allows deeper understanding of tumoral functional structures and a detailed multimodality approach comparing with MRI.
To evaluate the correlation between changes in mammographic microcalcifications associated with breast cancer and tumor response after neoadjuvant chemotherapy (NAC).

METHOD AND MATERIALS
This retrospective study included 218 breast cancer patients who received NAC from July 2011 to November 2015 and underwent mammography and MRI before and after NAC. One hundred and seven patients with microcalcifications associated with breast cancer on mammogram (group A) were compared with 111 patients without microcalcifications (group B). Changes in tumor size and microcalcifications after NAC were compared with MRI and histopathological findings. Decreased and increased calcifications were defined as any reduction and increase in number of calcifications, respectively, on mammogram after NAC. Pathologic complete response (pCR) was defined as no residual invasive or noninvasive tumor cells in the resected specimen. Trastuzumab was combined with chemotherapy in patients with human epidermal growth factor receptor 2 (HER2) positive breast cancer.

RESULTS
Tumor size reduction rate of group A and B measured by MRI were 48% and 63%, respectively (p < 0.001). Nine (8%) patients in group A and 20 (18%) patients in group B achieved pCR (p < 0.05). Microcalcifications on post-NAC mammogram decreased in 23 patients (21%), remained stable in 64 (60%), and increased in 20 (19%). Eight (35%) patients with decreased calcifications and 10 (16%) with stable calcifications achieved disappearance of invasive tumor cells (DIT). Even in patients with increased calcifications, HER2-positive tumor achieved DIT in 3 patients (50%). No patients with hormone receptor positive and HER2-negative tumor and one patient (25%) with triple-negative tumor achieved DIT when calcifications increased.

CONCLUSION
Breast cancers without associated microcalcifications showed a higher response rate to NAC. The number of microcalcifications remained stable after NAC in the majority of patients. Although increased calcifications indicate a poor therapeutic response in hormone receptor positive and HER2-negative tumors, it may predict a good response in HER2-positive tumors.

CLINICAL RELEVANCE/APPLICATION
Breast cancers with associated calcifications are more chemoresistant than those without calcifications. Changes in calcifications can be useful for estimating residual tumor by taking tumor subtypes and MRI findings into account.

BR223-SD- SUB3
Quantitative MRI in Determining Mechanisms of Action of Taxol and Anthracyclines in Breast Cancer

Participants
Reem Bedair, MBChB,MSc, Cambridge, United Kingdom (Abstract Co-Author) Nothing to Disclose
Andrew Patterson, PhD, Cambridge, United Kingdom (Abstract Co-Author) Nothing to Disclose
Mary A. McLean, PhD, Cambridge, United Kingdom (Abstract Co-Author) Nothing to Disclose
Martin J. Graves, PhD, Cambridge, United Kingdom (Abstract Co-Author) Nothing to Disclose
John R. Griffiths, DPhil, Cambridge, United Kingdom (Abstract Co-Author) Nothing to Disclose
Fiona J. Gilbert, MD, Cambridge, United Kingdom (Presenter) Research Grant, GlaxoSmithKline plc; Research Grant, General Electric Company; Research Grant, Hologic, Inc

PURPOSE
Taxanes and anthracycline-based chemotherapy regimens have commonly been used for the treatment of breast cancer in the adjuvant and neoadjuvant settings. In this work, we investigate the effects of anti-cancer drug regimens (taxane vs. anthracycline) on the pharmacokinetic (PK) parameter Ktrans after one cycle of chemotherapy.

METHOD AND MATERIALS
Thirty female patients (median age 51; range, 36–73) were prospectively enrolled for a 3T MRI in this IRB-approved study prior to the start, after one cycle and at the end of chemotherapy. All patients received 6 cycles of chemotherapy. Sixteen patients were started on taxanes while 14 received anthracyclines first. T1 mapping using the variable flip angle method and B1 mapping using the phase-based Bloch-Seigert method were performed. This enabled the calculation of native tissue T1 and correction for the transmit non-uniformity at 3T. Dynamic contrast-enhanced (DCE) images were acquired at a temporal resolution of 10 seconds using a 3D multi-slice fast SPGR sequence. Regions of interest (ROIs) encompassing the whole tumour were drawn on all slices of enhancing regions. The native T1 and the B1 field maps were used to correct Ktrans for any transmission non-uniformity.

RESULTS
Twelve patients showed complete pathological response while 18 showed partial response. The percentage decrease in size after one cycle did not significantly differentiate between treatment regimens (anthracyclines; −16.1 ±8.0% vs. taxanes; −18.4 ±12.3%, p=0.691). Interestingly, the percentage change in Ktrans was significantly different between the regimens after one cycle (Taxanes; −21.0 ±17.4% vs. Anthracycline; 15.2 ±9.7%, p=0.03). There was no substantial difference between response groups after cycle 1 with regards to mean tumor size or Ktrans (p=0.47, p=0.054).

CONCLUSION
The large decrease in Ktrans after one cycle of docetaxel reflects the likelihood of normalisation of the immature tumour vessels with decrease in the vascular permeability/perfusion in eventual responders.

CLINICAL RELEVANCE/APPLICATION
Ktrns offers a surrogate biomarker for the underlying physiological processes in breast cancer. Largely influenced by the type of treatment administered, Ktrns can be used for the quantitative assessment of therapy in vivo.

BR224-SD- SUB4
Automated Breast Ultrasound in Breast Cancer Screening in Asian women: Comparison on the Diagnostic Performance between Two-view and Three-view Scan Method
MRI utilization and deserves further study. Breast density is of great concern to patients and their providers. Breast density legislation has had an important impact on breast indication in non-high risk women. The majority of screening breast MRI exams were ordered by specialists and female providers.

**CONCLUSION**

43.8% by primary providers before BDL compared to 63.2% and 34.6% respectively, after the law went into effect. When considering only the MRIs ordered with density as indication, 53.1% were requested by specialists and 61.1% and 36.9% after the law went into effect, respectively. The majority of exams were ordered female providers, 80.3% before after the California BDL went into effect. When patients with known or defined high risk were excluded, the increase was from 7.7% to 16.3% (p<0.001). Prior to BDL, 60.9% of the ordering providers were specialists and 37.8% were from primary care compared to 63.2% and 34.6% respectively, after the law went into effect.

**RESULTS**

Thirty-seven malignancy (mean size, 1.9±1.1cm) in 33 breasts, 26 benign lesions (mean size, 0.8±0.4cm) in 16 breasts and 24 normal breasts were included. Average width on mammography and depth in ultrasound (US) were 18.3cm and 2.3cm in the two-view scan group, and 18.2cm and 2.2cm in the three-view scan group (p>0.05). The sensitivities for cancer detection were 93.3% (14/15) in the two-view scan group, and 90.9% (20/22) in the three-view scan group (p>0.05). Specificity was higher for three-view scans (92.9%, 26/28) than two-view scans (66.7%, 16/24) (p<0.05), and higher consistency with HHUS findings were noted for three-view scans 47.1% (8/17) than two-view scans 22.2% (2/9) of ABUS (p=0.39). In three cases of false-negative, all cancers were included in the scans, but 2 DCIS was missed due to non-mass finding, and 1 invasive ductal carcinoma was obscured by the heterogeneous background echotexture on ABUS.

**CONCLUSION**

In detection of malignant breast lesions, there was no difference in sensitivity between two-view scans and three-view scans of ABUS. Specificity was higher for three-view scans than two-view scans, with better visualization of benign lesions.

**CLINICAL RELEVANCE/APPLICATION**

For supplemental screening for breast cancer, automated technique with 2 scans of ABUS is feasible to detect breast cancers in Asian women with small breasts, although specificity loss is observed.

**Has the California Breast Density Law changed Provider-ordering Practices?**

**METHOD AND MATERIALS**

This study was approved by the institutional review board and informed consent was obtained. Between March and April 2016, bilateral whole breast ultrasound examination were performed with ABUS and handheld breast US (HHUS) for 32 consecutive women with known breast cancer (mean age, 50.5years; range, 35-78). Two-view or three-view scans of ABUS for each breasts were randomly assigned for the women who had less than 20cm of breast width on mammography. Two breast radiologists who were unaware of the results of HHUS and the clinical information reviewed the ABUS data. Sensitivity and specificity in detecting malignant lesions and consistency with HHUS data for benign lesions were calculated and compared in each scans of ABUS.

**RESULTS**

Screening breast MRI exams with breast density as clinical indication increased from 8.5% (32/376) to 20.9% (136/650, p<0.001) after the California BDL went into effect. When patients with known or defined high risk were excluded, the increase was from 7.7% to 16.3% (p<0.001). Prior to BDL, 60.9% of the ordering providers were specialists and 37.8% were from primary care compared to 61.1% and 36.9% after the law went into effect, respectively. The majority of exams were ordered female providers, 80.3% before and 75.7% after BDL. When considering only the MRIs ordered with density as indication, 53.1% were requested by specialists and 43.8% by primary providers before BDL compared to 63.2% and 34.6% respectively, after the law went into effect.

**CONCLUSION**

Screening breast MRI utilization more than doubled after the California BDL went into effect using breast density as the ordering indication in non-high risk women. The majority of screening breast MRI exams were ordered by specialists and female providers. This has not been affected by breast density legislation in California.

**CLINICAL RELEVANCE/APPLICATION**

Breast density is of great concern to patients and their providers. Breast density legislation has had an important impact on breast MRI utilization and deserves further study.

**Lesion Localization Using the Scroll Bar on Tomosynthesis: Why Doesn’t It Always Work?**

**METHOD AND MATERIALS**

We performed an IRB approved retrospective analysis of contrast-enhanced breast MRI studies done for screening in a 30 month period before and after the California breast density law (BDL) went into effect on 4/1/13. Screening breast MRIs were subcategorized into those with breast density mentioned as an exam indication. Patients were further classified into three levels of risk - (1) defined high risk (eg. calculated lifetime risk>20%, presence of a genetic mutation, radiation at young age for lymphoma or presence of syndromes), (2) above average risk, however not quantified or calculated as <20% lifetime risk, or (3) completely undefined/ average risk. Chi test statistical analysis was performed, using the 2-tailed Fisher exact test to compare overall MR utilization, use of breast density as an indication, patient demographics and ordering provider characteristics.

**RESULTS**

Screening breast MRI exams with breast density as clinical indication increased from 8.5% (32/376) to 20.9% (136/650, p<0.001) after the California BDL went into effect. When patients with known or defined high risk were excluded, the increase was from 7.7% to 16.3% (p<0.001). Prior to BDL, 60.9% of the ordering providers were specialists and 37.8% were from primary care compared to 61.1% and 36.9% after the law went into effect, respectively. The majority of exams were ordered female providers, 80.3% before and 75.7% after BDL. When considering only the MRIs ordered with density as indication, 53.1% were requested by specialists and 43.8% by primary providers before BDL compared to 63.2% and 34.6% respectively, after the law went into effect.

**CONCLUSION**

Screening breast MRI utilization more than doubled after the California BDL went into effect using breast density as the ordering indication in non-high risk women. The majority of screening breast MRI exams were ordered by specialists and female providers. This has not been affected by breast density legislation in California.

**CLINICAL RELEVANCE/APPLICATION**

Breast density is of great concern to patients and their providers. Breast density legislation has had an important impact on breast MRI utilization and deserves further study.
STRENGTHS AND SHORTCOMINGS OF SYNTHETIC MAMMOGRAPHY (SM): REVIEW OF C-VIEW PHYSICS, ARTIFACTS, AND COMPARISON WITH FULL FIELD DIGITAL MAMMOGRAPHY (FFDM)

Station #7

Awards
Cum Laude
Identified for RadioGraphics

Participants
Sarah M. Friedewald, MD, Chicago, IL (Abstract Co-Author) Consultant, Hologic, Inc; Research Grant, Hologic, Inc; Consultant, C. R. Bard, Inc
Victoria A. Young, MD, Chicago, IL (Presenter) Nothing to Disclose
Dipti Gupta, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The scroll bar on Digital Breast Tomosynthesis (DBT) is an important tool that facilitates localization of a lesion on the orthogonal view and helps target ultrasound evaluation. While this works well most of the time, occasionally the location of the lesion as directed by the scroll bar is not accurate. The purpose of this presentation is to understand the specific scenarios when the location of the lesion on the scroll bar will not accurately predict the true location of the lesion and why.

TABLE OF CONTENTS/OUTLINE
Review the techniques for lesion localization using digital mammography. Review of the role of the scroll bar in lesion localization on DBT. Four reasons why the lesion location on the scroll bar in DBT may not be precisely where the lesion is truly located. Not orthogonal views Paddle flex Superficial lesions more susceptible to moving during breast repositioning for different views Nipple position not always in the center of the scroll bar 4. Sample cases

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Linda Ratanaprasatporn, MD, Boston, MA (Presenter) Nothing to Disclose
Sona A. Chikarmame, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Catherine S. Giess, MD, Wellesley, MA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Synthesized 2D mammography (SM) images are two-dimensional images reconstructed from digital breast tomosynthesis. Unlike standard mammography, synthetic images do not require additional radiation exposure and have the potential to replace dose-requiring FFDM without any loss in performance and cancer detection. Studies have demonstrated synthetic images are comparable to standard mammography for the detection of cancer, particularly calcifications. Artifacts of SM include blurring of subcutaneous tissue, loss of resolution in the axilla on MLO views and pseudo-calcifications. Given the increasing focus on radiation exposure in a screening population, the objectives of this exhibit are to review the physics, artifacts, strengths and weaknesses of SM compared to FFDM.

TABLE OF CONTENTS/OUTLINE
1. To review synthetic mammography image acquisition and physics
2. To highlight synthetic mammography strengths: potential of reducing total radiation dose, increased conspicuity of certain cancers such as calcifications
3. To review synthetic mammography artifacts: Subcutaneous tissue blurring, loss of resolution in axilla, etc.
4. To explore synthetic mammography weaknesses: Appearance of images compared to FFDM, images with foreign objects such as pacemakers
5. To evaluate cancer conspicuity of screen detected cancers seen only or better on C-view vs. FFDM

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Catherine S. Giess, MD - 2015 Honored Educator
Participants

PARTICIPANTS

Clemens Kaiser, Mannheim, Germany

PROGRAM INFORMATION

Throughout this interactive hands-on session, participants will develop their interpretive skills through extensive case reviews at workstations equipped with syngo.MR Brevis and under the guidance of an expert tutor. By actively practicing on real cases using different imaging techniques, participants will also learn to avoid pitfalls in interpreting breast MRI.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Addressing the Clinical Need for 3D™ Breast Biopsy Technologies: Prone and Upright Solutions: Supported by Hologic Inc

Sunday, Nov. 27 1:30PM - 3:00PM Room: S101AB

Participants

PARTICIPANTS
Alejandro Tejerina, MD, Madrid, Spain
Linda Greer, MD, Phoenix, AZ

PROGRAM INFORMATION
Session will begin at 1:45pm. Sign in will occur 15 minutes prior to session. This 75-minute session focuses on the need for tomosynthesis imaging for guiding breast biopsy when managing complex, subtle and difficult-to-access lesions. Dr. Linda Greer of Phoenix, AZ and Dr. Alejandro Tejerina of Madrid, Spain will provide their clinical perspectives on the use of 3D™ breast biopsy technology using the Affirm™ Upright Breast Biopsy Guidance System and the Affirm™ Prone Breast Biopsy System. This course is intended for radiologists interested in learning more regarding how this technology can provide the ability to conduct 2D or 3D™ breast biopsies using the most exceptional imaging currently available. CME credit is available through a third party. This CME activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint sponsorship of World Class CME and Hologic, Inc. World Class CME is accredited by the ACCME to provide CME for physicians. They will offer ARRT credit in addition to CME credit.

RSVP

CLAIM CME CREDIT
The Biology of Breast Cancer

Sunday, Nov. 27 2:00PM - 3:30PM Room: N228

Participants
Cherie M. Kuzmiak, DO, Chapel Hill, NC, (Cherie_kuzmiak@med.unc.edu) (Moderator) Research Grant, FUJIFILM Holdings Corporation;

LEARNING OBJECTIVES

1) Understand the molecular classification of breast cancer and comparison with clinical definitions. 2) Learn some of the main genomic features and clinical and treatment outcomes that stratify with the molecular subtypes.

ABSTRACT

Breast Cancer Genomics

Participants
Cherie M. Kuzmiak, DO, Chapel Hill, NC, (Cherie_kuzmiak@med.unc.edu) (Presenter) Research Grant, FUJIFILM Holdings Corporation;

LEARNING OBJECTIVES

1) Understand the different types of genetic information that are being measured and used for the clinical care of breast cancer. 2) Convey that cancer development and evolution depends on both genetics and environment influences. 3) Demonstrate that imaging has the potential to better understand biology, capturing the complex combined influence of genetics and environment. 4) Illustrate the move toward personalized medicine in breast cancer and the role of imaging.

ABSTRACT

Breast Imaging for Improved Understanding of Genetic Risk & Cancer Biology

Participants
Elizabeth S. Burnside, MD, MPH, Madison, WI, (eburnside@uwhealth.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify known mammographic, sonographic, and MRI features of different immunohistochemical and molecular subtypes of breast cancer.
**RC150**

**MR Imaging-guided Breast Biopsy (Hands-on)**

**Sunday, Nov. 27 2:00PM - 3:30PM Room: E260**

**BR**

**MR**

**AMA PRA Category 1 Credits ™: 1.50**

**ARRT Category A+ Credits: 1.50**

**Participants**

Roberta M. Strigel, MD, MS, Madison, WI, (rstrigel@uwhealth.org) (Presenter) Research support, General Electric Company

Peter R. Eby, MD, Seattle, WA (Presenter) Consultant, Devicor Medical Products, Inc

Beatriz E. Adrada, MD, Houston, TX (Presenter) Nothing to Disclose

Lizza Lebron, MD, New York, NY (Presenter) Nothing to Disclose

Selin Carkaci, MD, Miami, FL, (selincarkaci@msn.com) (Presenter) Author with royalties, Reed Elsevier

Chloe M. Chhor, MD, Brooklyn, NY (Presenter) Consultant, Siemens AG

Mark J. Dryden, MD, Houston, TX (Presenter) Nothing to Disclose

Sarah M. Friedewald, MD, Chicago, IL, (sarah.friedewald@nm.org) (Presenter) Consultant, Hologic, Inc; Research Grant, Hologic, Inc; Consultant, C. R. Bard, Inc

Sujata V. Ghate, MD, Durham, NC (Presenter) Nothing to Disclose

Vilert A. Loving, MD, Gilbert, AZ, (vloving@mdanderson.org) (Presenter) Nothing to Disclose

Santo Maimone IV, MD, Jacksonville, FL (Presenter) Nothing to Disclose

Bethany L. Niell, MD, Tampa, FL (Presenter) Nothing to Disclose

Elissa R. Price, MD, San Francisco, CA (Presenter) Nothing to Disclose

John R. Scheel, MD, PhD, Seattle, WA (Presenter) Research support, General Electric Company

Jean M. Seely, MD, Ottawa, ON (Presenter) Nothing to Disclose

Laura B. Shepardson, MD, Cleveland, OH (Presenter) Nothing to Disclose

Toma Omofoye, Houston, TX, (tomofoye@mdanderson.org) (Presenter) Nothing to Disclose

Lilian Wang, MD, Chicago, IL (Presenter) Nothing to Disclose

Jocelyn A. Rapelyea, MD, Washington, DC (Presenter) Speakers Bureau, General Electric Healthcare Company; Research consultant, Q-view LLC.; Research consultant, QTUS

Ryan W. Woods, MD, MPH, Baltimore, MD, (rwoods12@jhmi.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Explain why MR-guided breast biopsy is needed for patient care. 2) Identify relative and absolute contraindications to MR-guided breast biopsy. 3) Describe criteria for MR-guided breast biopsy patient selection. 4) Debate risks and benefits of pre-biopsy targeted ultrasound for suspicious MRI findings. 5) Understand the basic MR-guided biopsy procedure, protocol and requirements for appropriate coil, needle and approach selection. 6) Manage patients before, during and after MR-guided breast biopsy. 7) Define the benefits and limitations of MR-guided vacuum assisted breast biopsy. 8) Apply positioning and other techniques to challenging combinations of lesion location and patient anatomy for successful MR-guided biopsy.

**ABSTRACT**

This course is intended to provide basic didactic instruction and hands-on experience for MR-guided breast biopsy. Because of the established role of breast MRI in the evaluation of breast cancer through screening and staging, there is a proven need for MR-guided biopsy of the abnormalities that can only be identified at MRI. This course will be devoted to the understanding and identification of: 1) appropriate patient selection 2) optimal positioning for biopsy 3) target selection and confirmation 4) various biopsy technologies and techniques 5) potential problems and pitfalls and 6) practice audits. Participants will spend 30 minutes in didactic instruction followed by 60 minutes practicing MR-guided biopsy using provided phantoms. Various combinations of full size state-of-the-art breast MRI coils, biopsy localization equipment and needles from multiple different vendors will be available for hands-on practice. Some stations will have monitors loaded with targeting software. Expert breast imagers from around the world will be at each of 10 stations to provide live coaching, tips, techniques and advice.

**Active Handout:** Roberta Marie Strigel

Participants

PARTICIPANTS

Bruce F. Schroeder, MD

PROGRAM INFORMATION

This one-hour workshop led by a Peer Educator will introduce GE’s SenoClaire™ breast tomosynthesis including an overview of design elements, and a review of clinical case study presentations covering masses, calcifications, superposition and associated findings to increase clinical confidence. Attendees will: Learn the unique features of GE’s Tomosynthesis design | See how accurate DBT exams are acquired on the SenoClaire system | Review clinical cases on the Seno Iris Workstation software during physician guided hands-on exam interpretation.

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop/event-summary-b904d22132614dc2b7633ee3b34f22de.aspx
Participants

Dr. John Lewin

PROGRAM INFORMATION

A 75 minute hands-on workshop: A Practical Perspective on the use of Contrast Enhanced 2D (CE2D) Mammography. The session includes a brief lecture providing an overview of CE2D and its relevance in the diagnosis and treatment of breast cancer. Participants will review and score actual case sets, followed by a faculty led review session with correlate ancillary imaging results. (24 Attendees per session) (Hologic I-View™ software available on the Selenia® Dimensions® system)

Registration

http://www.hologic.com/rsna-hologic-workshop-sessions
Automated Breast Volume Scanner (ABVS) Physician Training Workshop - An Interactive Learning Experience: Siemens Healthineers Vendor Workshop

Sunday, Nov. 27 3:50PM - 5:00PM Room: Booth 5534

Participants

PARTICIPANTS

Mariana Solari, Chicago, Illinois, USA

PROGRAM INFORMATION

Under the guidance of a breast imaging expert you will develop your skills in the interpretation of 3D breast ultrasound acquired with the ACUSON S2000™ Automated Breast Volume Scanner (ABVS), HELX Evolution with Touch Control and displayed on workstations equipped with syngo.Ultrasound Breast Analysis (sUSBA) Software. Active participation in real clinical cases will enable you to become familiar with the coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
ED001-MO

Breast Monday Case of the Day
Monday, Nov. 28 7:00AM - 11:59PM Room: Case of Day, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

Participants
Phoebe E. Freer, MD, Salt Lake City, UT (Presenter) Nothing to Disclose
Matthew Stein, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Nicole S. Winkler, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Matthew B. Morgan, MD, Sandy, UT (Abstract Co-Author) Consultant, Reed Elsevier
Anna K. McGow, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Laurie L. Fajardo, MD, MBA, Park City, UT (Abstract Co-Author) Consultant, Hologic, Inc; Scientific Advisory Board, Hologic, Inc; Consultant, Koninklijke Philips NV; Advisory Board, Koninklijke Philips NV; Consultant, Siemens AG; Consultant, FUJIFILM Holdings Corporation; Advisory Board, Galena Biopharma, Inc
Maryam Rezvani, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Scott Harada, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

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

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Maryam Rezvani, MD - 2015 Honored Educator
Breast Density

Monday, Nov. 28 8:30AM - 8:50AM Room: Arie Crown Theater

Validation Study of the Publically-Available Fully-Automated "LIBRA" Software for Mammographic Density Estimation: Results from a Case-Control Study of Breast Cancer

Wednesday, Nov. 28 8:50AM - 9:00AM Room: Arie Crown Theater

LEARNING OBJECTIVES

ABSTRACT

RC215-01 Breast Density

Monday, Nov. 28 8:30AM - 8:50AM Room: Arie Crown Theater

Participants
Jennifer A. Harvey, MD, Charlottesville, VA, (jharvey@virginia.edu) (Presenter) Research Grant, Hologic, Inc; Stockholder, Hologic, Inc; Research Grant, Volpara Health Technologies Limited; Stockholder, Volpara Health Technologies Limited;

LEARNING OBJECTIVES

ABSTRACT

RC215-02 Validation Study of the Publically-Available Fully-Automated "LIBRA" Software for Mammographic Density Estimation: Results from a Case-Control Study of Breast Cancer

Monday, Nov. 28 8:50AM - 9:00AM Room: Arie Crown Theater

Participants
Kathleen R. Brandt, MD, Rochester, MN (Presenter) Nothing to Disclose
Meng-Kang Hsieh, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Christopher G. Scott, MS, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Lauren Pantalone, BS, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Matthew Jensen, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Stacey Winham, PhD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Dana H. Whaley, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Carrie B. Hruska, PhD, Rochester, MN (Abstract Co-Author) Institutional license agreement, Gamma Medica, Inc
Fang Fang Wu, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Aarond Norman, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Vernon S. Pankratz, Albuquerque, NM (Abstract Co-Author) Nothing to Disclose
Andrew Oustimov, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Emily F. Conant, MD, Philadelphia, PA (Abstract Co-Author) Consultant, Hologic, Inc; Consultant, Siemens AG
Karla Kerlikowske, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Despina Kontos, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Celine M. Vachon, Rochester, MN (Abstract Co-Author) Nothing to Disclose

PURPOSE

Area and volumetric breast density measures are strong risk factors for breast cancer (BC). We compared breast density estimates from a publically available, fully-automated software tool, the Laboratory for Individualized Breast Radiodensity Assessment (LIBRA), which can be run both on "For Processing" and "For Presentation" digital mammogram formats, to those from commercial software, which are only run on "For Processing" format.

METHOD AND MATERIALS

Digital mammograms in both formats were obtained prior to diagnosis on 437 incident BC cases and 1225 age-matched controls from a large screening mammography practice. LIBRA estimates included dense area (DA) and percent density (PD) averaged from four mammogram views of both digital mammogram formats. Volumetric percent density (VPD) and dense volume (DV) estimates were also obtained on four views of "For Processing" formats only, using Volpara (Matakina Ltd.) and Quantra (Hologic Inc.) software.

We compared density measures using Pearson correlations (R) among controls, and odds ratios and 95% confidence intervals (OR (95%CI)) for BC per standard deviation (SD) density measure from conditional logistic regression, adjusting for age and body mass index.

RESULTS

LIBRA PD showed strong correlation with Volpara VPD (R=0.80-0.87), but moderate correlation with Quantra VPD (R=0.53-0.60). LIBRA DA was low to moderately correlated with Quantra DV (R=0.28-0.52) and Volpara DV (R=0.52-0.65). The strongest associations of LIBRA with BC were seen with "For Presentation" density measures, OR=1.3 (1.1-1.5) per SD of PD and OR=1.2 (1.1-1.4) per SD of DA, while estimates from "For Processing" images were attenuated: OR=1.1 (1.0-1.3) and OR=1.1 (0.97-1.2),
CONCLUSION

Our results confirm prior smaller studies showing that LIBRA, a publically available, fully-automated breast density estimation software run on readily available “For Presentation” mammograms, has similar BC associations as commercial software.

CLINICAL RELEVANCE/APPLICATION

A publically available, fully-automated software utilizing “For Presentation” images could further enable research on quantitative density measures in personalized screening and cancer risk assessment.

Use of Deep Learning in Breast Cancer Risk Assessment: Evaluation of Convolutional Neural Networks on a Large Clinical Dataset of FFDMs

Monday, Nov. 28 9:00AM - 9:10AM Room: Arie Crown Theater

Participants

Hui Li, MD, PhD, Chicago, IL (Presenter) Nothing to Disclose
Benjamin Q. Huynh, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Maryellen L. Giger, PhD, Chicago, IL (Abstract Co-Author) Stockholder, Hologic, Inc; Stockholder, Quantitative Insights, Inc; Co-founder, Quantitative Insights, Inc; Royalties, Hologic, Inc; Royalties, General Electric Company; Royalties, MEDIAN Technologies; Royalties, Riverain Technologies, LLC; Royalties, Mitsubishi Corporation; Royalties, Toshiba Corporation; Natalia O. Antropova, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Li Lan, Chicago, IL (Abstract Co-Author) Nothing to Disclose

PURPOSE

We evaluated the potential of deep learning in the assessment of breast cancer risk in which convolutional neural networks (CNNs) extract features directly from FFDM images instead of measuring breast density and parenchymal textures.

METHOD AND MATERIALS

The study included 456 clinical FFDM cases from two high-risk datasets - BRCA1/2 gene-mutation carriers (53 cases) and unilateral cancer patients (75 cases), and a low-risk dataset (328 cases). All FFDM images [12-bit quantization and 100 micron pixels] had been acquired with a GE Senographe 2000D system and were retrospectively collected under an IRB-approved, HIPAA-compliant protocol. Regions of interest (ROIs) of 256x256 pixels were selected from the central breast region behind the nipple in the craniocaudal projection of the FFDMs. We compared the use of direct image features, which were automatically extracted using transfer learning and pre-trained CNNs, and the use of features from radiographic texture analysis (RTA). Each feature set was input to a support vector machine classifier and underwent leave-one-case-out cross validation. Area under the ROC curve (AUC) served as the figure of merit in the task of distinguishing between high-risk and low-risk subjects.

RESULTS

In the task of distinguishing between the BRCA1/2 gene-mutation carriers and low-risk women, comparable classification performance was obtained using features extracted from CNNs (AUC=0.83; SE=0.03) and from RTA (AUC=0.82; SE=0.03). However, in the task of distinguishing between unilateral cancer and low-risk women, the performance was significantly improved with the CNNs (AUC=0.82; SE=0.03) compared to RTA (AUC=0.73; SE=0.03) with a p-value of 0.009.

CONCLUSION

Deep learning with CNNs appears to be able to extract textural characteristics directly from FFDMs as well as, or better than, conventional texture analysis in the task of distinguishing between cancer risk populations.

A Masking Index to Predict Reduced Sensitivity of Mammography Due to Breast Density

Monday, Nov. 28 9:10AM - 9:20AM Room: Arie Crown Theater

Participants

James G. Mainprize, PhD, Toronto, ON (Presenter) Institutional research agreement, General Electric Company
Olivier Alonzo-Proulx, Toronto, ON (Abstract Co-Author) Institutional research agreement, General Electric Company
Roberta A. Jong, MD, Toronto, ON (Abstract Co-Author) Nothing to Disclose
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Jennifer A. Harvey, MD, Charlottesville, VA (Abstract Co-Author) Research Grant, Hologic, Inc; Stockholder, Hologic, Inc; Research Grant, Volpara Health Technologies Limited; Stockholder, Volpara Health Technologies Limited;
Martin J. Yaffe, PhD, Toronto, ON (Abstract Co-Author) Research collaboration, General Electric Company Founder, Matakina International Ltd Shareholder, Matakina International Ltd Co-founder, Mammographic Physics Inc

PURPOSE

The sensitivity of screening mammography is reduced for dense breasts. BI-RADS density assessment emphasizes the masking potential of breast density, but the assessment is qualitative and achieves only moderate agreement between radiologists. We are refining a masking index based on the local “detectability map”, that predicts the probability of missing a cancer (if present) due to the amount and patterns of dense tissue in the breast. The maps are automatically calculated from the image and the DICOM header contents.

METHOD AND MATERIALS

Simulated breast cancer lesions are sequentially “inserted” into digital mammograms (contralateral to actual cancer), one location at a time. An automated computer “observer” is used to combine measured image features (contrast, noise power, texture) to
create a detectability map whose pixels represent the probability of detecting a possible cancer at each location in the mammogram. From the map, a masking index, giving the probability of missing a cancer due to reduced contrast or clutter caused by superposition of dense breast tissue, is calculated for the entire mammogram. Under IRB approval, for initial development, we analyzed a set of de-identified mammograms consisting of 8 cancers missed on mammography and 40 screen-detected cancers. Results from a larger set consisting of 106 interval cancers and 596 screen-detected cancers are currently under analysis. The masking index predictions are compared against truth status (cancer missed vs. cancer found).

RESULTS

In our preliminary ROC analysis, the ability to predict detected/missed status was found to have an AUC of 0.74 (0.54-0.87, 95% confidence interval). Interestingly, volumetric breast density alone was not as informative in predicting missed cancer status, AUC 0.67 (0.4-0.84 CI).

CONCLUSION

A masking index is being developed that has shown promise in predicting the probability of masking in a mammogram. It is based on detectability maps that indicated regions of high/low detectability and have been shown to correlate with radiologists’ impressions of mammograms and screening performance.

CLINICAL RELEVANCE/APPLICATION

A quantitative, objective measure of masking could become a key tool in determining when the performance of screening mammography in an individual woman is compromised due to breast density.

RC215-05  
**Associations of Volumetric Mammographic Density Measures with Breast Cancer Risk in 5,746 Women**

Monday, Nov. 28 9:20AM - 9:30AM Room: Arie Crown Theater

Participants

Bennett Battle, MD, Little Rock, AR (Presenter) Nothing to Disclose
Sharp F. Malak, MD, MPH, Little Rock, AR (Abstract Co-Author) Nothing to Disclose
Ishwori Dhakal, MPH, Little Rock, AR (Abstract Co-Author) Nothing to Disclose
Jeannette Lee, PhD, Little Rock, AR (Abstract Co-Author) Nothing to Disclose
Noel Keith, Little Rock, AR (Abstract Co-Author) Nothing to Disclose
Barbara Fuhrman, PhD, Little Rock, AR (Abstract Co-Author) Nothing to Disclose

PURPOSE

Previously, methods for measurement of mammographic density (MD) have been either time-consuming, or subjective and only modestly reliable. Because MD offers information both about individual risk and about the efficacy of screening, a standardized and robust method for measurement of this prevalent risk factor has been a goal of many researchers.

METHOD AND MATERIALS

Using Volpara software (Matakina, New Zealand), we measured volumetric mammographic density on images from 42,527 screening mammograms done on 13,942 women seen at our institution between 2006-2012. Billing data and data collected by the cancer registrar was gathered to document person-level and procedure-level factors on 25,034 women seen for mammography assessment in the same period. A retrospective cohort was defined using women with both imaging and billing data who were initially seen for a screening mammogram, had no previous history of breast cancer, and were followed at our institution for at least 6 months following their first captured visit.

RESULTS

Among 5746 eligible women, 92 registry-confirmed breast cancers and a total of 121 registry-confirmed or treated breast cancer cases were ascertained. We observed monotonically increasing risks of registry-verified incident breast cancers by quartile of VMD% with HR= 1.0, 1.2 (0.7-2.2), 1.2 (0.7-2.2), and 2.2 (1.2-4.1); P trend=0.02; a similar trend was seen by quartile of DV, with HR across quartiles = 1.0, 1.5 (0.8-2.9), 1.8 (0.9-3.4), and 2.9 (1.5-5.4) (P trend=0.0009). Among women without a breast cancer diagnosis, changes in MD were significantly modified by birth cohort; while both VMD% and DV increased significantly in serial mammograms done on 13,942 women seen at our institution between 2006-2012.

VMD% with HR= 1.0, 1.2 (0.7-2.2), 1.2 (0.7-2.2), and 2.2 (1.2-4.1); P trend=0.02; a similar trend was seen by quartile of DV, with HR across quartiles = 1.0, 1.5 (0.8-2.9), 1.8 (0.9-3.4), and 2.9 (1.5-5.4) (P trend=0.0009). Among women without a breast cancer diagnosis, changes in MD were significantly modified by birth cohort; while both VMD% and DV increased significantly in serial mammograms done on 13,942 women seen at our institution between 2006-2012.

CONCLUSION

Automated measurement of Volumetric MD allows for assessment of this important breast cancer risk factor in a large number of women and on repeated mammographic assessments. In this cohort, assembled using the Enterprise Data Warehouse, mammographic density was associated with increased risk of subsequent breast cancer as expected, supporting the validity of the automated measures.

CLINICAL RELEVANCE/APPLICATION

Automated volumetric mammographic density measurement allows for the identification of women at increased risk of developing breast cancer.

RC215-06  
**Parenchymal Pattern Analysis in Digital Mammograms versus Central Source Projection Tomosynthesis Images: A Case-Control Study for Breast Cancer Risk Estimation**

Monday, Nov. 28 9:30AM - 9:40AM Room: Arie Crown Theater

Participants

Lin Chen, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Lauren Pantalone, BS, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Andrew Oustimov, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Meng-Kang Hsieh, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Emily F. Conant, MD, Philadelphia, PA (Abstract Co-Author) Consultant, Hologic, Inc; Consultant, Siemens AG
Despina Kontos, PhD, Philadelphia, PA (Presenter) Nothing to Disclose

PURPOSE

Because MD offers information both about individual risk and about the efficacy of screening, a standardized and robust method for measurement of this prevalent risk factor has been a goal of many researchers.

METHOD AND MATERIALS

Using Volpara software (Matakina, New Zealand), we measured volumetric mammographic density on images from 42,527 screening mammograms done on 13,942 women seen at our institution between 2006-2012. Billing data and data collected by the cancer registrar was gathered to document person-level and procedure-level factors on 25,034 women seen for mammography assessment in the same period. A retrospective cohort was defined using women with both imaging and billing data who were initially seen for a screening mammogram, had no previous history of breast cancer, and were followed at our institution for at least 6 months following their first captured visit.

RESULTS

Among 5746 eligible women, 92 registry-confirmed breast cancers and a total of 121 registry-confirmed or treated breast cancer cases were ascertained. We observed monotonically increasing risks of registry-verified incident breast cancers by quartile of VMD% with HR= 1.0, 1.2 (0.7-2.2), 1.2 (0.7-2.2), and 2.2 (1.2-4.1); P trend=0.02; a similar trend was seen by quartile of DV, with HR across quartiles = 1.0, 1.5 (0.8-2.9), 1.8 (0.9-3.4), and 2.9 (1.5-5.4) (P trend=0.0009). Among women without a breast cancer diagnosis, changes in MD were significantly modified by birth cohort; while both VMD% and DV increased significantly in serial mammograms done on 13,942 women seen at our institution between 2006-2012.

VMD% with HR= 1.0, 1.2 (0.7-2.2), 1.2 (0.7-2.2), and 2.2 (1.2-4.1); P trend=0.02; a similar trend was seen by quartile of DV, with HR across quartiles = 1.0, 1.5 (0.8-2.9), 1.8 (0.9-3.4), and 2.9 (1.5-5.4) (P trend=0.0009). Among women without a breast cancer diagnosis, changes in MD were significantly modified by birth cohort; while both VMD% and DV increased significantly in serial mammograms done on 13,942 women seen at our institution between 2006-2012.

CONCLUSION

Automated measurement of Volumetric MD allows for assessment of this important breast cancer risk factor in a large number of women and on repeated mammographic assessments. In this cohort, assembled using the Enterprise Data Warehouse, mammographic density was associated with increased risk of subsequent breast cancer as expected, supporting the validity of the automated measures.

CLINICAL RELEVANCE/APPLICATION

Automated volumetric mammographic density measurement allows for the identification of women at increased risk of developing breast cancer.
PURPOSE

We evaluate the association of breast parenchymal texture features to breast cancer risk with full-field digital mammography (FFDM) versus digital breast tomosynthesis (DBT) central source projections (CSP) images.

METHOD AND MATERIALS

We retrospectively analyzed images from women who underwent routine breast cancer screening at our institution using a combined FFDM and DBT protocol (Selenia Dimensions, Hologic Inc.), during 9/2011-6/2014. Each DBT source projection was acquired at approximately 90% dose reduction, for a total of 15 source projection images per breast and view. A total of 86 women were diagnosed with unilateral invasive breast cancer. From these, 72 had "For Processing" DBT-CSP images available for analysis that were of sufficient image quality (no artifacts, implants, pace-makes), and were used as cases. A total of 360 controls were randomly selected from women who had negative screening exams and confirmed one-year negative follow-up, which were age-, race-, and side-matched to cases at 1:5 ratio. The mediolateral oblique (MLO) view of the "For Processing" FFDM and CSP-DBT images were used for parenchymal pattern analysis; for cases the contralateral (unaffected images) were analyzed. Multiple texture descriptors were extracted, including gray-level histogram, co-occurrence, run-length, and fractal dimension features, using a previously validated, fully-automated, lattice-based texture analysis pipeline. The discriminatory capacity of the texture features based on FFDM versus DBT-CSP was tested via a logistic regression classifier and the area under curve (AUC) of the receiver operating characteristic (ROC). The ROC AUCs were compared using DeLong's test.

RESULTS

The model with FFDM texture features had an AUC=0.75 (95% CI:0.69-0.82). Texture features from the corresponding low-dose DBT-CSP images had an AUC=0.76 (95% CI:0.70-0.82). No significant difference was found between FFDM and DBT-CSP based on the performance of the lattice texture features (p=0.87).

CONCLUSION

Our study suggests that parenchymal texture analysis from DBT-CSP images, acquired at substantially lower x-ray dose, is feasible and may result to similar associations to breast cancer risk compared to standard-dose FFDM images.

CLINICAL RELEVANCE/APPLICATION

Parenchymal texture analysis can provide robust indicators of cancer risk from low-dose DBT-CSP images, which may become important as DBT is increasingly replacing FFDM in breast cancer screening.
increasing pressure (77.0%, 69.7%, 74.5%, 63.2%, 66.7%) (p=0.02), specificity was similar, and PPV was highest in the midrange of pressure (28.5%, 31.0%, 34.2%, 26.7%, 25.7%) (p=0.03). Cutoff points for pressure dividing the data in groups of 20% were 7.7, 9.2, 10.7, 12.8 kPa. V and VD both decreased with increasing pressure. Mean VDG moderately increased (1.75, 2.0, 2.2, 2.4, 2.8).

**CONCLUSION**

Results suggest that if too much pressure is applied during mammography this may increase interval cancer rates and decrease PPV.

**CLINICAL RELEVANCE/APPLICATION**

Controlling pressure during mammography is important to decrease the discomfort experienced by women, but it may also be required to optimize screening outcomes.

**RC215-09  Harms of False Positive Stereotactic-biopsy: Does a Benign Biopsy Affect Screening Compliance?**

**Monday, Nov. 28 10:20AM - 10:30AM Room: Arie Crown Theater**

**Participants**

Alana A. Lewin, MD, New York, NY (Presenter) Nothing to Disclose
Yiming Gao, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Leng Leng Young Lin, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Marissa L. Albert, MD, MSc, New York, NY (Abstract Co-Author) Nothing to Disclose
James S. Babb, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
Hildegard B. Toth, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Samantha L. Heller, MD, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Critics of screening mammography argue that the harms of screening include unnecessary recalls and biopsies. The purpose of our study is to evaluate whether false positive biopsy affects subsequent mammographic screening compliance.

**METHOD AND MATERIALS**

This was an IRB approved, HIPAA compliant retrospective review of women with stereotactic-guided core biopsies performed between 2012-2014. Patient age, clinical history, biopsy pathology, short-term follow-up, and first post-biopsy screening mammogram were reviewed. Statistical analyses were performed using Fisher exact, Mann-Whitney, and Chi-square tests.

**RESULTS**

913 stereotactic vacuum assisted biopsies (SVAB) performed with a 9 Gauge Suros needle were performed in 2012-2014. Women with malignant or high-risk lesions or biopsies resulting in a recommendation of surgical excision were excluded. 458 SVABs yielded benign pathology in 436 women (average age is 53.7 years, range 24-85 years). Findings were matched with 29,774 patients who had a BI-RADS 1 or 2 screening mammogram in the same time period. 226/458 (49%) women who had a biopsy returned for annual follow-up compared to 20,256/29,774 (68%) women without biopsy who returned for follow-up (p<0.001). 228/458 (63%) women who had a biopsy returned for follow-up within 2 years compared to 21,677/29,774 (73%) women without biopsy who returned without biopsy (p=0.001). Women with a past history of cancer or atypia who had benign SVAB were more likely to return to screening (p=0.027 and p=0.049, respectively). Women who had unilateral short-term follow-up for evaluation of biopsy (30.6% [140/458]) were also more likely to return than women with no such follow-up (p<0.001). There was no association between pathology type or multi-site biopsy and return to subsequent screening mammography.

**CONCLUSION**

A significantly greater percentage of patients who did not undergo stereotactic-biopsy returned to screen compared with benign biopsy patients, suggesting that benign SVAB may have a negative impact on screening compliance. Biopsied patients with a history of cancer/atypia and those who had a post-biopsy diagnostic unilateral follow-up were more likely to return to screen.

**CLINICAL RELEVANCE/APPLICATION**

Benign breast biopsies may affect screening compliance. Additional education and discussion may be warranted when discussing future screening recommendations with patients after benign biopsy.

**RC215-10  Trends in Breast Density Assessment Over Time: Patterns Related to Legislation and Patient Age**

**Monday, Nov. 28 10:30AM - 10:40AM Room: Arie Crown Theater**

**Awards**

Student Travel Stipend Award

**Participants**

Krystal C. Buchanan, MD, New Haven, CT (Presenter) Nothing to Disclose
Patricia C. Barrett, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Paul H. Levesque, MD, Madison, CT (Abstract Co-Author) Nothing to Disclose
Jaime L. Geisel, MD, New Haven, CT (Abstract Co-Author) Consultant, QView Medical, Inc Consultant, Siemens AG
Regina J. Hooley, MD, New Haven, CT (Abstract Co-Author) Consultant, FUJIFILM Holdings Corporation; Consultant, Siemens AG
Liane E. Philpotts, MD, New Haven, CT (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Breast density notification legislation is being passed in more states every year. Density classification on mammography is primarily achieved by subjective means. With such laws in effect, there is the possibility of radiologists overtly or subconsciously changing density, particularly downgrading such that supplemental tests will not be required. The purpose of this study was to determine the effect of density classification over time and by patient age.
METHOD AND MATERIALS
A search of the electronic breast imaging database (PenRad, MN) was performed to determine the density classifications (BI-RADS categories a,b,c,d) reported on digital screening mammograms over a 10 year period (2006 – 2015). Our state density notification law went into effect in 2009. Prior to 2011 these were FFDM and after 2011, the majority were tomosynthesis exams (all Hologic, MA). The combined data was assessed and additionally, the data were subdivided by patient age by decade: 40-49, 50-59, 60-69, 70 and up.

RESULTS
A total of 76,924 screening exams were assessed. For all age groups, there was a small decrease in dense breast categories and corresponding increase in non-dense of 5% in 2009, which returned to usual the following year. However, there has been a consistent trend of increasing percentage of heterogeneously dense since that time, from 23% to 34%. When assessed by age, this trend is found mostly in women in the 50’s and 60’s decade. No specific pattern change was noted in 2011 with the conversion to tomosynthesis.

CONCLUSION
The patterns of density reporting appear to be initially affected by state legislation, yet the pattern did not return to previous rates, but actually shows increase towards more women being reported as dense, particularly women in the 50-69.

CLINICAL RELEVANCE/APPLICATION
Density reporting appears to be affected by legislation, but such trends may change over time, with increase towards more women being reported as dense. This may be a reflection of radiologists not downgrading density as women age, or leaning towards allowing more women the possibility of supplemental screening.

Clinicopathologic and Immunohistochemical Characteristics of Invasive Breast Cancers Visible Only on Digital Breast Tomosynthesis

Monday, Nov. 28 10:40AM - 10:50AM Room: Arie Crown Theater

Participants
Jin You Kim, MD, Busan, Korea, Republic Of (Presenter) Nothing to Disclose
Hyun Jung Kang, MD, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Seung Hyun Lee, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Tae Hong Lee, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Suk Kim, MD, Pusan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To analyze the clinicopathologic and immunohistochemical features of invasive breast cancers visible only on digital breast tomosynthesis (DBT) compared to those visible on both DBT and full-field digital mammography (FFDM).

RESULT
Of 205 cancers, 175 (85.4%) were visible on both DBT and FFDM (“both-visible” group). Twenty cancers (9.6%) not visible on FFDM were recognized by DBT as a mass (55.0%), an asymmetric density (35.0%), or an architectural distortion (10.0%) (“DBT-only” group). The remaining 10 tumors (4.9%) were not evident on either DBT or FFDM (“both-occult” group). The mean tumor size of the DBT-only group was significantly smaller than that of the both-visible group (1.53 ± 0.79 vs. 2.35 ± 1.26 cm, P=0.027) but did not differ significantly from that of the both-occult group (1.53 ± 0.79 vs. 1.89 ± 1.09 cm, P=0.310). Tumors of the DBT-only group had more lower histological grade (45.0% vs. 14.9%, P=0.001), estrogen receptor positivity (100.0% vs. 76.0%, P=0.013), progesterone receptor positivity (95.0% vs. 68.6%, P=0.013), human epidermal growth factor receptor-2 negativity (95.0% vs. 71.4%, P=0.023), and lower expression levels of Ki-67 (45.0% vs. 20.6%, P=0.014), compared to the both-visible group.

CONCLUSION
In patients with invasive breast cancer, tumors visible only on DBT were less histologically aggressive than tumors visible on both DBT and FFDM.

A Randomized Controlled Trial to Evaluate Efficacy of Tomosynthesis versus Digital Mammography Screening in Reducing Interval and Advanced Breast Cancer Incidence: Preliminary Results

Monday, Nov. 28 10:50AM - 11:00AM Room: Arie Crown Theater

Participants
Valentina Iotti, MD, Reggio Emilia, Italy (Presenter) Nothing to Disclose
Cinzia Campani, Reggio Emilia, Italy (Abstract Co-Author) Nothing to Disclose
Andrea Nitrosi, PhD, Reggio Emilia, Italy (Abstract Co-Author) Nothing to Disclose
Rita Vacondio, Reggio Emilia, Italy (Abstract Co-Author) Nothing to Disclose
Paolo Giorgi Rossi, Reggio Emilia, Italy (Abstract Co-Author) Nothing to Disclose
Pierpaolo Pattacini, Reggio Emilia, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the impact of screening with digital breast tomosynthesis (DBT) compared with digital mammography (DM) on breast cancer prognosis and mortality in a randomized test and treat study. Will be presented interim data at baseline on detection rate, recall rate, and positive predictive value on recalls.

METHOD AND MATERIALS
Consenting women attending the population-based (45-70 age range) mammography screening of our provincial program and presenting for a new screening round, were invited to participate in the study and randomized to DM (standard of care) or DBT + DM two-view bi-lateral examinations, both with double independent reading. Results of DBT only were recorded separately for analyses, and women in the investigational arm were managed based on the combined evaluation of DBT and DM. Interval between screening rounds is one and two years for women 45-49 and 50-70 age groups, respectively. The planned sample size is 20,000 women per arm (NCT02698202).

RESULTS
From March 2014 to March 2016, 38762 women have been invited. Among the 79% accepting the screening call, 50.6% consented to participate and were enrolled in the study.

Data for 9776 women were available at the interim analysis: 4832 in the DM-arm and 4944 in the DBT-arm. Recall rate was 3.6% and 3.5% with DM and DBT, respectively (RR 0.97; 95%CI:0.79-1.20); detection rate was 5.4/1000 and 7.7/1000 (RR 1.43; 95%CI:0.87-2.35), respectively; positive predictive value was 15.5% and 23.3 (RR 1.50; 95%CI:0.96-2.33). Out of 38 cancers identified in the investigational arm, 8 were detectable only in DBT. Reading time was 37'' vs 60'' in women at first round, (+62%, p<0.05) and 32'' vs 56'' at second round (+75%, p<0.05); the increase was not significant in recalled women: 99'' vs 108'' and 93'' vs 108'' at first and second round, respectively.

CONCLUSION
Initial data from this randomized two-arm study confirmed the results of higher detection rate without increasing recall rate with DBT screening. By August 2016, the second year interim results on about 20,000 women will be available.

CLINICAL RELEVANCE/APPLICATION
In this randomized two-arm study in a screening setting, tomosynthesis confirmed a higher detection rate compared to digital mammography, without increasing the recall rate.

RC215-13  Breast Cancer Screening
Monday, Nov. 28 11:00AM - 11:20AM Room: Arie Crown Theater

Participants
Robert A. Smith, PhD, Atlanta, GA, (robert.smith@cancer.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Describe current screening guidelines and factors influencing differences. 2) State global evidence for effectiveness of breast cancer screening. 3) Describe opportunities for improved effectiveness of breast cancer screening in the U.S.

RC215-14  Trends in Screening Mammography Interpretation over 4 Years with Digital Breast Tomosynthesis: Are Recall and Cancer Detection Rates Maintained?
Monday, Nov. 28 11:20AM - 11:30AM Room: Arie Crown Theater

Awards
Student Travel Stipend Award

Participants
Christine Chen, MD, New Haven, CT (Presenter) Nothing to Disclose
Melissa A. Durand, MD, New Haven, CT (Abstract Co-Author) Research Grant, Hologic, Inc
Madhavi Raghu, MD, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Regina J. Hooley, MD, New Haven, CT (Abstract Co-Author) Consultant, FUJIFILM Holdings Corporation; Consultant, Siemens AG
Liane E. Philpotts, MD, New Haven, CT (Abstract Co-Author) Nothing to Disclose

PURPOSE
Digital breast tomosynthesis (DBT) has been shown to reduce recall rate and increase cancer detection in screening compared to 2D-mammography during its initial implementation; however, outcome metrics during subsequent rounds of interpretation are uncertain. The purpose of this study was to determine whether the initial improved outcomes can be maintained and to assess trends in these metrics over time.

METHOD AND MATERIALS
A HIPPA-compliant retrospective review of the electronic database (PenRad, MN) at five clinical sites was performed over 4 consecutive years since introduction of DBT at our facility (8/1/2011-7/31/2015). DBT screens interpreted by breast-subspecialized radiologists were identified. Recall rate (RR), cancer detection rate (CDR) and positive predictive value for recall (PPV1) for each one-year study period (DBT1-4) were analyzed and compared with those of 2D digital mammography control from 8/1/2008 to 7/31/2010 (2D-DM). Differences in outcome metrics between consecutive DBT years were also assessed. Percentage of screen-detected in-situ vs invasive cancers for each study period was calculated.

RESULTS
A total of 42,470 screening DBT exams were performed during a 4-year period (vs. 20,553 2D-DM screening exams over 2-year period). Recall rate decreased slightly over 4 years of DBT (DBT1, 7.9%; DBT2, 8.7%; DBT3, 7.9%; DBT4, 7.5%) and remained significantly reduced compared with 2D-DM recall rate of 11.4% (p<.05). A trend toward increasing cancer detection rate per 1000 exams was observed over years 1 to 4 of DBT (DBT1, 5.7; DBT2, 5.1; DBT3, 5.9; DBT4, 6.4 vs. 2D-DM, 3.8), which was
significantly different from 2D-DM in the third and fourth DBT years (p<.05). Similarly, there was a trend toward rising PPV1 over 4 years of DBT (DBT1, 7.2%; DBT2, 5.9%; DBT3, 7.4%; DBT4, 8.5% vs. 2D-DM, 3.4%). Significant increase in PPV1 with DBT versus 2D-DM was sustained across years 2-4 of DBT (p<.05). A higher percentage of invasive cancers was detected over time (DBT1, 50%; DBT2, 55%; DBT3, 59%; DBT4, 74% vs. 2D-DM, 59%).

CONCLUSION
Significant RR reduction and increase in CDR and PPV1 with DBT screening is sustainable. Our results showed a trend toward continued improvement in these outcome metrics over time.

CLINICAL RELEVANCE/APPLICATION
The sustainable, superior performance of DBT over 2D-DM illustrates the integral role of DBT in breast cancer screening, which has important implications for policy making in the future.

RC215-15 Current Era Screening Mammography Outcomes from the National Mammography Database, Involving Nearly 7 Million Examinations

Monday, Nov. 28 11:30AM - 11:40AM Room: Arie Crown Theater

Participants
Cindy S. Lee, MD, San Francisco, CA (Presenter) Nothing to Disclose
Debapriya Sengupta, MBBS,MPh, Reston, VA (Abstract Co-Author) Nothing to Disclose
Judy Burleson, Reston, VA (Abstract Co-Author) Nothing to Disclose
Mythreyi Bhargavan-Chatfield, PhD, Reston, VA (Abstract Co-Author) Nothing to Disclose
Edward A. Sickles, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Elizabeth S. Burneside, MD, MPH, Madison, WI (Abstract Co-Author) Nothing to Disclose
Margarita L. Zuley, MD, Pittsburgh, PA (Abstract Co-Author) Research Grant, Hologic, Inc;

PURPOSE
Mammography is the standard imaging examination for breast cancer screening and has substantially reduced mortality from breast cancer. In the last decade, different interpretations of the evidence on outcomes have resulted in various screening guidelines and debate regarding the balance of benefits and risks of mammography screening. There is uncertainty about when to stop screening, as women ≥75 years were not included in randomized trials, limiting available data to mostly small observational studies. This knowledge gap may be informed by new large-scale evidence from the National Mammography Database (NMD), an, up-to-date mammography outcomes database with data representing a large proportion of US states. The purpose of our study is to evaluate the relationship between patient age and screening mammography performance metrics in women age ≥40 years.

METHOD AND MATERIALS
Our HIPAA Compliant and IRB approved project analyzed data from 218 mammography facilities in 39 states in the NMD registry. The NMD receives clinical practice data including self-reported demographics, clinical findings, screening mammography interpretation, and biopsy results (the reference standard). Performance metrics calculated were cancer detection rate, recall rate, and positive predictive values for biopsy recommended (PPV2) and biopsy performed (PPV3).

RESULTS
We analyzed data for 6,980,054 screening mammograms performed between January 2008 and December 2014 in 3,416,075 women. Overall, we found a mean cancer detection rate of 3.65 per 1000 (95% CI: 3.60-3.69), recall rate of 10% (95% CI: 10-10%), PPV2 of 20% (95% CI: 19-20%), and PPV3 of 28% (95% CI: 28-29%). Based on increasing age, performance metrics demonstrate a gradual upward trend for cancer detection rate, PPV2 and PPV3, and downward trend in recall rate, until age 90 years.

CONCLUSION
The NMD provides up-to-date nationwide benchmarks for screening performance metrics. According to these metrics demonstrating preserved cancer detection, recall rate, and PPV, our study suggests that there is no clear age cut-point to inform the decision when to stop screening.

CLINICAL RELEVANCE/APPLICATION
The stability of screening mammography performance metrics in women aged 75-90 years, does not provide evidence for age-based mammography cessation but rather adds support for guidelines that encourage screening decisions based on individual patient values, co-morbidities, and health status.


Monday, Nov. 28 11:40AM - 11:50AM Room: Arie Crown Theater

Participants
Constance D. Lehman, MD, PhD, Boston, MA (Presenter) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company
Rob F. Arao, MPH, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Brian L. Sprague, PhD, Burlington, VT (Abstract Co-Author) Nothing to Disclose
Janie M. Lee, MD, Bellevue, WA (Abstract Co-Author) Research Grant, General Electric Company
Diana S. Buist, PhD,MPh, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Diana Miglioretti, PhD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Louise M. Henderson, Chapel Hill, NC (Abstract Co-Author) Nothing to Disclose
Tracy Onega, PhD,MS, Lebanon, NH (Abstract Co-Author) Nothing to Disclose
Anna N. Testeson, Lebanon, NH (Abstract Co-Author) Nothing to Disclose
Garth H. Rauscher, PhD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Karla Kerlikowske, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose

PURPOSE
The sustainable, superior performance of DBT over 2D-DM illustrates the integral role of DBT in breast cancer screening, which has important implications for policy making in the future.
To establish performance benchmarks for modern screening digital mammography and assess performance trends over time in U.S. community practice.

METHOD AND MATERIALS

In this HIPAA compliant IRB approved study we measured performance of digital screening mammography interpreted by 359 radiologists across 95 facilities in six Breast Cancer Surveillance Consortium registries. The study population included 1,682,504 digital screening mammograms performed between 2007 and 2013 in 792,808 women. Performance measures were calculated according to the American College of Radiology BI-RADS 5th edition and compared to published prior benchmarks by the BCSC, the National Mammography Database (NMD) and published recommendations for performance by expert opinion. Benchmarks were derived from the distribution of performance metrics across radiologists and presented as 50th (median), 10th, 25th, 75th and 90th percentiles with graphic presentations using smoothed curves.

RESULTS

Mean performance measures (95% Confidence Interval) were: abnormal interpretation rate (AIR) 11.6% (11.5%-11.6%); cancers detected per 1000 screens (CDR) 5.1 (5.0-5.2); sensitivity 86.9% (86.3%-87.6%); specificity 88.9% (88.8%-88.9%); false negative rate per 1000 screens 0.8 (0.7-0.8); PPV-1 1.4% (4.3%-4.5%); PPV-2 25.6% (25.1%-26.1%); PPV-3 28.6% (28.0%-29.3%); 76.9% of screen detected cancers were stage 0 or 1; 57.7% were minimal cancers; 79.4% were node negative invasive cancers. Recommended CDRs were achieved by 92.1% of radiologists in community practice and 97.1% achieved recommended ranges for sensitivity. CDR was significantly higher than that reported by the NMD (3.4/1000). Only 59.0% of radiologists achieved recommended AIR and 63.0% achieved recommended specificity.

CONCLUSION

The majority of radiologists in the BCSC surpass performance recommendations for screening mammography; however, abnormal interpretation rates continue to be higher and specificity lower than the recommended rates for almost half of radiologists interpreting screening mammograms.

CLINICAL RELEVANCE/APPLICATION

Efforts to implement advanced technology should be combined with effective educational programs to reduce false-positive rates without sacrificing high detection rates of invasive cancers.

RC215-17  Trade-Offs of Risk-Based Versus Age-Based Mammography Screening in Women Aged < 50 Years

Monday, Nov. 28 11:50AM - 12:00PM Room: Arie Crown Theater

Participants
Elizabeth S. Burnside, MD, MPH, Madison, WI (Presenter) Nothing to Disclose
Wendy B. Demartini, MD, Stanford, CA (Abstract Co-Author) Nothing to Disclose
Sarina Schrager, MD, MS, Madison, WI (Abstract Co-Author) Nothing to Disclose
Amy Trentham-Dietz, Madison, WI (Abstract Co-Author) Nothing to Disclose
John Hampton, Madison, WI (Abstract Co-Author) Nothing to Disclose
Christina Shafer, PhD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Lee G. Wilke, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose

PURPOSE

Risk-based screening in women < 50 years old has been promoted to increase benefits and decrease harms of a mammography screening program, but has not been evaluated in practice. We compared the impact of risk-based screening to age-based screening in women <50 to determine screening program outcomes.

METHOD AND MATERIALS

We analyzed a database of consecutive screening mammograms (1/1/2006-12/31/2013) from an academic practice—starting at 40 without an upper age limit. To evaluate only “average risk” women, we excluded those with a personal history of breast cancer or with documented BRCA mutation. We matched our population with a cancer registry as our reference standard. In women <50 we used clinical intake data at the time of each mammogram to estimate breast cancer risk using the BCSC risk calculator (https://tools.bscs-sc.org/bc5yearrisk/calculator.htm). We emulated a risk-based screening strategy by excluding women <50 whose five-year breast cancer risk was less than the average risk for a 50-year old (≤ 1.253%). We emulated an age-based screening similar to the American Cancer Society guidelines by removing all women <45. We compared outcomes for the two strategies, including number of cancers detected, proportion of DCIS/all cancers), recalls, and biopsies using the chi-square statistical test, defining a p value of <0.05 as statistically significant.

RESULTS

In our actual clinical baseline practice, screening average risk women age ≥40, we performed 75,107 screening mammograms in 25,155 women and detected 344 cancers—230 invasive (183 local and 43 regional) and 91 DCIS, and had 4,816 recalls and 995 biopsy recommendations. The clinical practice audit outcomes were cancer detection rate of 4.58/1000 and recall rate of 8.2%. Age-based screening starting at 45 detected more cancers than risk-based screening (p<0.05), while prompting more recalls (p<0.0001) and biopsies (p<0.01). There was no statistically significant difference in the proportion of DCIS (p=0.99).

CONCLUSION

Risk-based screening in women < 50 results in less recalls and biopsies but also detects fewer cancers than an age-based strategy that starts screening at age 45.

CLINICAL RELEVANCE/APPLICATION

Evaluating the potential effects of risk-based compared to age-based strategies can enumerate trade-offs: fewer cancers detected and false positives without altering the proportion of DCIS.
LEARNING OBJECTIVES

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

ABSTRACT

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

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Eren D. Yeh, MD - 2015 Honored Educator
Automated Breast Volume Scanner (ABVS) Physician Training Workshop - An Interactive Learning Experience: Siemens Healthineers Vendor Workshop

Monday, Nov. 28 10:15AM - 11:25AM Room: Booth 5534

Participants

PARTICIPANTS

Ellen B. Mendelson, Chicago, Illinois, USA

PROGRAM INFORMATION

Under the guidance of a breast imaging expert you will develop your skills in the interpretation of 3D breast ultrasound acquired with the ACUSON S2000™ Automated Breast Volume Scanner (ABVS), HELX Evolution with Touch Control and displayed on workstations equipped with syngo.Ultrasound Breast Analysis (sUSBA) Software. Active participation in real clinical cases will enable you to become familiar with the coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSPA16/
The Phenomenon of Ambiguous Location on Tomosynthesis: Contributing Factors and Practical Solutions:
Hologic Vendor Workshop

Monday, Nov. 28 10:30AM - 11:45AM Room: Booth 5521

Participants

PARTICIPANTS
Dr. Linda Greer

PROGRAM INFORMATION

An advanced 75 minute hands-on workshop: Clinical Insights exploring day-to-day location dilemmas associated with tomosynthesis imaging. Subsequent to a brief lecture, participants will review and score challenging cases. A Faculty led review with practical solutions and correlate ancillary imaging results will follow. (24 Attendees per session) (Hologic Selenia® Dimensions® system with C-View™ software)

Registration

http://www.hologic.com/rsna-hologic-workshop-sessions
Breast Tomosynthesis Self-guided Reading Sessions: Siemens Healthineers Vendor Workshop
Monday, Nov. 28 10:30AM - 5:00PM Room: Booth 5534

Participants

PROGRAM INFORMATION
You are invited to our self-guided reading sessions. With syngo Breast Care workstations configured especially to allow you to work at your own place at a time that suits you! A series of breast tomosynthesis cases presented as problem cases with a solution enables you to develop and test your tomosynthesis reading skills.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RNSA16/
Automated Breast Volume Scanner (ABVS) Self-guided Reading Sessions: Siemens Healthineers Vendor Workshop

Monday, Nov. 28 10:30AM - 5:00PM Room: Booth 5534

Participants

PROGRAM INFORMATION

With syngo.Ultrasound Breast Analysis (sUSBA) Software, self guided reading sessions with real clinical cases will enable you to become familiar with the coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Participants

PARTICIPANTS

Maria Bernathova, Vienna, Austria

PROGRAM INFORMATION

During this hands-on workshop you will learn to evaluate 2D mammography and 3D Breast Tomosynthesis. An expert tutor will lead you through cases that will both fascinate and confound you! All cases have been acquired with Siemens Mammomat Inspiration and are displayed on syngo.Breast Care workplaces so you will also become familiar with the image quality and ease of use of our systems.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Participants

Dr. Alejandro Tejerina

Program Information

A 60 minute hands-on workshop: Drawing on a breadth of experience, faculty presents a seasoned clinical perspective with the Affirm™ Prone Biopsy System, which includes comparison of tomosynthesis guided breast biopsy to stereotactic guided biopsy. The lecture will be followed by a hands-on case-based demonstration of the Hologic 3D™ image guided breast biopsy procedure using the Affirm™ Prone Biopsy System. (12 Attendees per session) (Affirm™ Prone Biopsy System)

Registration

http://www.hologic.com/rsna-hologic-workshop-sessions
Breast Monday Poster Discussions

Monday, Nov. 28 12:15PM - 12:45PM Room: BR Community, Learning Center

BR

Value of Preoperative Axillary US for Preventing Unnecessary axillary Lymph Node Dissection in a Large Series of Patients with Early-Stage Breast Cancers

Station #1

Participants
Lilian Wang, MD, Chicago, IL (Moderator) Nothing to Disclose

Sub-Events

BR226-SD-MOA1

Purpose
To investigate value of preoperative axillary ultrasound (US) for preventing unnecessary axillary lymph node dissection (ALND) in a large series of patients with early-stage breast cancers.

Method and Materials
From March 2009 to February 2013, 1929 patients who had undergone preoperative axillary US and subsequent breast conserving surgery for clinically node negative T1/T2 breast cancers were included as follows: 1475 (76.5%) with negative sentinel lymph node biopsy (SLNB) and stability on follow-up for more than 2 years, 327 (17.0%) with positive SLNB and subsequent ALND, 127 (6.6%) with positive US-guided fine-needle aspiration result of axillary LN and subsequent ALND. Preoperative axillary US results (positive or negative) and clinicopathologic features (age, clinical T stage, histologic type, nuclear grade, lymphovascular invasion, and molecular subtypes) were compared according to the presence of non-SLN metastasis. Multivariate logistic regression was performed to find independent factors for non-SLN metastasis.

Results
Of 1929, 203 (10.5%) patients had non-SLN metastasis in their ALNDs. Patients with ultrasonographically positive axilla showed non-SLN metastasis more frequently than patients with ultrasonographically negative axilla (53.8% versus 3.6%, P <0.001). At multivariate analysis, the independent factors associated with non-SLN metastasis were ultrasonographically positive axilla (odds ratio [OR], 30.163; 95% confidential interval [CI], 19.970-45.558), clinical T2 stage (OR, 1.733; CI, 1.156-2.598) and lymphovascular invasion (OR, 5.922; CI, 3.971-8.832). In our 1284 patients who had clinical T1 cancers and ultrasonographically negative axilla, 185 (14.4%, 184 of 1284) underwent ALND, and non-SLN metastasis was confirmed in 30 patients (2.3%, 30 of 1284).

Conclusion
In early-stage breast cancer patients, positive axilla and clinical T2 stage determined by preoperative staging US were significantly associated with non-SLN metastasis. This study suggests that ALND can be avoided for patients with ultrasonographically negative axilla and clinical T1 stage cancers with a minimal risk of non-SLN metastasis.

Clinical Relevance/Application
Axillary lymph node dissection might be avoided for patients with negative axilla and clinical T1 stage determined by preoperative US with a minimal risk of non-sentinel lymph node metastasis.

Follow-up of Patients Undergoing Oncoplastic Surgery- More Palpable Masses and Benign Biopsies

Station #2

Participants
Yoav Amitai, MD, Tel Aviv, Israel (Presenter) Nothing to Disclose
Orit Golan, MD, PhD, Tel-Aviv, Israel (Abstract Co-Author) Nothing to Disclose
Yoav Barnea, Tel Aviv, Israel (Abstract Co-Author) Nothing to Disclose
Tehillah Menes, MD, Tel Aviv, Israel (Abstract Co-Author) Nothing to Disclose

Purpose
Oncoplastic surgery is increasingly being used in the management of women undergoing breast conserving surgery. Data on the impact of oncoplastic surgery on the follow-up of these women is lacking. We hypothesized that the combined surgery may make post-operative surveillance more difficult, mainly due to breast parenchymal rearrangement. The goal of this study was to compare the post-operative follow up of patients who underwent breast conserving surgery with and without plastic reconstruction.

Method and Materials
All patients undergoing breast conserving surgery with oncoplastic reconstruction in our institution between 2009-2014 were
Included in the study. For each patient in the oncoplastic reconstruction group, the first 4 patients who underwent lumpectomy alone in the same week were selected and included in the control arm. The two groups were compared regarding demographics, tumor characteristics, details of the surgery, post-operative patient complaints, breast exam, imaging findings and subsequent biopsies done during follow-up.

RESULTS
The study group included 72 women who had oncoplastic surgery and 291 who underwent breast conserving surgery without oncoplastic surgery. Mean follow up was similar (888 vs. 932; p=0.5). Patients undergoing oncoplastic surgery were younger (49 vs. 57 years; P=0.015), had more advance disease (Average tumor size 1.9 vs. 1.6 cm; P=0.02, Involved lymph nodes 41% vs. 17%; P<0.001) and more often had undergone neoadjuvant treatment (35% vs. 8%; P<0.001). Larger volumes of tissue were removed in the oncoplastic group (388 cm³ vs. 123 cm³, P<0.001). New lumps on physical examination were more frequently found in patients after oncoplastic surgery (22% vs. 5%; P<0.001). Patients after oncoplastic surgery had more biopsies during follow-up (30% vs. 14%; P<0.001). This finding remained significant after controlling for age, use of neoadjuvant treatment and volume of tissue removed. Ninety percent of biopsies in the oncoplastic group were benign, most commonly-fat necrosis (63%).

CONCLUSION
Oncoplastic surgery is followed by higher rates of palpable findings and subsequent breast biopsies compared to lumpectomy alone. Most biopsies are benign, most commonly fat necrosis.

CLINICAL RELEVANCE/APPLICATION
Women and their physicians should be aware of the higher rate of palpable abnormalities and breast biopsies after oncoplastic surgery, and more importantly of its benign nature.

Impact of Imaging Features and Neoadjuvant Chemotherapy on Breast Intraoperative Specimen Interpretation
Station #3

Awards
Student Travel Stipend Award

Participants
Bryan Jordan, MD, Houston, TX (Presenter) Nothing to Disclose
Wei Wei, Houston, TX (Abstract Co-Author) Nothing to Disclose
Mark J. Dryden, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Alejandro Contreras, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Kelly K. Hunt, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Basak E. Dogan, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate the influence of imaging features and history of neoadjuvant therapy (NAC) on the accuracy of intraoperative specimen radiography (IOSR) evaluation of histopathological margin status in breast cancer patients.

METHOD AND MATERIALS
We retrospectively reviewed electronic health records of consecutive patients with invasive carcinoma who underwent specimen radiography at the time of their definitive surgery from July 2014-February 2015 at our institution in an IRB approved study. Patient demographics, type of surgery, and tumor histopathological type (with or without associated DCIS), history of NAC and clinical NAC response, initial IOSR assessment, need for intraoperative additional tissue, re-excision surgery and mastectomy rates were recorded. History of NAC prior to surgical excision were compared with IOSR interpretation findings and final pathological margin [close or positive margins (CPM) versus negative margins (NM)] status.

RESULTS
Our eligibility criteria was met by 625 patients. Median patient age was 56 (range 28-87) years. At presentation, 223(52.5%) patients had pure invasive, 271(46%) had invasive and in situ cancer, and 131(3%) were of other subtypes. 514(82.2%) cancers were unifocal, 106(17.8%) were multifocal or centric. 300(48%) underwent mastectomy and 325(52%) segmental mastectomy. A total of 226 (36%) patients underwent NAC and 399 (63%) upfront surgery. IOSR indicated CPM in 232 (37.1%), prompting excision of additional tissue, while final pathology showed CPM in 29.7%. Sensitivity, specificity, PPV, and NPV, and accuracy of IOSR in predicting CPM were, 94%, 86.8%, 75.4%, 97.1%, 89%, respectively (95% CI: 86-91%). CPM was significantly lower in the NAC group (21%) than non NAC group (35%) (p=0.0002). While sensitivity (93.6 vs 94.1%), specificity (86.4 vs 87.6%) and NPV (98.0 vs 96.4%) of IOSR were similar in NAC vs non NAC groups, false positive rate was higher in NAC (35%) vs non NAC (19.5%) and PPV was lower in the NAC (64.7%) compared to non NAC(80.5%) group.

CONCLUSION
IOSR is a highly accurate method of intraoperative specimen margin evaluation. While preoperative NAC increases the rate of negative surgical margins, it increase false positive rate and decreases PPV of IOSR.

CLINICAL RELEVANCE/APPLICATION
While NAC history decreases the probability of CPM, it influences IOSR evaluation of surgical margins and may contribute to an increase in excision volume.

Long-term Survival Outcomes of Primary Breast Cancer in Women with or without Preoperative MR Imaging: A Matched Cohort Study
Station #4

Participants
Ga Young Yoon, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Woo Jung Choi, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Pilot Reader Study of Concurrent CAD for Digital Breast Tomosynthesis

Station #6

Participants

Eun Young Chae, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Monica L. Huang, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Beatriz E. Adrada, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
William R. Geiser, MS, Houston, TX (Abstract Co-Author) Nothing to Disclose
Rosalind P. Candelana, MD, Houston, TX (Presenter) Nothing to Disclose
Roland Bassett Jr, Houston, TX (Abstract Co-Author) Research Grant, Lantheus Medical Imaging, Inc
Deanna L. Lane, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Marion E. Scoggins, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Elsa M. Ambas, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Lumarie Santiago, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

Purpose

To investigate whether preoperative magnetic resonance (MR) imaging use in patients with primary breast cancer are predictive of disease-free (DFS) and overall (OS) survival.

Method and Materials

From 2009 to 2010, 875 women with primary breast cancer who underwent preoperative MR imaging were matched with 1635 women without preoperative MR imaging. The patients were matched with regard to age at diagnosis, address, job, parenchymal pattern of mammography, operation date, hormone receptor status, Ki-67 status and molecular subtype. Cox proportional hazards model was used to investigate time to recurrence and to estimate the hazard ratio (HR) for preoperative MR imaging.

Results

A total of 759 matched-pairs were available for survival analysis. There were 143 recurrence; 65 locoregional recurrence, 23 contralateral breast cancer, and 55 distant recurrence. There were 40 deaths. The MR imaging group had a tendency toward better distant recurrence DFS (HR, 0.67; 95% confidence interval; 0.39, 1.14; P = .138) than did the no MR imaging group. However, no difference was found for locoregional recurrence (P = .893), contralateral breast cancer (P = .839) DFS or OS (P = .504).

Conclusion

Preoperative breast MR imaging for primary breast cancer was associated with a reduced risk of distant recurrence; however, no observed reduction in risk of locoregional, contralateral breast cancer or overall survival was shown.

Clinical Relevance/Application

The use of a breast MR imaging at the time of initial diagnosis and evaluation of primary breast cancer may help reduce risk of distant recurrence.
Participants
Corinne Balleyguier, MD, PhD, Villejuif, France (Presenter) Nothing to Disclose
Julia Arfi Rouche, Maisons-Alfort, France (Abstract Co-Author) Nothing to Disclose
Laurent Levy, MD, Paris, France (Abstract Co-Author) Nothing to Disclose
Patrick R. Toubiana, MD, Paris, France (Abstract Co-Author) Nothing to Disclose
Franck Cohen-Scali, MD, Neuilly Sur Siene, France (Abstract Co-Author) Nothing to Disclose
Alicia Toledano, DSc, Kensington, MD (Abstract Co-Author) Consultant, iCAD, Inc
Senthil Periaswamy, PhD, Nashua, NH (Abstract Co-Author) Director of Research, iCAD, Inc
Jonathan Go, Nashua, NH (Abstract Co-Author) Sr. Vice President, iCAD, Inc
Jeffrey W. Hoffmeister, MD, Nashua, NH (Abstract Co-Author) Employee, iCAD, Inc; Stockholder, iCAD, Inc
Bruno Boyer, MD, Saint-Mande, France (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the concurrent use of a Computer-Aided Detection (CAD) system with Digital Breast Tomosynthesis (DBT). To obtain performance estimate information for use in designing and computing the sample size (number of readers and cases) to adequately power a pivotal reader study.

METHOD AND MATERIALS
6 radiologists read an enriched sample of 80 DBT cases, with 21 cancer cases and 23 malignant lesions with a crossover design with and without CAD. All readers reviewed all cases in 2 visits separated by a period of at least 4 weeks. The CAD system detects and extracts suspicious masses, architectural distortions and asymmetries from 3D DBT planes and blends them into the corresponding 2D synthetic image. With CAD, the radiologist views the lesion on 2D projection then navigates directly to the tomosynthesis plane for characterization. Area Under the Receiver Operating Characteristic (ROC) Curve (AUC) was used to compare the two readings in terms of cancer detection. Sensitivity, specificity, recall rate and reading time were also assessed. The magnitude, direction of differences between AUCs and reading time for with and without CAD and correlations that influence sample sizes for the pivotal study were obtained from the pilot study.

RESULTS
Average AUC across readers without CAD was 0.854 and 0.850 with CAD (-0.046, 0.039, 95% CI). Time reduction of reading time with CAD was statistically significant with average improvement in reading time of 23.5% (7.0 to 37.0%, 95% CI). No statistically significant differences in radiologist sensitivity, specificity or recall rate for non-cancers when reading concurrently with CAD vs. without CAD was found. Using parameter estimates obtained from the pilot study, sample size calculation determined that a pivotal reader study with 20 readers, 60 cancers, and 180 non-cancers provides estimated power of 90% for demonstrating non-inferior AUC and estimated power of 93% for demonstrating superior radiologist reading time.

CONCLUSION
Concurrent use of CAD results in a 23.5% faster reading time with non-inferiority of radiologist performance compared to reading without CAD. A pivotal reader study with 20 readers, 60 cancers, and 180 non-cancers is planned to more robustly evaluate these endpoints.

CLINICAL RELEVANCE/APPLICATION
Concurrent use of CAD maintains high performance of DBT with a significant reduction in reading time thus improving workflow even for very experienced radiologists.

BR128-ED-MOA7  Spectrum of Axillary Hyperdense Masses and Foci

Station #7

Participants
Jaclyn Thiessen, MD, Portland, OR (Presenter) Nothing to Disclose
Philip A. Setran, MD, Portland, OR (Abstract Co-Author) Nothing to Disclose
Karen Y. Oh, MD, Portland, OR (Abstract Co-Author) Nothing to Disclose
Mark D. Kettler, MD, Portland, OR (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Axillary hyperdense foci visible on mammography are caused by a variety of malignant, benign and iatrogenic conditions. In the setting of breast cancer, calculations in axillary lymph nodes may, but do not necessarily reflect metastatic disease. Knowledge of benign and iatrogenic patterns of axillary hyperdense foci can obviate unnecessary additional imaging and biopsies.

TABLE OF CONTENTS/OUTLINE
Definition: Axillary hyperdense foci include calcifications and/or metallic densities within axillary lymph nodes or masses/foci denser than normal axillary tissue. Axillary lymph node calcifications caused by iatrogenic disease Invasive breast cancer and DCIS Metastases Psammomatous calcifications associated with metastatic thyroid and ovarian cancer Axillary lymph node calcifications caused by systemic disease Sarcoïdosis Granulomatous diseases Axillary lymph nodes containing metal opacities Gold salt therapy for rheumatoid arthritis Tattoo pigment Hyperdense axillary lymph nodes associated with hematoologic disorders such as leukemia and lymphoma Other/Iatrogenic causes of axillary hyperdensities Dermatomyositis Talc emboli Calcified oil cyst Catheter fragment Free silicone/silicone granuloma Surgical clip Deodorant artifact

BR178-ED-MOA8  Breast Imaging in the Transgender Patient: Traversing New Terrain

Station #8

Awards
Certificate of Merit

Participants
Bianca M. Carpentier, MD, San Francisco, CA (Presenter) Nothing to Disclose
Jessica H. Hayward, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
TEACHING POINTS

The purpose of this exhibit is to provide the reader with an approach to breast imaging in the transgender patient. After viewing this presentation, the reader will gain a better understanding of the appropriate terminology to use with transgender patients who may present for screening or diagnostic breast evaluation. Surgical and hormonal treatments most commonly used in gender reassignment, including both male-to-female (MTF) and female-to-male (FTM) patients, will be reviewed, as well as the resultant expected imaging features on mammography, ultrasound and MRI. This exhibit will also cover the known breast cancer risk in the transgender population with examples of malignancy. The reader will be provided with current screening recommendations of this population, as well as the current screening controversies.

TABLE OF CONTENTS/OUTLINE

- Terminology to use with transgender patients
- Current therapy and resultant physiological changes
- Imaging features post therapy
- Breast cancer risk with gender reassigned patients
- Current screening recommendations and controversies
- Reimbursement in the US for the asymptomatic transgender screening patient
- How to create a sensitive, welcoming environment in your practice
- Our institution's approach for both screening and diagnostic evaluation in transgender patients
PURPOSE
Access to breast cancer screening in China is primarily limited by the shortage of qualified radiologists in primary hospitals. Automated Breast Ultrasound System (ABUS) is a potential method to alleviate current challenges in accessible breast cancer screening. This study aims to evaluate the initial effectiveness of ABUS by comparing it with Hand Held Ultrasound (HHUS) and Mammography (MAM) in a hospital-based multi-center study.

METHOD AND MATERIALS
Women ages of 30 to 69 who visited breast surgeons for the first time without visible, suspicious signs of breast cancer were eligible undergone HHUS and ABUS, and women in the older group (40 to 69 years old) also received MAM. The images of the lesions were interpreted independently by using BI-RADS without knowledge of clinical or other imaging results. 122 women have been enrolled. By taking breast as the unit of analysis, we have acquired 244 results for each exam. The consistency rates and Kappa statistics were calculated to assess the reliability of ABUS compared with HHUS or MAM.

RESULTS
The average age was 44.47 in the whole group and 48.52 in the older group. Of all the 244 breasts, HHUS detected 41 suspicious lesions and ABUS detected 32. Among the 41 suspicious lesions detected by HHUS, ABUS detected 31; In the older group, ABUS detected 22 suspicious lesions and MAM detected 21. Among the 21 suspicious lesions detected by MAM, only 3 lesions were undetected by ABUS. Among the 22 lesions detected by ABUS, only 4 were not detected by MAM. The consistency rates between HHUS and ABUS was 95.49%, and that between ABUS and MAM in the older group was 95.39%. The Kappa value between ABUS and HHUS was 0.82 and that of ABUS and MAM in the older group was 0.81.

CONCLUSION
Fairly good reliability was observed in comparisons between ABUS and HHUS or MAM. As ABUS is an automated system, images can be collected by technicians and interpreted later by qualified doctors, it may be an alternative modality in breast cancer screening in remote or low-resource areas. Other clinical performance indicators of ABUS, including sensitivity and specificity, need to be further demonstrated in multi-center screening trials.

CLINICAL RELEVANCE/APPLICATION
Reliability of ABUS was comparable to HHUS and MAM, it may be an alternative modality in breast cancer screening in remote or low-resource areas.
second-look US. First MRI was performed in prone position using a 1.5-T imager and second MRI was performed in a supine position for MR-navigated US.

**RESULTS**

Of 40 lesions, 31 (78%) were identified with MR-navigated US, whereas 5 (13%) lesions disappeared on supine MRI and 4 (10%) showed no correlation on MR-navigated US. Of 31 lesions with pathologic confirmation, 7 (23%) were malignant, 2 (6%) were high risk lesions and 22 (71%) were benign lesions. Comparing the US findings of benign and malignant lesions, orientation of the lesion showed significant difference (p=0.045), whereas lesion shape, margin and echo pattern were not significantly different between two groups (p=0.088, p=0.094 and p=0.412, respectively). Median difference of lesion to nipple distance on supine and prone MRI was 8 mm (0-34 mm) in horizontal direction and 5 mm (0-39.5 mm) in vertical direction. Thirteen lesions showed more than 1cm difference in both horizontal and vertical direction.

**CONCLUSION**

MR-navigated US is useful for the evaluation of MRI-detected lesions which were not visible on second-look US in breast cancer patients.

**CLINICAL RELEVANCE/APPLICATION**

MR-navigated US is useful for the evaluation of MRI-detected lesions which were not visible on second-look US in breast cancer patients.

**BR234-SD-MOB3 Intravoxel Incoherent Motion Diffusion Weighted Imaging: Does It Correlate with Prognostic Factors and Molecular subtypes of Breast Cancers?**

Station #3

Participants
Shunan Che, MD, Beijing, China (Presenter) Nothing to Disclose
Chunwu Zhou, Beijing, China (Abstract Co-Author) Nothing to Disclose
Xinming Zhao, Beijing, China (Abstract Co-Author) Nothing to Disclose
Han Ouyang, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Jing Li, MD, PhD, Beijing, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

to investigate whether parameters deriving from intravoxel incoherent motion (IVIM) model correlate with prognostic factors and subtypes of breast cancers

**METHOD AND MATERIALS**

From March 2014 to May 2015, 110 cases with 114 lesions, histologically confirmed breast invasive ductal cancer, were collected. All of them were examined with multiple-b value DWI (12b from 0-1000s/mm²) before surgery or core needle biopsy. GE post-processing workstation was used to automatically calculate parameters (D, D* and f) deriving from IVIM model. Correlation between IVIM parameters and prognostic factors (including size, grade, status of vascular invasive and axillary lymph node, and the expression status of ER, PR, HER2 and Ki67) was analyzed using Mann–Whitney U test and spearman’s correlation coefficient. IVIM parameters among different molecular subtype was compared with Kruskal–Wallis H test.

**RESULTS**

The median D value of the low aggressive group, PR-negative group and HER2-positive group were significantly higher than that of the highly aggressive group, PR-positive group and HER2-negative one (p<0.001; p=0.042; p=0.001, respectively). The median D* value of HER2-positive lesions was significantly higher than that of HER2-negative ones (p=0.033). The median f value of the low aggressive lesions was significantly lower than that of the highly aggressive ones (p<0.001). The median D value of HER2 enriched subtype tumor (1.11x10⁻³mm²/s) was significantly higher than that of Luminal and triple-negative subtype one (0.80x10⁻³mm²/s; 0.82x10⁻³mm²/s, respectively), there were statistically significant differences among them (p=0.026, p=0.048; respectively)

**CONCLUSION**

D value was negatively correlated with tumor grade and PR status, while positively correlated with HER2 status. D* value was positively correlated with HER2 status. f value was positively correlated with tumor grade. D value can be used to distinguish the subtype of HER2 enriched tumors from the Luminal and triple-negative ones.

**CLINICAL RELEVANCE/APPLICATION**

Parameters of IVIM model may be valuable for predicting the prognosis and distinguishing different molecular subtype of breast cancer.

**BR235-SD-MOB4 T2 Signal Intensity of Breast Cancer as a Prognostic Indicator of Response to Neoadjuvant Chemotherapy**

Station #4

Awards
Student Travel Stipend Award

Participants
John C. Benson, MD, Saint Paul, MN (Presenter) Nothing to Disclose
Lei Zhang, MS, Minneapolis, MN (Abstract Co-Author) Nothing to Disclose
Noelle E. Hoven, MD, Minneapolis, MN (Abstract Co-Author) Nothing to Disclose
Michael Nelson, MD, Minneapolis, MN (Abstract Co-Author) I hold license and patents on a breast marker named VizMark
Patrick J. Bolan, PhD, Minneapolis, MN (Abstract Co-Author) Research Consultant, Breast-Med, Inc

**PURPOSE**

To evaluate quantitative intra-tumoral T2 signal intensity as a prognostic marker in patients receiving neoadjuvant chemotherapy.
for breast cancer.

**METHOD AND MATERIALS**

This was an exploratory, retrospective analysis using data from the I-SPY 1 TRIAL (CALGB 150007/ACRIN6657). Patients had a stage 2 or 3 breast tumor measuring ≥3 cm; each received neoadjuvant chemotherapy with an anthracycline-cyclophosphamide (AC) regimen with or without a taxane-based regimen. MR imaging was completed ≤4 weeks before starting AC (MR1), ≥2 weeks after AC cycle #1 and prior to AC cycle #2 (MR2), after AC cycle #2 and before taxane (MR3), and after completing neoadjuvant chemotherapy (MR4). Regions of interest (ROIs) corresponding to tumors on T2-weighted images (T2WI) were obtained by co-registering T2WI to the functional tumor volume (FTV) ROIs, which were calculated using signal enhancement ratio (SER) images and were used in the trial's primary analysis. The median, 5th percentile, 95th percentile, and interquartile range of intra-tumoral T2 signal intensity from MR1 and MR2 images were recorded. Patient outcome was evaluated using change in FTV and presence or absence of complete pathologic response (pCR) following chemotherapy.

**RESULTS**

Of 222 patients, 57 lacked imaging at MR2 or FTV/pCR data, and 56 lacked imaging sequences or had poor image quality. Hence, 109 patients met inclusion criteria (100% female); mean age at time of enrollment was 46.7±9.2 years. Of all patients, 31/109 (28.4%) had pCR following neoadjuvant chemotherapy. The 5th percentile of intra-tumoral T2 intensity on MR2 was significantly lower in patients that achieved pCR (p=0.0169). The median and 95th percentile signal intensity of tumoral T2 intensity on MR2 were also lower in patients that achieved pCR, though these findings were not statistically significant (p=0.3147 and p=0.2388, respectively). No association was found between MR2 tumoral T2 signal intensity and ∆FTV.

**CONCLUSION**

Patients that achieved pCR following chemotherapy had low 5th percentile intra-tumoral T2 signal intensity after early neoadjuvant chemotherapy. Further investigation is warranted to assess quantitative T2 signal as a prognostic indicator in breast cancer.

**CLINICAL RELEVANCE/APPLICATION**

In patients receiving neoadjuvant chemotherapy for breast cancer, intra-tumoral T2 signal intensity may represent a useful prognostic tool on non-contrast MR imaging.

**BR236-SD-MO65** Leveraging "Deep Learning" Methods to Elucidate and Incorporate Novel Breast Parenchymal Complexity Phenotypes to Enhance Breast Cancer Risk Assessment

**Station #5**

**Participants**

Andrew Oustimov, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Aimilia Gastounioti, Philadelphia, PA (Presenter) Nothing to Disclose
Meng-Kang Hsieh, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Lauren Pantalone, BS, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Emily F. Conant, MD, Philadelphia, PA (Abstract Co-Author) Consultant, Hologic, Inc; Consultant, Siemens AG
Despina Kontos, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To leverage the use of Deep Learning methods for elucidating novel quantitative phenotypes of breast parenchymal complexity and investigate their added value in breast cancer risk assessment.

**METHOD AND MATERIALS**

We retrospectively analyzed “For Processing” contralateral mediolateral-oblique (MLO) view digital mammograms from 106 women with unilateral primary invasive breast cancer and 318 age- and side-matched controls, acquired with either a GE Healthcare 2000D or DS FFDM system. We coupled our previously validated lattice-based strategy for mammographic texture analysis with deep convolutional neural networks (ConvNets), which are capable of non-linearly merging input data to hierarchical representations (i.e., meta-features) useful for a particular learning task, here discriminating between cancer cases and controls. The lattice-based strategy was first used to generate feature maps of 29 established texture descriptors, including histogram, co-occurrence, run-length, and fractal dimension features, each capturing a different aspect of the tissue complexity and its distribution within the breast. The extracted feature maps for each woman were then simultaneously fed into a ConvNet, with two convolutional layers, and a fully-connected multilayer perceptron (MLP) layer feeding into a logistic regression classifier. Training and validation was performed using a split-sample approach. Discriminatory capacity was assessed via the area under the curve (AUC) of the receiver operating characteristic (ROC), and compared to the standard approach of feeding the texture features directly into a logistic regression classifier.

**RESULTS**

The deep learning classifier demonstrated high discriminatory capacity, having an AUC=0.90 (95% CI=[0.82–0.98]), outperforming conventional logistic regression classification of the texture features which had a discriminatory capacity of AUC=0.85 on the same case-control dataset. Deep learning classification was based on 5 meta-features efficiently combining subtle discriminative information.

**CONCLUSION**

Deep learning methods hold the promise to reveal parenchymal pattern phenotypes that may augment the predictive value of conventional parenchymal pattern measures in risk prediction.

**CLINICAL RELEVANCE/APPLICATION**

Improving breast cancer risk prediction using deep-learned parenchymal pattern phenotypes could help better guide personalizing breast cancer screening and prevention strategies.

**BR237-SD-MO66** Trends in Breast Density Assessment Over Time: Patterns Related to Legislation and Patient Age

**Station #6**
Breast density notification legislation is being passed in more states every year. Density classification on mammography is primarily achieved by subjective means. With such laws in effect, there is the possibility of radiologists overtly or subconsciously changing density, particularly downgrading such that supplemental tests will not be required. The purpose of this study was to determine the effect of density classification over time and by patient age.

**METHOD AND MATERIALS**

A search of the electronic breast imaging database (PenRad, MN) was performed to determine the density classifications (BI-RADS categories a,b,c,d) reported on digital screening mammograms over a 10 year period (2006 – 2015). Our state density notification law went into effect in 2009. Prior to 2011 these were FFDM and after 2011, the majority were tomosynthesis exams (all Hologic, MA). The combined data was assessed and additionally, the data were subdivided by patient age by decade: 40-49, 50-59, 60-69, 70 and up.

**RESULTS**

A total of 76,924 screening exams were assessed. For all age groups, there was a small decrease in dense breast categories and corresponding increase in non-dense of 5% in 2009, which returned to usual the following year. However, there has been a consistent trend of increasing percentage of heterogeneously dense since that time, from 23% to 34%. When assessed by age, this trend is found mostly in women in the 50’s and 60’s decade. No specific pattern change was noted in 2011 with the conversion to tomosynthesis.

**CONCLUSION**

The patterns of density reporting appear to be initially affected by state legislation, yet the pattern did not return to previous rates, but actually shows increase towards more women being reported as dense, particularly women in the 50-69.

**CLINICAL RELEVANCE/APPLICATION**

Density reporting appears to be affected by legislation, but such trends may change over time, with increase towards more women being reported as dense. This may be a reflection of radiologists not downgrading density as women age, or leaning towards allowing more women the possibility of supplemental screening.

**TEACHING POINTS**

Graphically illustrate the continuum between CT, tomosynthesis, and radiography. Understand the effect of various acquisition parameters on image quality and dose. Understand why some objects are discernible in tomosynthesis and others are not. Understand the source of common artifacts seen in tomosynthesis. Help the radiologist understand when tomosynthesis is preferred over CT or radiography.

**TABLE OF CONTENTS/OUTLINE**

Provide an overview of the geometry of tomosynthesis acquisition. Graphically compare tomosynthesis acquisition to CT and radiography. Graphically compare the information contained within a tomosynthesis scan to the information within a CT scan or radiograph. Using computer simulations, demonstrate the impact of changing different acquisition parameters, including: angular range, number of projections and reconstruction filter. Using experiments based on physical phantoms, demonstrate the impact of an objects location, orientation, and size. Using simple examples, explain the source of common tomosynthesis artifacts. Relate these concepts to the clinically available scanners. Describe the situations in which tomosynthesis is preferable to radiography or CT.
Although dynamic contrast-enhanced MR images are the pivotal part of breast MRI, routinely scanned T2-weighted images can contain useful information for proper diagnosis. This exhibit focuses on differential diagnosis of high signal intensity areas on T2-weighted images (T2-high SI areas). We will:

1. Classify T2-high SI areas identified on breast MRI based on location.
2. Propose a diagnostic algorithm of T2-high SI areas based on enhancement patterns and ADC values obtained from diffusion-weighted images, with corresponding pathological findings.

**TABLE OF CONTENTS/OUTLINE**

1. Location of T2-high SI area: outside/inside a breast mass.
2. T2-high SI area outside a breast mass: edema, dilated and fluid filled mammary ducts, breast vessels, intramammary lymph nodes, uneven fat suppression.
4. T2-high SI area inside a breast mass and its classification based on ADC value—breast cancer and cancer mimics: triple negative breast carcinoma with central necrosis, granulomatous mastitis, mucinous carcinoma.
Participants

PARTICIPANTS

Marc Inciardi, MD, Susan Roux, MD

PROGRAM INFORMATION

In this era of cost-conscious medicine, Marc Inciardi, MD and Susan Roux, MD, investigators on the Somo-Insight Clinical Trial will discuss their current experience with ABUS including cancer detection rate in conjunction with 3D mammography and "how to" keep one's call back rate as low as possible.

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop/event-summary-b904d22132614dc2b7633ee3b34f22de.aspx
Automated Breast Volume Scanner (ABVS) Physician Training Workshop - An Interactive Learning Experience: Siemens Healthineers Vendor Workshop

Monday, Nov. 28 1:05PM - 2:15PM Room: Booth 5534

Participants

PARTICIPANTS

Ellen B. Mendelson, Chicago, Illinois, USA

PROGRAM INFORMATION

Under the guidance of a breast imaging expert you will develop your skills in the interpretation of 3D breast ultrasound acquired with the ACUSON S2000™ Automated Breast Volume Scanner (ABVS), HELX Evolution with Touch Control and displayed on workstations equipped with syngo.Ultrasound Breast Analysis (sUSBA) Software. Active participation in real clinical cases will enable you to become familiar with the coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Bienvenida/Welcome

Participants
Pablo R. Ros, MD, PhD, Cleveland, OH (Moderator) Nothing to Disclose
Jose L. Criales, MD, Mexico City, Mexico (Moderator) Nothing to Disclose
Miguel E. Stoopen, MD, Mexico City, Mexico (Moderator) Nothing to Disclose

LEARNING OBJECTIVES
1) To understand what imaging biomarkers are and how they can improve diagnosis and treatment follow-up. 2) To describe the different types of biomarkers. 3) To analyze the process of biomarkers development, including validation, qualification and standardization.

ABSTRACT
Imaging seems ideally suited to flourish as a quantitative science. Quantitative imaging biomarkers extract and measure objective biological characteristics from any type of medical images, being resolved in space, through parametric images, and in time, as response maps. As medical imaging does not destroy the evaluated samples, test-retest evaluations are feasible, allowing the repetition of experiments and measurements as frequently as desired. Each voxel in a computer derived image represents both the location and the value of a specific calculated parameter (morphological, biological, response) obtained by the application of mathematical or simulation models to the source images. These synthetic parametric maps represent the new paradigm in clinical radiology and should be considered as virtual biopsies, showing different morphological and biopathological abnormalities. Biomarkers can be classified as prognostic, if accuracy of patient diagnosis or prognosis is improved; predictive, if the most beneficial treatment can be defined; response, when the beneficial outcomes can be shown after treatment; and monitoring, to detect relapse or toxicity.

Precise and Personalized Medical Imaging

Participants
Luis Marti-Bonmati, MD, PhD, Godella, Spain, (Luis.Marti@uv.es) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To describe basic background about quantitative MRI techniques applied to multiple sclerosis. 2) To discuss how quantitative MRI techniques contribute to monitoring of MS progression.

ABSTRACT
Multiple sclerosis (MS) is a chronic demyelinating and neurodegenerative disease that affects the central nervous system (CNS). Brain and spine MRI are most important paraclinical tool for the diagnosis of MS as conventional MRI techniques, such as T2/FLAIR weighted and gadolinium-enhanced T1-weighted sequences are highly sensitive for detecting focal active white matter lesions. However, these techniques are not specific enough to detect diffuse injuries in both grey and white matter. Pathological and imaging data indicated that lesion pattern and timely detection of tissue damage could help identify patients with an increased risk
of developing severe disability and cognitive impairment. In this context, advanced quantitative MR tools have been used to access brain and spinal cord lesions in MS. Proton magnetic resonance spectroscopy (MRS) has been used in patients with CIS to identify tissue damage apart from the visible T2 lesions. Diffusion tensor imaging and magnetization transfer imaging have also revealed differences in normal-appearing brain tissue between patients with CIS and controls. Additionally, double inversion recovery (DIR) sequence, quantitative susceptibility mapping and phase sensitive inversion recovery (PSIR) are promising technique to monitor cortical damage and disease progression in patients with MS. The purpose of this lecture are (1) to describe basic background regarding quantitative MRI techniques applied to multiple sclerosis and (2) to discuss how quantitative MRI techniques contribute to monitoring of MS progression.

URL

SPSP21D Preguntas/Q & A

Participants

SPSP21E Resonancia Magnética en las Cardiopatías/Non-invasive Evaluation of Cardiac Disease by MRI

Participants

Aloha Meave, MD, Mexico City, Mexico (Presenter) Nothing to Disclose

SPSP21F Enfermedad Hepática por Depósito (Estatosis, Fibrosis, Cirrosis y Hemocromatosis)/Liver Storage Disease (Steatosis, Fibrosis, Cirrhosis, and Hemochromatosis)

Participants

Manuela Franca, MD, Porto, Portugal, (mariamanuela.franca@gmail.com) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the most common imaging features related to different liver storage diseases. 2) Understand that fat, iron and fibrosis commonly co-exist in different diffuse liver diseases. 3) Apply the best MR imaging techniques to assess and to quantify liver steatosis and iron overload, and to stage liver fibrosis/cirrhosis. 4) Discuss the clinical relevance of MR imaging biomarkers in different clinical scenarios of liver diseases, emphasizing the role of MR biomarkers on follow up of patients and treatment monitoring, taking hemochromatosis as a clinical example.

ABSTRACT

Different amounts of fat, iron deposits and fibrosis can be found in different diffuse liver diseases. Because liver biopsy has several limitations, MR imaging biomarkers have been developed for fat and iron quantification, and to stage liver fibrosis. Quantification of proton density fat fraction (PDFF) can be accurately performed with multi-echo chemical shift encoded (MCESE) gradient echo MR sequences, which must be corrected for T1 relaxation, T2* decay effect, noise and fat spectral complexity. Quantification of liver iron content is needed to detect and stage iron overload, and also to monitor iron-reducing treatments. Iron MR quantification may be performed with R2/R2* relaxometry techniques. Also, MCESE-MR sequences allow to simultaneously quantifying PDFF and R2* of liver parenchyma. MR elastography can detect and stage significant or advanced fibrosis and cirrhosis, with high accuracy. All of these MR measurements are increasingly being used as non-invasive biomarkers of hepatic steatosis, siderosis and fibrosis.

URL

SPSP21G Preguntas/Q & A

Participants

SPSP21I Cáncer de Próstata: Marcadores en Diagnóstico y Seguimiento/Prostate Cancer: Biomarkers in Diagnosis and Follow Up

Participants

Ivan Pedrosa, MD, Dallas, TX (Presenter) Nothing to Disclose

SPSP21J Osteoartrosis: Evaluación Cuantitativa del Cartílago Articular/Osteoarthritis: Cartilage Quantitative Evaluation

Participants

Nicolas Zilleruelo, MD, Santiago, Chile, (nzilleruelo@alemana.cl) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Assess the potential of technological innovations and advances to enhance clinical practice and problem-solving. 2) Identify the different quantitative techniques in the study of articular cartilage. 3) Practical applications of these quantitative techniques and discuss their clinical relevance.
Participants

Julia Camps Herrero, DIPLPHYS, Alzira, Spain, (juliacamps@gmail.com) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To know the diagnostic accuracy of Diffusion MRI in the evaluation of early response to Neoadjuvant Chemotherapy (NAC).
2) To learn the proof of principle and proof of mechanism of Diffusion Tensor MRI (DTI) as an Imaging Biomarker.
3) To learn about the results of early response evaluation to NAC with DTI.

ABSTRACT

Dynamic contrast-enhanced (DCE) Breast MRI is the standard imaging modality in the response evaluation to neoadjuvant chemotherapy (NAC). Diagnostic accuracy of DCE-MRI in response evaluation to NAC is limited to around 70% in published meta-analysis with very few studies dealing with early response evaluation and DCE-MRI. Diffusion MRI has been show to be a solid imaging biomarker in the evaluation of response to neoadjuvant chemotherapy (NAC) and a recent meta-analysis (Wu, Breast Cancer Res Treat, 2012) showed that it adds sensitivity to the high specificity provided by DCE-MRI. Pickles et al showed in 2006 that diffusion changes precede size reduction in neoadjuvant treatment of breast cancer (Magnetic Resonance Imaging, 2006). Diffusion Tensor imaging (DTI) is a three-dimensional technique, one must apply diffusion gradients along at least 6 non-coplanar, non coplanar directions in order to provide enough information. The mammary ducts are anisotropic structures which need non-scalar or multiple ADC measurements in order to characterize the orientation-dependent water mobility in this tissues. These multiple ADC measurements are provided by DTI. We show our preliminary results in more than 30 patients treated with NAC in which we performed an early evaluation after the first two cycles of treatment with DTI, proving that the prediction of response to NAC is earlier and more accurate than the response evaluation with DCE-MRI.
Participants

PARTICIPANTS

Dr. Daniela Bernardi

PROGRAM INFORMATION

A 75 minute hands-on workshop: A Clinical Perspective on the use of Contrast Enhanced 2D (CE2D) Mammography. The session includes a brief lecture providing first-hand knowledge and experience in implementing CE2D in an actual clinical environment. Participants will review and score actual case sets, followed by a faculty led review session with correlate ancillary imaging results. (24 Attendees per session) (Hologic I-View™ software available on the Selenia® Dimensions® system)

Registration

http://www.hologic.com/rsna-hologic-workshop-sessions
Are We Ready for Risk Based Screening?: GE Vendor Workshop
Monday, Nov. 28 2:00PM - 2:30PM Room: Booth 5528

Participants

PARTICIPANTS
Jennifer Harvey, MD

PROGRAM INFORMATION
Population based screening, using only gender and age, is known to reduce breast cancer mortality but is expensive. Screening based on risk may be more effective. In this talk, Dr. Harvey will review the pros and cons of screening for breast cancer based on risk.

Registration
http://ge.cvent.com/events/ge-breast-health-advantage-workshop/event-summary-b904d22132614dc2b7633ee3b34f22de.aspx
Participants

PARTICIPANTS

Clemens Kaiser, Mannheim, Germany

PROGRAM INFORMATION

Throughout this interactive hands-on session, participants will develop their interpretive skills through extensive case reviews at workstations equipped with syngo.MR Brevis and under the guidance of an expert tutor. By actively practicing on real cases using different imaging techniques, participants will also learn to avoid pitfalls in interpreting breast MRI.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Imaging and the 'Dark Art' of Machine Learning: GE Vendor Workshop

Monday, Nov. 28 3:00PM - 3:30PM Room: Booth 5528

Participants

PARTICIPANTS

Christopher Austin, MD

PROGRAM INFORMATION

Radiology has quickly emerged as healthcare's top target for proving the value of artificial intelligence applied to imaging data. Is the future of radiology paved with algorithms? Or will machine learning prove to be more of a placebo than a panacea? Join Dr Christopher Austin, MD, GE's Healthcare Director of Imaging Analytics, for a global perspective on the realities and possibilities for machine intelligence in imaging.

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop/event-summary-b904d22132614dc2b7633ee3b34f22de.aspx
**Breast Imaging (MRI Response to Treatment)**

**PURPOSE**

Imaging based pretreatment prediction of response to NAC in locally advanced breast cancer patients can improve patient selection for NAC and determining prognosis. We have investigated the role of baseline multiparametric DCE-MRI for prediction of pCR in different breast cancer receptor subtypes.

**METHOD AND MATERIALS**

We retrospectively studied 75 biopsy proven breast cancer patients who had DCE-MRI with diffusion weighted imaging (DWI) prior to NAC followed by breast surgery. The morphology (tumor size, type, and margin), multi-focality of malignancy, qualitative enhancement (pattern and curve type) and quantitative enhancement kinetics (Ktrans, Kep, and Ve calculated by Tofts model), absolute apparent diffusion coefficient (ADC) and normalized ADC (tumor ADC divided by normal glandular tissue ADC), and receptor subtype (luminal [ER/PR+] and non-luminal [triple negative/HER2+]) were assessed for prediction of pCR versus no pCR. Binary logistic regression was used for univariate and multivariate analysis.

**RESULTS**

Twenty two patients (29%) had pCR. In univariate analysis, smaller tumor size (p=.03), lower normalized ADC (p=.01), circumscribed margin (p=.04), lower Ktrans (p=.05), lower Ve (p=.04), and non-luminal receptor (p=.03) were significantly correlated with pCR. In multivariate analysis, tumor size (p=.02), normalized ADC (p=.03), and receptor subtype (p=.04) remained significantly correlated with pCR; whereas, Ktrans (p=0.07) and Ve (p=.08) became near-significantly correlated with pCR. Following classifying patients based on receptor subtypes, none of the evaluated parameters were significantly correlated with pCR in luminal subtype. In non-luminal subtype, lower normalized ADC (p=.02) and lack of multifocality (p=.02) were significantly correlated with pCR. Absolute tumor ADC, qualitative enhancement parameters, and Kep were not significantly different in pCR versus no pCR in any group.

**CONCLUSION**

On baseline DCE-MRI, tumor morphology (size and margin), DWI with normalized ADC, and quantitative enhancement kinetics (Ktrans and Ve) may be predictive of pCR to NAC in breast cancers. These predictive measures are stronger in triple-negative and HER2-enriched subtypes compared to luminal subtype.

**CLINICAL RELEVANCE/APPLICATION**

Baseline DCE-MRI with DWI and quantitative pharmacokinetics is valuable in pretreatment prediction of breast cancer response to NAC and can improve patient selection for NAC.

**SSE01-02 Simpsons Diversity Index as a Biomarker of Quantification of Vascular Heterogeneity for Prediction of Overall Survival after Neoadjuvant Treatment for Locally Advanced Breast Cancer**

**PURPOSE**

To evaluate Simpsons diversity index as a biomarker for quantification of heterogeneity of vascular permeability as a biomarker of overall survival (OS) after to neoadjuvant treatment for locally advanced breast cancer.
METHOD AND MATERIALS

Two MRI examination were performed, one baseline and control examination after two of three cycles of anthracyclines regimen for 48 patients. Quantitive DCE-MRI was performed and Ktrans was categorized as Kt 2sd, 3sd and 4sd corresponding to 2, 3 and 4 sd more than Ktrans value of the mammary gland. Then, Simsons’ index was calculated according to the following formula: 1-((kt2sd* (kt2sd-1)+kt3sd* (kt3sd-1)+kt4sd* (kt4sd-1))/((kt2sd*kt3sd)+(kt2sd*kt4sd)+(kt3sd*kt4sd)))) The continuing variable of Simsons index was then converted to 4 quadriles (group 1 representing the lowest and group 4 the highest vascular heterogeneity. OS was calculated using the Kaplan Mayer statistical analysis and comparison of survival curves was performed by Logrank test.

RESULTS

At MRI1 Simpsons index group1 and group2 showed better OS than group3. The comparison of group1 versus group3 showed a p = 0.09 and for group2 versus group3 p = 0.15. At MRI2 Simpsons index group1 and group2 showed better OS than group3. The comparison of group1 versus group3 showed a p = 0.06 and for group2 versus group3 p = 0.23. However group4 had similar OS at MRI as group1.

CONCLUSION

Vascular permeability heterogeneity can be quantified with a known Simpsons index. This quantification showed good correlation with 5 years OS for groups 1, 2 and 3.

CLINICAL RELEVANCE/APPLICATION

Heterogeneous tumors tend to show resistance during neoadjuvant treatment. By quantifying heterogeneity of vascular permeability we could possibly predict heterogeneous molecular background and select patients for alternative treatments.

SSE01-03 Lesion to Background Signal Enhancement Ratio on Breast MRI is Useful in Distinguishing Presence of Residual Tumor versus No Residual Tumor after Neoadjuvant Chemotherapy

Monday, Nov. 28 3:20PM - 3:30PM Room: Arie Crown Theater

Participants
Sooyeon Kim, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Nary A Park, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Su Hyun Lee, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sung Ui Shin, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Bo Ra Kwon, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
So Min Lee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jung Min Chang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE

To investigate whether the lesion to background signal enhancement ratio (SER) on dynamic contrast enhanced (DCE)-MRI is useful in distinguishing residual tumor versus no residual tumor as well as minimal invasive tumor versus residual DCIS on histopathology after neoadjuvant chemotherapy (NAC).

METHOD AND MATERIALS

Between 2009 and 2015, 861 consecutive women who had undergone NAC, DCE-MRI, and subsequent surgery were identified. Among them, a total of 221 women (mean age 47.9, range 26-82 years) with no residual tumor (n= 75), residual DCIS (n= 51) or minimal invasive tumor ≤ 5mm (n=95) on histopathology were included. To compare the mean SER (signal intensity of the lesion / signal intensity of normal parenchyma) and lesion size on MRI according to the presence of residual tumor, independent sample t-test and multivariate logistic regression analysis were performed. Area under the receiver operating characteristic curve (Az) was used to evaluate performance of SER.

RESULTS

Mean SER of residual tumor (minimal invasive tumor plus DCIS) was higher than that of no residual tumor (1.72±0.40 vs. 1.49±0.32, P<0.001). Mean SER of residual DCIS was not different that of minimal invasive tumor (1.78±0.36 vs. 1.69±0.41, P=0.181). Mean MRI lesion size of residual tumor was larger than that of no residual tumor (2.42±1.97cm vs. 1.37±1.57cm, P<0.001). In multivariate analysis, higher SER (OR, 6.206, 95% CI, 2.512-15.331, P<0.001) and larger lesion size on MRI (OR, 1.576; 95% CI, 1.249-1.988, P<0.001) were independently associated with the presence of residual tumor. Az value of SER in distinguishing residual tumor versus no residual tumor was 0.662 (95% CI: 0.595-0.724) with an optimal cut-off point of 1.7 yielding maximal sum of sensitivity and specificity.

CONCLUSION

Lesion to background SER on MRI was useful in distinguishing presence of residual tumor from no residual tumor after NAC, however, it was not useful in distinguishing minimal invasive tumor from residual DCIS.

CLINICAL RELEVANCE/APPLICATION

When an enhancing lesion shows its SER < 1.7 on DCE-MRI after NAC, the lesion has high possibility of pathologic complete response, which might be helpful in deciding surgical extent.

SSE01-04 Computerized Texture Analysis of Locally Advanced Breast Cancers on Pre Treatment MRI May Identify Triple-Negative Tumors and Help Predicting Response to Neo-Adjuvant Chemotherapy

Monday, Nov. 28 3:30PM - 3:40PM Room: Arie Crown Theater

Participants
Faucauld Chaming's, MD, PhD, Montreal, QC (Presenter) Speaker, Supersonic Imagine
Yoshiko Ueno, MD, PhD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
PURPOSE
To evaluate whether texture analysis of breast cancers on pre-treatment Magnetic Resonance Imaging (MRI) may identify tumor sub-types and predict Pathologic Complete Response (pCR) to Neo Adjuvant Chemotherapy (NAC).

METHOD AND MATERIALS
Institutional review board was obtained. 85 patients with 86 Locally Advanced Breast Cancers (LABC) who underwent breast MRI before NAC were included in this retrospective study. 2D texture analysis was performed using TexRAD® software on T2-weighted (T2W) and one minute post-contrast non-subtracted T1-weighted (T1W) MRI with filtering technique. Quantitative parameters were compared between Triple Negative Breast Cancers (TNBC) and non-TNBC and between complete and non-complete responders using Mann Whitney U test. Multivariate logistic regression (LR) analysis with stepwise selection was used to determine independent parameters and to build a prediction model for identification of TNBC. Prediction performance of this model was assessed using Receiving Operator Curves (ROC) analysis.

RESULTS
sixteen (19 %) tumors were Triple Negative Breast Cancers (TNBC). pCR was achieved in thirty tumors (35%). On univariate analysis, mean (P=0.006), Mean Proportion of Positive pixel (mpp) (P=0.038), skewness (P=0.018) and kurtosis (P=0.005) on T2W and kurtosis on post-contrast T1W (P=0.0037) showed significant difference between the TNBC and non-TNBC groups. Kurtosis on T2W (P=0.008) showed a significant difference between the pCR and non-pCR groups. On multivariate analysis, kurtosis on T2W (P=0.033; Odd Ratio (OR): 1.44, 95% Confidence Interval (CI): [1.02-2.34]) and post contrast T1W (P=0.009; OR: 3.31 [1.32-9.92]) were independent parameters for identification of TNBC. A multivariate model incorporating T2W and post-contrast T1W kurtosis showed good performance (area under the curve: 0.815; sensitivity: 75%; specificity: 72%; Accuracy: 72%) for the identification of TNBC.

CONCLUSION
Among quantitative parameters derived from texture analysis of LABC on pre-treatment MRI, kurtosis appears to be significantly associated with pathologic response to NAC and to be a promising biomarker for the identification of TNBC.

CLINICAL RELEVANCE/APPLICATION
Computerized texture analysis of breast cancers on pre-treatment MRI might be used to better characterize tumors and improve selection of patient before neo adjuvant chemotherapy.

HONORED EDUCATORS
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Caroline Reinhold, MD, MSc - 2013 Honored Educator
Caroline Reinhold, MD, MSc - 2014 Honored Educator

SSE01-05 Triple Negative Breast Cancer: MRI Characteristics and Clinico-pathologic Factors Associated with Response to Neoadjuvant Chemotherapy

Monday, Nov. 28 3:40PM - 3:50PM Room: Arie Crown Theater

Participants
Hye J. Eom, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Joo Hee Cha, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Eun Young Chae, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Woo Jung Choi, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hee Jung Shin, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hak Hee Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
The purpose of the study was to investigate the findings of MRI and clinico-pathologic factors associated with response to neoadjuvant chemotherapy in patients with triple negative breast cancer (TNBC).

METHOD AND MATERIALS
Our institutional review board approved this retrospective study. Between Jan 2009 and Dec 2009, 74 TNBC patients who had baseline MRI, completed neoadjuvant chemotherapy, and underwent surgery in our constitutie. Clinico-pathologic factors of the tumor including tumor type, nuclear grade, histologic grade, Ki-67 index, axillary LN involvement, and stage were evaluated. Pathological CR (pCR) was defined as the absence of invasive cancer. Near pCR was defined as presence of only a very small residual invasive cancer of less than 0.3 cm in diameter or of a small number of scattered tumor cells. Morphologic characteristics of the tumor, kinetics and pattern of tumor volume reduction on follow-up MRI were evaluated. Tumor characteristics such as size, presentation of the tumor being mass or non-mass, shape, margin and internal enhancement characteristics of the tumor, and kinetic curve assessment were defined and assessed according to BI-RADS lexicon. Additional MRI features such as presence of intratumoral necrosis, T2 signal intensity, multiplicity, background parenchymal enhancement, and amount of fibroglandular tissue were evaluated. All Clinical-pathologic and MRI findings were compared between the patients with pCR including near pCR and non-pCR.

RESULTS
Among 74 patients, 19 patients (26%) showed pCR. Nuclear grade (p=0.017), histologic grade (p=0.008), and presence of axilla lymph node involvement (p=0.023) showed statistical significance difference between pCR and non-pCR group. Shape of the tumor
parity at baseline MRI (p=0.039) and pattern of reduction at follow-up MRI (p=0.024) showed significant difference. At multivariate analysis, shape of the tumor was independently associated with recurrence. Patients in the group were likely to have irregular shape compared with those in non-pCR group (OR 3.61).

CONCLUSION
In this study, an association between pathologic response to neoadjuvant chemotherapy and MRI characteristics and clinico-pathologic factors were found in patients with triple negative breast cancer.

CLINICAL RELEVANCE/APPLICATION
MRI characteristics, changes on follow-up MRI and clinico-pathologic factors may be helpful in assessing response to neoadjuvant chemotherapy in patients with triple negative breast cancer.

PURPOSE
To assess the utility of the mono-exponential (ME), bi-exponential (BE) and stretched-exponential (SE) models in evaluating response of breast tumours to neoadjuvant chemotherapy (NACT) at 3 T.

METHOD AND MATERIALS
Thirty-six female patients (median age; 53 years) with invasive breast cancer undergoing NACT were prospectively enrolled for diffusion-weighted MRI (DW-MRI) in this IRB-approved study prior to the start of treatment. For assessment of early treatment response, changes in parameters were evaluated on the mid-treatment MRI in 22 patients. DW-MRI was performed using 8 b-values (0, 30, 60, 90, 120, 300, 600, 900 s/mm2). Apparent diffusion coefficient (ADC), tissue diffusion coefficient (Dt), vascular fraction (f), distributed diffusion coefficient (DDC) and alpha (α) parameters were derived. Regions of interest were drawn on the largest tumour diameter and data was analysed on a voxel-wise basis. T-tests compared the baseline and change in parameters between response groups. Receiver operator characteristics (ROC) curves for response prediction were generated. Repeatability was assessed at inter- and intra-observer levels.

RESULTS
All patients underwent the baseline MRI whereas 22 lesions were available at mid-treatment. Sixteen patients demonstrated complete response while 20 were non-responders. At pre-treatment, the mean diffusion coefficients showed significant differences between groups (p<0.05). On ROC analysis, DDC showed a larger area under the curve (0.756) compared to ADC and Dt. The DDC cut-off to differentiate response groups (1.141×10-3 mm2/s) yielded the highest measures of sensitivity (81%) and specificity (72%). At mid-treatment, increase in ADC and DDC showed significant differences between response groups (p=0.03, p=0.04). However the change in Dt was not significant (p=0.14). The decrease in f in responders was substantially different from the increase in non-responders (p=0.05). Responders also showed larger increase in α, although non-significant (p=0.68). Overall, the SE parameters showed excellent repeatability.

CONCLUSION
DW-MRI is sensitive to baseline and early treatment changes in breast cancer using non-mono-exponential models and the SE model can potentially monitor such changes.

CLINICAL RELEVANCE/APPLICATION
Multi-exponential models offer imaging biomarkers, which can potentially provide insights to the cellular compartments and membranes and may become more sensitive to treatment-induced tissue changes.
Breast Imaging (Quantitative Imaging and CAD)

Monday, Nov. 28 3:00PM - 4:00PM Room: E450A

Concurrent CAD for Digital Breast Tomosynthesis

Monday, Nov. 28 3:00PM - 3:10PM Room: E450A

Participants
Sungheon G. Kim, PhD, New York, NY (Moderator) Nothing to Disclose
Robert M. Nishikawa, PhD, Pittsburgh, PA (Moderator) Royalties, Hologic, Inc; Research Consultant, iCAD, Inc

Sub-Events

SSE02-01 Concurrent CAD for Digital Breast Tomosynthesis

Participants
Richard A. Benedikt, MD, San Antonio, TX (Presenter) Nothing to Disclose
Cynthia A. Swann, MD, San Antonio, TX (Abstract Co-Author) Nothing to Disclose
Aaron D. Kirpatrick, MD, San Antonio, TX (Abstract Co-Author) Nothing to Disclose
Alicia Toledano, DSc, Kensington, MD (Abstract Co-Author) Consultant, iCAD, Inc
Senthil Periaswamy, PhD, Nashua, NH (Abstract Co-Author) Director of Research, iCAD, Inc
Justin E. Boatsman, MD, San Antonio, TX (Abstract Co-Author) Nothing to Disclose
Jonathan Go, Nashua, NH (Abstract Co-Author) Sr. Vice President, iCAD, Inc
Jeffrey W. Hoffmeister, MD, Nashua, NH (Abstract Co-Author) Employee, iCAD, Inc; Stockholder, iCAD, Inc

Purpose
Digital Breast Tomosynthesis (DBT) is more accurate than Full-Field Digital Mammography (FFDM) alone, but prolongs reading time. A reader study evaluated the concurrent use of a Computer-Aided Detection (CAD) system to shorten reading time, while maintaining performance.

Method and Materials
A CAD system was developed to detect suspicious soft tissue lesions (masses, architectural distortions and asymmetries) in DBT planes. Rather than marking lesions, detected locations are extracted from the DBT planes and blended into the corresponding 2D synthetic image. Thus, lesions can be efficiently viewed in a CAD-enhanced 2D synthetic image without overlapping tissue. Twenty (20) radiologists retrospectively reviewed 240 cases in a multi-reader, multi-case (MRMC) crossover design. An enriched DBT sample included 67 malignancies in 60 patients and compared reading with CAD versus without CAD. All readers reviewed all cases with and without CAD in 2 visits separated by a memory washout period of at least 4 weeks. Radiologist performance was assessed by measuring Area Under the Receiver Operating Characteristic (ROC) Curve (AUC) for malignant lesions with CAD versus without CAD. Reading time, sensitivity, specificity and recall rate were also assessed.

Results
Reading time improved 29.2% with use of CAD (95% CI: 21.1%, 36.5%; p < 0.01). Reader performance was non-inferior with CAD, for non-inferiority margin delta = 0.05. Average AUC increased by 0.007 (95% CI: 0.013, 0.028; non-inferiority p < 0.01), from 0.839 without CAD to 0.847 without CAD to 0.870 with CAD (95% CI: -0.006, 0.053); showing a 0.032 increase in average sensitivity for soft tissue densities (95% CI: 0.002, 0.066), from 0.837 without CAD to 0.869 with CAD. Average specificity decreased from 0.525 without CAD to 0.507 with CAD (-0.018; 95% CI: -0.041, 0.005), and average recall rate for non-cancers increased from 0.476 without CAD to 0.494 with CAD (0.018; 95% CI: -0.005, 0.041).

Conclusion
Concurrent use of CAD results in a 29.2% faster reading time with non-inferiority of radiologist performance compared to reading without CAD.

Clinical Relevance/Application
Concurrent use of CAD maintains high performance of DBT with a significant reduction in reading time.

SSE02-02 Dynamic Textural Analysis of Pre-treatment DCE-MRI Predicts Pathological Complete Response to Neoadjuvant Chemotherapy in Breast Cancer

Monday, Nov. 28 3:10PM - 3:20PM Room: E450A

Participants
Nathaniel Braman, Cleveland, OH (Presenter) Nothing to Disclose
Maryam Etesami, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Prateek Prasanna, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Christina Dubcuk, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Anant Madabhushi, PhD, Piscataway, NJ (Abstract Co-Author) Nothing to Disclose

Awards
Student Travel Stipend Award
PURPOSE

Fewer than 30% of breast cancer patients who undergo neo-adjuvant chemotherapy (NAC) prior to surgery achieve pathological complete response (pCR). A pre-treatment dynamic contrast-enhanced MR imaging (DCE-MRI) biomarker predictive of pCR would enable more precise prognosis assessment and NAC targeting. We explore radiomic analysis of computer-extracted dynamic texture features at two DCE-MRI enhancement phases as a means of predicting breast cancer NAC response from baseline imaging.

METHOD AND MATERIALS

75 1.5T DCE-MRI scans prior to NAC were retrospectively analyzed. 22 patients had histology-confirmed pCR, while 53 had partial or non-response (NR). Computer-extracted texture features (Haralick, Co-occurrence of Local Anisotropic Gradient Orientations (CoLlAGE), and Laws) were separately extracted from initial and peak enhancement phases. The 5 most distinguishing features were selected by interaction capping and used to randomize a forest classifier in a 3-fold cross-validation setting. Ability to predict pCR was assessed by area under the receiver operating characteristic curve (AUC) among all patients and within 100% (ER/PR+, 9 pCR, 41 NR) and non-luminal (triple-negative and HER2+, 13 pCR, 12 NR) patient subgroups.

RESULTS

Initial post-contrast phase texture features were effective in predicting pCR within luminal lesions (AUC = .863 ± .051), as well as identifying responders without separation by subtype (.821 ± .044). Prediction of pCR from initial phase was less reliable within the non-luminal group (AUC = .743 ± .087), yet peak contrast features better identified non-luminal responders than within luminal or all subtype groups (.831 ± .060 vs. .732 ± .054 and .679 ± .043). Top distinguishing features for the luminal group were homogeneity-based: standard deviation of CoLlAGE energy and sum variance, Haralick inverse difference moment. Non-luminal studies were partially identified by similar homogeneity features like CoLlAGE energy, but also by Laws energy features that detect “spottiness” and edges.

CONCLUSION

Dynamic textural analysis of DCE-MRI phases was shown to successfully predict pCR to NAC in luminal and non-luminal breast cancers.

CLINICAL RELEVANCE/APPLICATION

The ability to identify patients who will achieve pCR to NAC from baseline DCE-MRI texture features may provide a pre-treatment indicator of pathological complete response to neo-adjuvant chemotherapy, avoiding both under and over treatment of breast cancer subtypes.
Reducing the number of unnecessary breast biopsies without loss in diagnostic sensitivity is an important step towards improved breast cancer diagnosis and cost reduction.

**SSE02-04**  
Quantitative Characteristics of Background Parenchymal Enhancement in Longitudinal Breast DCE-MRIs of Healthy Women

**PURPOSE**

Breast DCE-MRI background parenchymal enhancement (BPE) has been reported to be associated with breast cancer risk. It became clinically important to understand key characteristics of BPE in developing it as a potential risk biomarker. In this study we investigated quantitative statistics and temporal variations of BPE in a longitudinal breast DCE-MRI dataset acquired from healthy women.

**METHOD AND MATERIALS**

We retrospectively identified 251 longitudinal breast DCE-MRI scans (earliest on Sep 2004 and latest on Dec 2015) from 93 women (31% have BRCA1/2 mutations) who underwent high-risk breast MRI screening at our institution (2-6 sequential scans per woman). For all the 251 scans, the average age-at-scan was 48.8±7.2 YO (range 26-67), the average between-scan time was 419±165 days (range 171-1605), and 134 (53%) were pre-menopausal with the rest post-menopausal. All 93 women remain breast cancer-free at the time of analysis. Fully automated computerized methods were applied to quantify BPE from the first post-contrast sequence at both bilateral and unilateral level. A quantitative BPE measure (BPE%) was derived as the percentage of the volume of enhanced voxels (at least 20% relative enhancement) over the fibroglandular tissue relative to the volume of fibroglandular tissue. A set of descriptive statistics were computed for BPE%, and variability of BPE% between sequential scans was measured by the intraclass correlation coefficient (ICC) in a linear mixed effects model.

**RESULTS**

For all 251 scans, mean BPE% was 25.1% ±13.7 (range 1.1% - 83.9%); the Pearson’s correlation coefficient of BPE% between left (mean 27.4%±14.7) and right breasts (mean 24.2%±14.1) was 0.85; mean BPE% was 29.7%±15.0 (range 9.2% - 83.9%) for pre-menopausal and 20.9%±10.9 (range 1.1% - 67.0%) for post-menopausal scans (unpaired t-test p<0.0001). For 71 (or 48) women who had at least 2 (or 3) sequential scans, ICC of BPE% was 0.63 (or 0.46), and temporal variations of BPE% between longitudinal scans are shown in the figure.

**CONCLUSION**

In longitudinal DCE-MRI scans of breast cancer-free women, BPE% is highly correlated bilaterally, significantly higher among pre-than post-menopausal women, and the mean value decreases with aging.

**CLINICAL RELEVANCE/APPLICATION**

Quantitative characterization of BPE in longitudinal MRIs of healthy women will help determine BPE’s temporal variability and reproducibility, building baseline measures for its use as a risk biomarker.

**SSE02-05**  
Applying Data-driven Imaging Biomarker in Mammography for Breast Cancer Screening

**PURPOSE**

To assess feasibility of data-driven imaging biomarker (DIB; an imaging biomarker that is derived from large-scale medical image data by using deep learning technology) in mammography and evaluate its potential for detection of breast cancer.

**METHOD AND MATERIALS**

We collected 9,757 digital mammograms from five institutions. 3,228 cancer cases were confirmed by pathology. 6,529 normal cases were defined by BI-RADS final assessment category 1 without developing malignancy for 2 years. Each case includes 4 views of mammograms. 800 cases were randomly chosen as validation (n=400) and test (n=400) sets, and the remainder (2428 for cancer, 5,729 for normal) were used for training. The core algorithm of DIB-M (DIB for mammography) is deep convolutional neural network; a deep learning algorithm specialized for images. It learns discriminative features directly from training data according to the final task (cancer detection). For each case in training data, the probability of cancer inferred from DIB-M is compared with the...
ground-truth diagnosis result (cancer: 1, normal: 0). Then the model parameters for DIB-M are updated based on the error between
the prediction and the ground-truth. Training proceeds to minimize the prediction error of the entire training set, and the final DIB-
M performed the best on the validation set is used for evaluation. We performed the experiment with 3 different random-split
datasets to verify performance consistency.

RESULTS
AUC was 0.813 and 0.814 for the validation and test sets, respectively. Accuracy at threshold 0.5 was 72.9% (validation) and
73.4% (test). Sensitivity (specificity) according to different thresholds for the test set is: 0.940 (0.383), 0.810 (0.635), 0.690
(0.778), 0.505 (0.903), and 0.313 (0.983) with respect to the thresholds 0.1, 0.3, 0.5, 0.7, and 0.9. ROC curves according to 3
random sets were similar (Fig.1).

CONCLUSION
This research showed the potential of DIB-M as a screening tool for breast cancer. Further studies using a large number of high-
quality data including benign cases are needed to further investigate its feasibility as a screening tool.

CLINICAL RELEVANCE/APPLICATION
Unlike previous computer-aided detection (CAD) algorithms, DIB-M is purely based on data-driven features from a large-scale
mammography data instead of manually designed features. With further validation, DIB-M may help radiologists to diagnose breast
cancer with higher accuracy and efficiency.

PURPOSE
To retrospectively investigate whether the kinetic features of breast cancers assessed with computer-aided detection (CAD) at
preoperative magnetic resonance (MR) imaging are associated with disease-free survival in patients with invasive breast cancer.

METHOD AND MATERIALS
This is an institutional review board-approved retrospective study, with a waiver of informed consent. Between January 2012 and
February 2013, 330 consecutive women (mean age, 52.9 years; age range, 32-88 years) with newly diagnosed invasive breast
cancer who had undergone preoperative MR imaging and curative surgery were identified. We retrospectively reviewed all
preoperative MR images using a commercially available CAD system and noted the following kinetic parameters for each lesion: peak
enhancement (the highest pixel signal intensity in the first post-contrast series), angio-volume (the total volume of the enhancing
lesion), and delay enhancement profiles (the proportions of washout, plateau, and persistent-enhancing component within a
tumor). Cox's proportional hazards modeling was used to identify associations between CAD-generated kinetic features and
disease-free survival, after controlling for clinicopathological variables.

RESULTS
A total of 31 recurrences developed at a median follow-up time of 42 months (range, 3-50 months). The mean peak enhancement
was significantly higher in patients with recurrences than in those who remained disease-free (553.65 ± 686.59 vs. 249.89 ±
263.25, P=0.020). Multivariate Cox's analysis showed that a higher peak enhancement (hazard ratio [HR]=1.001, 95% confidence
interval [CI]=1.000-1.002, P=0.009) and presence of lymphovascular invasion (HR=2.433, 95% CI=1.086-5.449, P=0.031) were
independently, and significantly, associated with poorer disease-free survival.

CONCLUSION
A higher CAD-measured peak enhancement at preoperative breast MR imaging was independently associated with poorer disease-
free survival of patients with invasive breast cancer.

CLINICAL RELEVANCE/APPLICATION
Kinetic features assessed by applying computer-aided detection (CAD) to preoperative breast MR images can be used to identify a
subgroup of breast cancer patients at high risk of recurrence.
CONCLUSION

Transitioning from II to FPD systems was not associated with radiation dose savings, but FPD with newer dedicated image processing software has allowed for substantial dose reduction.

Background

Imaging technology for fluoroscopically guided interventional (FGI) procedures has advanced from image intensifiers (II) to flat panel detectors (FPD) and recently, to FPD systems with dedicated image processing software for radiation dose reduction. The purpose of this work was to evaluate the effect of imaging technology on radiation dose from FGI procedures.

Evaluation

After IRB approval, data from FGI procedures performed in interventional radiology suites was obtained from RIS (years: 2011-2015). Fluoroscopy time, cumulative air kerma (CAK; only for FPD systems) and kerma-area product (KAP) were obtained for all procedures performed either using II, FPD or FPD systems with dose reduction software (ClarityIQ, Philips Healthcare; FPD-CIQ). Data from RIS was cross-verified, and analyzed in aggregate and split by procedure codes (procedures with n > 30 cases with each type of system).

Discussion

Data from 27251 cases was obtained. Error checking and deleting duplicate instances resulted in 22414 cases from 92 unique procedures. Overall, ANOVA revealed a significant effect of imaging technology on fluoroscopy time, CAK and KAP (p<0.01). The median fluoroscopy time and KAP were 1.3 minutes and 11.0 Gy*cm² (n=6300), 1.9 minutes and 15.0 Gy*cm² (n=10418), and 2.4 minutes and 6.9 Gy*cm² (n=5696) for II, FPD and FPD-CIQ systems, respectively. The median CAK values for FPD and FPD-CIQ systems were 43.4 mGy and 23.5 mGy, respectively. Trend data showed complex cases increasingly being performed on FPD and FPD-CIQ systems (e.g., 194, 1075 and 699 embolization cases on II, FPD and FPD-CIQ systems, respectively). There were 27 unique procedures with more than 30 cases performed on each type of system; a significant effect of imaging technology on dose values for each of these procedures was noted (p<0.01). In this subset, the ratios of median KAP ranged from 0.4 to 1.7 (FPD/II) and from 0.2 to 0.6 (FPD-CIQ/II). For 26 of these procedures, the median CAK with FPD-CIQ systems was less than FPD systems.
SSE23-04
Frequent screening of women with higher risk of breast cancer. Radiation dose reduction in DPC imaging would further extend the scope of its potential clinical utilities such as earlier and more frequent screening of women with higher risk of breast cancer.

CLINICAL RELEVANCE/APPLICATION
A novel energy-resolved grating interferometer system was developed to successfully reduce radiation dose by 50% for DCP imaging.

RESULTS
Compared with images of the ACR phantom acquired at 100% reference dose level and standard DPC image processing method, images acquired with 50% radiation dose and the proposed ran-one approximation method demonstrated equivalent image quality. The measured noise standard deviation for the 50% dose images with the proposed method \((1.98\pm0.13)\times10^{-2}\) was no greater than that of the 100% dose images \((2.12\pm0.04)\times10^{-2}, p < 0.01\). Neither spatial resolution loss nor noise texture distortion was observed.

CONCLUSION
A novel energy-resolved grating interferometer system was developed to successfully reduce radiation dose by 50% for DCP imaging.
Diagnostic accuracy of the radiologic images should be evaluated by taking into account various factors due to human observers as well as the characteristics of the display used in the interpretation. The aim of this study was to propose a simplified method for performing an FROC observer study to optimize patient dose in digital mammography based on the diagnostic accuracies for low-contrast signal detection in a CDMAM phantom.

METHOD AND MATERIALS

The digital images of a CDMAM phantom were obtained by a full-field digital mammography system (Amulet, Fuji Film, Japan) with three levels of patient dose (60, 80, and 100% of the average glandular dose, 30 kV, W/Rh) to compare the diagnostic accuracies for low-contrast signal detection. Case sample images without and with various number of signals (0-3 signals/case) were cropped along the threshold lines predicted by using a CDMAM Analyser (14 regions/image × 3 images × 3 conditions). Case sample images were observed on a high resolution medical LCD by six board-certified breast radiographers using a publically available computer interface (ROC Viewer 2015 ver. 1.0). The figure of merit (FOM) values was calculated and significant differences were statistically tested among the three different imaging conditions with the JAFROC software. Our results obtained with the proposed FROC method were validated by comparison with those obtained from CDMAM Analyser.

RESULTS

Average FOM values and sensitivities of the 6 breast radiographers’ performance improved with increasing dose level, whereas no statistically significant difference was found among the three conditions. In addition, there was a high correlation between the average FOM and inverse image quality figure (inv. IQF) in each dose level (r = 0.98). Furthermore, the average reading time for 120 case samples was 22 min, which could be considered very short.

CONCLUSION

The effect of dose reduction on the low-contrast signal detection was assessed by a simplified FROC observer study using ROIs of CDMAM phantom images as case sample images. FROC observer studies were conducted in shorter time, with smaller errors and reduced complexity, and the results were well-supported by those obtained by a CDMAM Analyser.

CLINICAL RELEVANCE/APPLICATION

This FROC method can demonstrate changes in diagnostic accuracies of various dose levels and can be utilized for the optimization of patient dose, which is a primary concern in digital mammography.

SSE23-05 Phantom Estimated Dose Comparison between Contrast Enhanced Spectral Mammography (CESM) and Established X-ray Breast Screening Modalities

Monday, Nov. 28 3:40PM - 3:50PM Room: S404AB
that the reported measures should not be used to compare x-ray systems of different vendor.

**CLINICAL RELEVANCE/APPLICATION**

This study provides phantom validation for AGD appropriateness of GE-CESM for breast cancer screening.

**SSE23-06  Automatic Exposure Control using Constant CNR in Digital Radiography**

**Monday, Nov. 28 3:50PM - 4:00PM Room: S404AB**

Participants
Alexander W. Scott II, PhD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Yifang Zhou, PhD, Los Angeles, CA (Presenter) Nothing to Disclose
Jessica L. Nute, PhD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Christina M. Lee, BS, ARRT, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To modify the calibration of automatic exposure control in digital radiography from constant exposure index (EI) to constant contrast-to-noise ratio (CNR) and to determine the resulting dose reduction for small or pediatric patients.

**METHOD AND MATERIALS**

A Philips Optima x-ray unit and Carestream DRX-1C digital detector were used along with phantoms composed of 2-8" of Lucite over an ACR accreditation plate. The plate has targets of decreasing contrast to assess image quality; the third-lowest contrast target (7) was required to be visualized for ACR radiographic accreditation. The kVp for each Lucite stack was selected based on the detector calibration instructions. Images were acquired for each kVp/Lucite combination using a range of mAs values. The CNR of target #7 was measured using ImageJ by placing an ROI over the target and then drawing an annulus of similar area around the target as background. CNR vs. mAs was fitted using Curve Expert Professional for each kVp/stack combination. For the purpose of making constant CNR exposures, a baseline CNR was determined using the lowest-dose image allowing visualization of target #7 for the 85kVp/5" Lucite combination. The results were then used to back-calculate a mAs and resultant EI for other kVp/sizes to provide an optimal technique.

**RESULTS**

Baseline CNR was determined to be 0.86 but conservatively set to 1.0 to account for variability in visibility vs. CNR. The back-calculated mAs values corresponding to the baseline CNR at different kVps had uncertainties of 20% - 40%. Compared to the initial phototimer setup for an EI of 1400, the entrance skin exposure (ESE) for the small phantom (2” – 3”) would decrease by 60%, the ESE for the medium phantom would be consistent, and the ESE for the large phantom (8”) would increase by a factor of 5 – 10.

**CONCLUSION**

Maintaining constant CNR instead of constant EI when varying patient size would improve image quality for large patients while minimizing dose for small patients (especially important for pediatrics). However, given that the ESE for the 8” and 125 kVp combination would increase from 44 mR to 462 mR, we are currently recommending constant EI for large patients and constant CNR for small patients to save dose.

**CLINICAL RELEVANCE/APPLICATION**

Recalibration of AEC settings to achieve constant CNR across some patient sizes could be used to reduce unnecessarily high dose in small patients while increasing image quality for large patients.
Participants

Dr. Wade Hedegard

Program Information

An advanced 75 minute hands-on workshop: Optimizing tomosynthesis using a multifaceted approach to improve mammographic outcomes. Subsequent to a brief lecture, participants will review and score challenging cases. A Faculty led review with practical solutions and correlate ancillary imaging results will follow. (24 Attendees per session) (Hologic Selenia® Dimensions® system with C-View™ software)

Registration

http://www.hologic.com/rsna-hologic-workshop-sessions
Breast Tomosynthesis Reading Session: Siemens Healthineers Vendor Workshop
Monday, Nov. 28 3:50PM - 5:00PM Room: Booth 5534

Participants

PARTICIPANTS

Mahesh Shetty, Houston, Texas, USA

PROGRAM INFORMATION

During this hands-on workshop you will learn to evaluate 2D mammography and 3D Breast Tomosynthesis. An expert tutor will lead you through cases that will both fascinate and confound you! All cases have been acquired with Siemens Mammomat Inspiration and are displayed on syngo.Breast Care workplaces so you will also become familiar with the image quality and ease of use of our systems.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
DBT vs Mammography in a Randomized Screening Trial: GE Vendor Workshop
Monday, Nov. 28 4:00PM - 4:30PM Room: Booth 5528

Participants

PARTICIPANTS
Pierpaolo Pattacini, MD

PROGRAM INFORMATION

Initial results and interim analysis of diagnostic performance, interval cancers, and other performance indicators including more than 19,000 women from the breast cancer screening program of Reggio Emilia's province in Italy.

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop/event-summary-b904d22132614dc2b7633ee3b34f22de.aspx
Participants

LEARNING OBJECTIVES

1) Describe opportunities for improved adherence with regular breast cancer screening through systems and partnerships with referring physicians. 2) Describe the importance of assessment of mammography interpretative skills and regular feedback on performance to improve the overall accuracy of mammography. 3) State the shortcomings in current assessment of breast cancer risk and how breast cancer screening facilities can insure accurate risk assessment for all patients.

Sub-Events

SPSI26A Introduction

Participants
Robert A. Smith, PhD, Atlanta, GA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSI26B Improving Adherence to Breast Cancer Screening Using a Systems-based Approach in a Primary Care Network

Participants
Steven J. Atlas, MD, MPH, Boston, MA, (satlas@mgh.harvard.edu) (Presenter) Editor with royalties, UpToDate, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

Active Handout: Steven J. Atlas


SPSI26C State of the Art (and Feasible!) Risk Assessment in a Breast Imaging Center

Participants
Mary Freivogel, Greenwood Village, CO, (mary.freivogel@riaco.com) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSI26D Assessing and Improving the Interpretation of Mammography Images

Participants
Matthew G. Wallis, MD, Cambridge, United Kingdom (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Evaluation of screening has to encompass both population level outcomes as well as individual practitioner performance. To alter (improve) performance feedback needs to be tailored, educationally focused and benchmarked against peers. Radiologists want to do the best for their patients and have a competitive nature so the key to delivering change is to allow individuals to understand their performance. This requires dedicated data collection with the emphasis on data completeness and interpretive skills to translate numbers into intelligent information. The ability to determine sensitivity is key to looking at population performance but this requires accurate and timely data linkage to Cancer Registries with comprehensive coverage which is far from straightforward. In lieu of this a great deal of information can be obtained from 3 figures: number screened, number recalled and number of cancers found but for any form of statistical stability this requires a minimum number of women to be screened every year (probably at least 3,000). When comparing individuals or services within a national programmes or individual countries simple cancer detection can be very misleading without taking into account the characteristics of the programme and the background population and I will argue for the development of age standardised, expected invasive cancer detection rates. I will illustrate my talk with examples from the UK programme and show how regular audit and feedback has been used to improve performance.

SPSI26E Panel Discussion

Participants
Robert A. Smith, PhD, Atlanta, GA (Presenter) Nothing to Disclose
Mary Freivogel, Greenwood Village, CO (Presenter) Nothing to Disclose
Matthew G. Wallis, MD, Cambridge, United Kingdom (Presenter) Nothing to Disclose
Steven J. Atlas, MD, MPH, Boston, MA (Presenter) Editor with royalties, UpToDate, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.
Breast Tuesday Case of the Day

Tuesday, Nov. 29 7:00AM - 11:59PM Room: Case of Day, Learning Center

Participants
Phoebe E. Freer, MD, Salt Lake City, UT (Presenter) Nothing to Disclose
Matthew Stein, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Nicole S. Winkler, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Matthew B. Morgan, MD, Sandy, UT (Abstract Co-Author) Consultant, Reed Elsevier
Anna K. McGow, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Laurie L. Fajardo, MD, MBA, Park City, UT (Abstract Co-Author) Consultant, Hologic, Inc; Scientific Advisory Board, Hologic, Inc; Consultant, Koninklijke Philips NV; Advisory Board, Koninklijke Philips NV; Consultant, Siemens AG; Consultant, FUJIFILM Holdings Corporation; Advisory Board, Galena Biopharma, Inc
Maryam Rezvani, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Scott Harada, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose

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

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Maryam Rezvani, MD - 2015 Honored Educator
Participants

PROGRAM INFORMATION

Join a global panel of expert breast imagers for an interactive discussion on how personalized breast care is being delivered around the world. Learn new approaches to implementing breast care with impactful outcomes. Also, keynote speakers will present their individualized breast care protocols and how they have optimized workflow, implemented risk stratification, and utilized a multi-modality, multi-disciplinary approach to improve overall clinical performance. This course does not offer CME credit.
Participants
Jean L. Wright, MD, New York, NY (Presenter) Nothing to Disclose
Susan C. Harvey, MD, Lutherville, MD, (sharvey7@jhmi.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand breast and regional lymph node anatomy. 2) Be familiar with how the basic anatomic structures appear on a variety of imaging modalities. 3) Be familiar with breast and regional lymph node contouring techniques used in radiation treatment planning for breast cancer. 4) Apply contouring knowledge to inform radiation treatment planning for breast cancer.

ABSTRACT

Review breast and axillary anatomy.
**Purpose**
To assess the diagnostic performance of unenhanced abbreviated protocols (AP) consisting of fused DWI using T1-weighted imaging (T1WI) with DWI maximum intensity projections (DWI MIPs), compared with conventional protocol (CP) consisting of dynamic contrast-enhanced T1WI with MIPs in the screening setting of patients with personal history of breast cancer.

**Method and Materials**
We conducted a retrospective observational reader study in 351 patients with personal history of breast cancer. Three breast radiologists reviewed the two sets of AP and CP images as follows: First, three readers reviewed the DWI MIP initially to search for the significant lesion and then reviewed the remaining images of AP to characterize the detected lesion on DWI MIPs and establish BIRADS final assessment. Second, MIPs of CP was evaluated, and then the remaining images of CP were assessed. Time to make each decision was measured and recorded.

**Results**
MRI acquisition time was 5 minutes for the AP and 15 minutes for the CP. For AP, average times to read the DWI MIP and complete AP images were 5.51 and 22.14 seconds, respectively. For CP, average times to read MIP and complete CP images were 7.80 and 39.62 seconds, respectively. Ten in-breast recurrences (7 invasive ductal carcinomas and 3 ductal carcinoma in situ) were diagnosed. Among them, one DCIS was missed by all three readers, which were calcifications alone on mammography and not visible on MRI. On DWI MIP, three readers detected 9, 8, and 9 of 10 cancers, respectively and negative predictive values (NPVs) were 99.6%, 99.3%, and 99.6%, respectively. Complete AP showed sensitivities of 80%, 90%, and 80% and specificities of 94.9%, 93.2%, and 95.2%, respectively. On CP MIP, three readers detected 9, 8, and 9 of 10, respectively, and NPVs were 99.6%, 99.3%, and 98.6%, respectively. Complete CP showed sensitivities of 90.9 %, 90.0 %, and 80.0 % and specificities of 93.8%, 93.8%, and 96.3%, respectively.

**Conclusion**
An unenhanced AP showed short acquisition time of 5 minutes, and DWI MIP showed high NPVs more than 99% across three readers. Diagnostic performance of complete AP was equivalent to that of CP in the screening of patients with personal history of breast cancer.

**Clinical Relevance/Application**
Diagnostic performance of an unenhanced AP was equivalent to that of CP with short acquisition time and no usage of contrast material in the screening of patients with personal history of breast cancer.
METHOD AND MATERIALS
In this two-center study prospectively populated data-bases were searched for patients with a BI-RADS 0,4/5 finding, who underwent MP MRI of the breast with DCE-MRI and DWI and subsequent histopathologic verification. 100 patients were randomly selected and MP MRI data was retrospectively evaluated by two experienced readers in consensus. All DCE images and DWI with ADC maps were randomly assessed in an independent review, i.e readers assessed DWI without being provided DCE-MRI and vice-versa. Examinations were classified as either normal or abnormal (suspicious finding, further assessment necessary). A BI-RADS rating (1-5) was assigned. Lesion size and ADC values were recorded. MP MRI with DWI and DCE-MRI was assessed using a reading method that adapted ADC-thresholds to the BI-RADS classification. Histopathology was used as the reference standard. Appropriate statistical tests were used to assess sensitivity, specificity, and diagnostic accuracy.

RESULTS
There were 42 malignant and 58 benign tumors. DCE-MRI was the most sensitive test for breast cancer detection with a sensitivity of 100%. DWI as a stand-alone parameter was significantly less sensitive with 80% (p=0.001) but more specific with 78.6% compared to DCE-MRI with 66.7%. Diagnostic accuracy was 80% for DWI and 86% for DCE-MRI respectively. Except for a mucinous carcinoma and a ILC, missed cancers with DWI (11/42) were consistently lesions <12mm. When both parameters where used complementary as MP MRI, sensitivity was 96.7% which was not significantly different from DCE-MRI (p=0.45) and specificity almost as good as DWI with 76.2% (p=1) resulting in the best diagnostic accuracy of 88%.

CONCLUSION
DWI cannot be used as a stand-alone parameter for breast cancer detection with sensitivities decreasing in smaller lesions. MP MRI with DWI and DCE-MRI achieves the best diagnostic accuracy for breast cancer detection.

CLINICAL RELEVANCE/APPLICATION
Radiologist should be aware that DWI should not be used as a stand-alone parameter for breast cancer detection but used complementary to DCE-MRI.
randomized for each reader. Suspicious findings were scored using the BI-RADS scoring system and a likelihood scale from 0-100. Multi-case-multi-reader ROC analysis was used to evaluate reader performance. McNemar tests were used to compare the mean sensitivity and specificity.

RESULTS
The mean AUC for the FDP was 0.87 and 0.89 for UDCE only reading (p=0.21). Readers worked on a slightly different operating point of the ROC curve; the mean sensitivity of UDCE vs FDP was slightly lower (80 vs 85%; p=0.1), while the specificity was significantly higher (81 vs 77%; p=0.001), respectively.

CONCLUSION
UDCE only is as accurate as a standard FDP for screening women at increased risk of developing breast cancer.

CLINICAL RELEVANCE/APPLICATION
Ultrafast high spatiotemporal resolution MRI such as a UDCE can be performed within 102 seconds, substantially decreasing the time needed to perform accurate breast MRI and thus the costs.

PURPOSE
Background parenchymal enhancement (BPE) at breast magnetic resonance imaging (MRI) has been shown to be associated with breast cancer risk. The factors responsible for BPE were not sufficiently studied. Our study aimed to evaluate a correlation between BPE and plasma sex hormone levels and ability to predict BPE based on a combination of sex hormone levels.

METHOD AND MATERIALS
Eligible MRI studies included high-risk screening and diagnostic studies. Exclusion criteria were prior breast carcinoma or radiation therapy and current anti-oestrogen medication (e.g. tamoxifen). MRI studies were performed on Siemens units at 1.5 T or 3 T with standard protocol (T1 and T2-weighted imaging without and with fat saturation, diffusion-weighted imaging and ADC maps) with Gadavist enhancement (0.1 mmol/kg at 2.0 mL/s with 20 mL saline flush, scanning at 35 s, 1, 2 and 6 min). MRI studies were post-processed on an automated viewing platform to calculate BPE (MultiView software, HOLOGIC). Serum drawn at time of MRI measured estradiol, progesterone, follicular stimulating hormone (FSH), luteinizing hormone (LH) and prolactin. Patient demographic data collected included MRI indication, menopausal status, menarche, HRT use, date of LMP (day of cycle), prior oophorectomy, height and mass (BMI).

RESULTS
86 women were enrolled, with sex hormone levels measured and automated BPE measurement obtainable. Median age was 49 years (29-70). We observed a negative correlation between each sex hormone and BPE, however, none of these correlations were statistically significant: estradiol (r=0.05, p=0.63); progesterone (r=0.003, p=0.98); FSH (r=-0.05, p=0.63); LH (r=-0.1, p=0.36); prolactin (r=0.02, p=0.85). Based on multiple regression (with stepwise selection), there was no combination of sex hormones that could significantly predict BPE.

CONCLUSION
We observed no association between individual or combination serum sex hormone levels and BPE.

CLINICAL RELEVANCE/APPLICATION
Our results suggest that factors other than blood sex hormones may play a significant role in predicting background parenchymal enhancement (BPE). Our study does not provide direct support for current practice of scheduling breast MRI during the second week of the menstrual cycle.
The purpose of this study was to estimate the T2* relaxation time in breast cancer and to evaluate the relationship of the T2* value of breast cancer with clinical-imaging-pathological features.

METHOD AND MATERIALS

Between January 2011 and July 2013, 107 consecutive women with 107 breast cancers underwent multi-echo T2* weighted imaging on a 3.0 T clinical magnetic resonance image system. The Student’s t-test and one-way analysis of variance (ANOVA) were used to compare the T2* values of cancer for different groups based on clinical-imaging-pathological features (age at diagnosis, menopausal status, symptoms at diagnosis, family history, mammographic density, calcification at mammography, lesion location, size, and signal intensity on T2-weighted image (T2WI) at MRI, pathologic subtype, LN metastasis, histologic grade, ER, PR, HER2, p53, Ki-67, CK 5/6, and molecular subtype). In addition, multiple linear regression analysis was performed to find independent predictive factors associated with T2* values.

RESULTS

The mean T2* value of 92 invasive cancers was significantly longer than that of 15 ductal carcinomas in situ (DCIS) (p=0.029). Signal intensity on T2-weighted MR images (T2WI) and histologic grade of invasive breast cancers showed significant correlation with T2* relaxation time in univariate and multivariate analysis. Breast cancer group with higher signal intensity compared with breast parenchyma on T2WI showed longer T2* relaxation time (p=0.006). Cancer group with higher histologic grade showed longer T2* relaxation time (p=0.014).

CONCLUSION

T2* value was significantly longer in invasive cancer than DCIS. In invasive cancers, T2* relaxation time was significantly longer in cancer with high histologic grade and high signal intensity on T2WI. Based on these preliminary data, quantitative T2* mapping is a potentially useful technique for the characterization of breast cancer.

CLINICAL RELEVANCE/APPLICATION

Quantitative T2* mapping is a potentially useful technique for the characterization of breast cancer in yielding information of the tumor microstructure.

PURPOSE

To evaluate the role of early temporal kinetics in differentiating invasive ductal carcinoma (IDC) and ductal carcinoma in situ (DCIS) by tumor grade, tumor type and prognostic markers.

METHOD AND MATERIALS

In this institutional review board-approved study, 152 women with 178 pathology-proven lesions underwent breast DCE-MRI on a 3.0T magnet with a 7 channel breast coil. The protocol consisted of pre-contrast, first post-contrast and subtraction images. Lesion size, shape, morphology, initial enhancement ratio (IER; % signal increase over baseline at the first post-contrast acquisition), pathology, axillary metastases, Oncotype DX score, background parenchymal enhancement (BPE) and peritumoral BPE were evaluated. Statistical analysis included Fisher’s exact tests, Mann-Whitney U tests and Spearman rank correlation.

RESULTS

Cancers were 76% (135/178) IDC and 24% (43/178) DCIS. For IDC, 57% (77/135) were estrogen receptor/progesterone receptor-positive (ER/PR+), 21% (28/135) were triple negative breast cancer (TNBC) and 22% (31/135) were human epidermal growth factor receptor 2-positive (HER2+). IER was higher for IDC than DCIS (p<0.001) and for high-grade DCIS and IDC compared to low-grade DCIS (p<0.001). IER increased as tumor grade increased (r=0.38, p<0.001), as ki-67 increased (r=0.28, p=0.002), as BPE increased (r=0.31,p<0.001), and as size increased (r=0.37, p=0.001). Mean IER was higher for IDC with positive nodes (211% [82-452%]) than for no nodes (156% [44-359%], p=0.00) and for HER2+ (mean=213% [100-359%]) and TNBC (mean=227% [110-452%]) than for ER/PR+ tumors (mean=164% [54-298%], p=0.026). There was no correlation between Oncotype DX score and IER. There was no correlation between BPE/peritumoral BPE and size, tumor grade, ki-67, or positive axillary nodes.

CONCLUSION

High IER at the first post-contrast imaging can differentiate high-grade malignancy, HER2+/TNBC cancers, axillary invasion, and high ki-67 tumors, all predictors of tumor recurrence after therapy. There is a growing clinical interest in an abbreviated breast MRI protocol for breast cancer screening; IER is an important temporal kinetic marker that can be easily assessed with such a protocol.

CLINICAL RELEVANCE/APPLICATION

Initial enhancement ratio (IER) correlates with likelihood of a biologically significant breast cancer and is easily incorporated into screening abbreviated breast MRI (AB-MRI).
 PURPOSE

To evaluate the diagnostic value of Electronic Property Tomography (EPT) in differentiating malignant from benign breast lesions.

METHOD AND MATERIALS

EPT is a method that maps the conductivity and permittivity using phase-based conductivity images reconstructed from clinical MR sequences. The causes of elevated conductivity in tumors are the presence of necrosis and cell membrane breakdown, increased cell membrane charge, increased sodium concentration, and changes in water content. We obtained phase images reconstructed from the 3D TSE sequence (TR/TE=2000/210 ms, voxel size=0.7x0.7x0.8mm³) using a 3T system (Philips Achieva TX) with a 16 channel breast coil. A tissue conductivity map was then made from phase images using the EPT technique. 69 patients with 32 benign and 51 malignant breast lesions were enrolled in this study. All malignant lesions and 24 benign lesions were confirmed pathologically, and 8 benign lesions were confirmed by clinical follow-up for more than 2 years. The lesions were segmented semi-automatically on pre/post-contrast subtraction images, and the segmented volume of the lesions was registered to the phase images. Subsequently, reconstruction of the conductivity map was performed. The conductivity reconstruction was made only inside the lesions. The mean conductivity of benign and malignant breast lesions was compared. Statistical analysis was performed using paired Wilcoxon and Mann–Whitney U tests.

RESULTS

The mean conductivity of malignant lesions was -0.0964±1.80403 S/m, and that of benign lesions was 1.3017±1.21225 S/m. There was a statistically significant difference between two groups (p = 0.0001). The corresponding ROC yielded an AUC of 75% (Sensitivity, specificity, PPV and NPV were 71, 79, 84 and 63% using the cut-off point of 0.88512 S/m).

CONCLUSION

Our study revealed that there was a statistically significant difference in mean conductivity between benign and malignant breast lesions. The result suggests that EPT could be useful in differentiating benign and malignant breast lesions.

CLINICAL RELEVANCE/APPLICATION

The novel technique of EPT has the potential to differentiate benign and malignant breast lesions.
skewness: 0.601); for dual-parametric Ktrans-ADC 2D histogram approach, all the parameters had diagnostic value (Xm: 0.852, Ym: 0.743, kurtosis: 0.809, skewness: 0.803).

**CONCLUSION**

The major limitation of DCE MR imaging in breast disease is that benign lesions like fibroadenoma can also cause a local perfusion increase. The implementation of dual-parametric MR imaging in combination with DCE MR imaging and DWI optimizes the diagnostic accuracy in our study of breast tumors at 3T. Further investigation on the clinical usage of dual-parameter analysis in a larger population base is a necessity, and it also might be useful in classifying pathological subtypes of breast cancer and monitoring the changes of neoadjuvant chemotherapy.

**CLINICAL RELEVANCE/APPLICATION**

To improve the diagnostic value of MRI in breast lesions.

**RC315-11 Difference in Enhancement Pattern between Malignant and Benign Non-Mass Enhancement Lesions at Very Early Post-Contrast Phase on Ultra-Fast Breast MRI**

**Participants**

Hiroyuki Abe, MD, Chicago, IL (Presenter) Nothing to Disclose

Andrea L. Magee, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

Naoko Mori, MD, PhD, Sendai, Japan (Abstract Co-Author) Nothing to Disclose

Keiko Tsuchiya, Otsu, Japan (Abstract Co-Author) Nothing to Disclose

Deepa Sheth, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

David V. Schacht, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

Gregory S. Karczmar, PhD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

Federico Pineda, PhD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

Kirti M. Kulkarni, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To evaluate the kinetic data of benign and malignant breast non-mass enhancement lesions in the ultra-early phase after contrast injection, using a whole breast ultrafast (UF) MR scanning technique.

**METHOD AND MATERIALS**

29 non-mass enhancing breast lesions (biopsy-proven 12 benign and 17 malignant lesions) were obtained with an acquisition protocol of UF-MRI, consisting of pre and 8 post-contrast bilateral, fat-suppressed T1 weighted images of the whole breasts, with temporal resolution of 7 second on a Philips Achieva 3T-TX. Regular scans (temporal resolution of 75 second) were followed immediately after UF-MRI. The size of malignant lesions ranged from 15 to 112 mm (mean 46 mm) and that of benign lesions ranged from 9 to 34 mm (mean 22 mm). All benign lesions were proven by MR-guided biopsy, and all malignant lesions were surgically excised and confirmed with surgical pathology. The kinetic curve of the highest enhancing voxel in each lesion during the UF phase (0 – 56 sec) was assessed with a commercially available CAD system (Dynacad). To compensate for differences in time-of-arrival of contrast media, time points in the ultrafast scans were relative to the initial contrast enhancement in the descending aorta: we referred to the time point when the aorta began to enhance as ‘C1’, and referred to subsequent time points as ‘C2,’ ‘C3,’ etc.

Enhancement rate (ER: % increase in signal after contrast injection) and area under the kinetic curve (kinetic-AUC) of UF-MRI and Signal enhancement rate (SER) of the regular scans were compared between malignant and benign lesions. Wilcoxon test and ROC test were performed for statistical analysis.

**RESULTS**

ER and kinetic-AUC both showed significant differences between malignant and benign non-mass lesions (p<0.0001 at C2 – C5), but SER of the regular scans did not show a significant difference. With ROC analysis, area under curve for ER was over 0.94 at C2 – C5, and that for kinetic-AUC was over 0.94 at C3 – C6.

**CONCLUSION**

The kinetic curve obtained during the very early post-contrast phase was quite useful in differentiating malignant and benign non-mass enhancement breast lesions. Kinetic data from a voxel of the highest enhancement in a lesion is critical to performing this task.

**CLINICAL RELEVANCE/APPLICATION**

The kinetic curve of a voxel of the highest enhancement in a lesion obtained from Ultrafast MRI is useful in differentiating malignant and benign non-mass enhancement breast lesions.

**RC315-12 Quantitative Breast MRI**

**Participants**

Despina Kontos, PhD, Philadelphia, PA, (Despina.Kontos@uphs.upenn.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review fundamental principles of quantitative breast MRI. 2) Identify key factors that affect quality and standardization of quantitative breast MRI measures. 3) Describe emerging clinical applications of quantitative breast MRI in diagnostic interpretation, prognostication, and evaluation of response to treatment.

**ABSTRACT**

**RC315-13 Breast Cancer Heterogeneity Assessed by Texture Analysis in Magnetic Resonance Imaging: Its Relationship with Survival Outcomes**

Tuesday, Nov. 29 10:30AM - 10:40AM Room: Arie Crown Theater

Participants

Hiroyuki Abe, MD, Chicago, IL (Presenter) Nothing to Disclose

Andrea L. Magee, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

Naoko Mori, MD, PhD, Sendai, Japan (Abstract Co-Author) Nothing to Disclose

Keiko Tsuchiya, Otsu, Japan (Abstract Co-Author) Nothing to Disclose

Deepa Sheth, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

David V. Schacht, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

Gregory S. Karczmar, PhD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

Federico Pineda, PhD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

Kirti M. Kulkarni, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate the kinetic data of benign and malignant breast non-mass enhancement lesions in the ultra-early phase after contrast injection, using a whole breast ultrafast (UF) MR scanning technique.

METHOD AND MATERIALS

29 non-mass enhancing breast lesions (biopsy-proven 12 benign and 17 malignant lesions) were obtained with an acquisition protocol of UF-MRI, consisting of pre and 8 post-contrast bilateral, fat-suppressed T1 weighted images of the whole breasts, with temporal resolution of 7 second on a Philips Achieva 3T-TX. Regular scans (temporal resolution of 75 second) were followed immediately after UF-MRI. The size of malignant lesions ranged from 15 to 112 mm (mean 46 mm) and that of benign lesions ranged from 9 to 34 mm (mean 22 mm). All benign lesions were proven by MR-guided biopsy, and all malignant lesions were surgically excised and confirmed with surgical pathology. The kinetic curve of the highest enhancing voxel in each lesion during the UF phase (0 – 56 sec) was assessed with a commercially available CAD system (Dynacad). To compensate for differences in time-of-arrival of contrast media, time points in the ultrafast scans were relative to the initial contrast enhancement in the descending aorta: we referred to the time point when the aorta began to enhance as ‘C1’, and referred to subsequent time points as ‘C2,’ ‘C3,’ etc.

Enhancement rate (ER: % increase in signal after contrast injection) and area under the kinetic curve (kinetic-AUC) of UF-MRI and Signal enhancement rate (SER) of the regular scans were compared between malignant and benign lesions. Wilcoxon test and ROC test were performed for statistical analysis.

RESULTS

ER and kinetic-AUC both showed significant differences between malignant and benign non-mass lesions (p<0.0001 at C2 – C5), but SER of the regular scans did not show a significant difference. With ROC analysis, area under curve for ER was over 0.94 at C2 – C5, and that for kinetic-AUC was over 0.94 at C3 – C6.

CONCLUSION

The kinetic curve obtained during the very early post-contrast phase was quite useful in differentiating malignant and benign non-mass enhancement breast lesions. Kinetic data from a voxel of the highest enhancement in a lesion is critical to performing this task.

CLINICAL RELEVANCE/APPLICATION

The kinetic curve of a voxel of the highest enhancement in a lesion obtained from Ultrafast MRI is useful in differentiating malignant and benign non-mass enhancement breast lesions.

**RC315-12 Quantitative Breast MRI**

Participants

Despina Kontos, PhD, Philadelphia, PA, (Despina.Kontos@uphs.upenn.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Review fundamental principles of quantitative breast MRI. 2) Identify key factors that affect quality and standardization of quantitative breast MRI measures. 3) Describe emerging clinical applications of quantitative breast MRI in diagnostic interpretation, prognostication, and evaluation of response to treatment.
Participants

Eun Sook Ko, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Boo-Kyung Han, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Eun Young Ko, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jungmin Bae, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Ji Soo Choi, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE

To determine the relationship between tumor heterogeneity assessed by magnetic resonance imaging (MRI) texture analysis and survival outcomes in patients with primary breast cancer.

METHOD AND MATERIALS

This study was approved by the institutional review board, and the need for informed consent was waived. Between January 2010 and August 2010, texture analysis of the entire primary tumor was performed using T2-weighted and contrast-enhanced T1-weighted subtraction MR images obtained from 203 patients for preoperative staging. Histogram-based uniformity and entropy were calculated. To dichotomize texture parameters for survival analysis, the 10-fold cross-validation method was used to determine cutoff points in the receiver operating characteristic curve analysis. The Cox proportional hazards model and Kaplan-Meier analysis were used to determine the association of MRI texture parameters and morphologic or volumetric information obtained from MRI or clinicopathological variables with recurrence-free survival (RFS).

RESULTS

There were 26 events, including 22 recurrences (10 locoregional and 12 distant) and 4 deaths, after a mean follow-up time of 56.2 months. In multivariable analysis, higher N stage (RFS hazard ratio, 11.15 [N3 stage]; \( P = 0.003 \)), triple-negative subtype (RFS hazard ratio = 16.91; \( P < 0.001 \)), high risk of T1 entropy (less than the cutoff value, RFS hazard ratio = 4.55; \( P = 0.018 \)), and T2 entropy (equal to or higher than the cutoff value, RFS hazard ratio = 9.84; \( P = 0.001 \)) were associated with worse outcomes.

CONCLUSION

Patients with more heterogeneous breast cancers on T2-weighted images (higher entropy) and less heterogeneous tumors on contrast-enhanced T1-weighted subtraction images (lower entropy) exhibited poorer RFS.

CLINICAL RELEVANCE/APPLICATION

No study determined whether tumor texture is related to survival outcomes based on preoperative breast MRI. Our study suggests that magnetic resonance imaging texture analysis for measurements of tumor heterogeneity can be used as an additional risk stratification method for patients with primary breast cancer.

RC315-14 Predicting Level of Tumor Infiltrating Lymphocyte in Patients with Triple Negative Breast Cancer:
Usefulness of Breast MRI Computer-aided Detection & Diagnosis

Participants

Seon Jeong Oh, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Hak Hee Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
You Jin Ku, Incheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Joo Hee Cha, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hee Jung Shin, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hee Jin Lee, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Gyungyub Gong, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE

Triple negative breast cancer (TNBC) is a heterogeneous malignancy with varying prognosis. Recently, the importance of tumor-infiltrating lymphocytes (TILs) has been determined. That is, increased TILs positively correlated with the pathological complete response and patient survival. The purpose of this study is to evaluate the usefulness of MRI computer-aided detection & diagnosis (CAD) in TNBC patients for prediction of tumor infiltrating lymphocyte.

METHOD AND MATERIALS

We retrospectively enrolled 60 lesions in 59 patients with TNBC (mean age, 48.7 years; range, 25-81 years) who underwent dynamic contrast-enhanced MRI. The CAD for all lesions were obtained, and the analyzed quantitative kinetic features included degree of initial peak enhancement; enhancement profiles including lesion percentages of washout, plateau and persistent enhancement; worst kinetic curve and predominant kinetic curve. According to level of TIL, we divided the tumors into two groups (<50% TILs as the low TIL group and ≥50% TILs as the high TIL group). Kinetic parameters in low TIL group versus high TIL group were compared using student t-test and chi-square test. We developed empirical model to predict high TIL group and low TIL group using logistic regression analysis and receiver operating characteristics (ROC) analysis.

RESULTS

There were 48 low TIL and 12 high TIL lesions. Among enhancement profiles of MRI CAD, persistent portion of tumors were negatively correlated with the TIL level of tumor (mean proportion of persistent on high TIL group was 43%, \( p = 0.003 \)). The persistent-washout value of low TIL group was significantly higher than that of high TIL group (\( p = 0.008 \)). The odds ratios were 0.944 (95% confidence interval (CI), 0.896-0.982; \( p=0.012 \)) for persistent and 0.971 (95% CI, 0.948-0.991; \( p=0.008 \)) for persistent-washout value. The area under the receiver operating characteristic curve (AUC) was >0.7 with the optimal cutoff values of 26 for persistent and -19 for persistent-washout.

CONCLUSION

The prediction model using quantitative kinetic parameters, particularly plateau proportion and plateau-washout value, could be helpful for identifying TIL level of patient with triple negative breast cancer and may be used as an imaging biomarker to guide the
treatment plan.

**Clinical Relevance/Application**

Kinetic parameters acquired by MRI CAD can be a useful tool for assessing TIL level of patients with triple negative breast cancer.

**RC315-15 Quantitative Radiogenomics: Association between Breast MRI Functional Tumor Volume and Oncotype DX Recurrence Score**

Tuesday, Nov. 29 11:30AM - 11:40AM Room: Arie Crown Theater

Participants
Lina Nayak, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Kimberly M. Ray, MD, San Francisco, CA (Presenter) Nothing to Disclose
Genevieve A. Woodard, MD, PhD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Bonnie N. Joe, MD, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Nola M. Hylton, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Elissa R. Price, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Jessica Gibbs, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Iryna Lobach, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
David Newitt, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Rick Baehner, MD, San Francisco, CA (Abstract Co-Author) Stockholder, Agenda BV

**Purpose**

To investigate the association between MRI functional tumor volume (FTV), a non-invasive quantitative measure of contrast kinetics, and breast cancer recurrence risk as determined by a validated gene expression assay.

**Method and Materials**

This is an IRB-approved, HIPAA-compliant retrospective review of 82 patients with ER+ HER2- invasive breast cancer treated at our institution between 2005 and 2013 who underwent breast MRI and an Oncotype DX (Odx) assay (Genomic Health, Inc.) at the time of diagnosis. MRI signal enhancement ratio (SER), a relative measure of contrast uptake and washout, was calculated on a per-voxel basis. Functional tumor volume (FTV) was defined as the volume of enhancing voxels above an initial enhancement level of 70%. Fraction of Washout and Plateau (FWP) was defined as the volume of enhancing voxels with “washout” or “plateau” kinetics (SER > 0.9) divided by FTV. Fraction of Washout (FW) was defined as the volume of voxels with “washout” kinetics only (SER > 1.3) divided by FTV. Concordance between Odx score and MRI parameters was examined using Spearman correlation ($\rho$, $\chi^2$ tests, and linear regression models.

**Results**

FTV measurements [mean(cm$^3$) +/-SD] for patients with high, intermediate and low risk Odx scores were 3.7 ± 3.84, 2.7 ± 3.9 and 1.95 ± 2.39, respectively. Odx scores were significantly associated with FTV ($\beta=1.4$, $p=0.006$, $R^2=0.31$) in a model adjusted for age, tumor size (measured on MRI), tumor grade, and lymph node status. In a subset of tumors measuring 14-25mm (25-75th percentile of observed tumor size), FWP and Odx scores were concordant ($p=0.34$, $p=0.025$) . FW alone was not significantly correlated with Odx score.

**Conclusion**

Higher FTV is significantly associated with higher Odx score, independent of patient age, tumor size, tumor grade or lymph node status. Larger FWP is significantly correlated with higher Odx score for tumors 14-25 mm in size, which represent the majority of tumors in our dataset.

**Clinical Relevance/Application**

Quantitative MRI FTV measurements may serve as imaging biomarkers of breast cancer recurrence risk.

**RC315-16 Evaluating Breast Cancer by Using Mono-exponential, Bi-exponential, Stretched-exponential Diffusion-weighted MR Imaging and Diffusion Kurtosis MR Imaging**

Tuesday, Nov. 29 11:40AM - 11:50AM Room: Arie Crown Theater

Participants
Kun Sun, Shanghai, China (Presenter) Nothing to Disclose
Xu Yan, Shanghai, China (Abstract Co-Author) Employee, Siemens AG
Caixia Fu, Shenzhen, China (Abstract Co-Author) Employee, Siemens AG
Fuhua Yan, MS, Shanghai, China (Abstract Co-Author) Nothing to Disclose

**Purpose**

To quantitatively compare the potential of various diffusion parameters obtained from mono-exponential, bi-exponential, and stretched-exponential diffusion weighted imaging and diffusion kurtosis imaging in evaluating breast cancer.

**Method and Materials**

Institutional review board approval and written informed consent were obtained. Both diffusion-weighted-imaging and diffusion-kurtosis-imaging were performed in 94 patients with pathologically proven breast lesions by using a 1.5 T MRI unit. Apparent diffusion coefficient (ADC) was by using a mono-exponential model. Diffusion coefficient (D), pseudo-diffusion coefficient (D*), and perfusion fraction (f) were calculated by using a bi-exponential model. A water molecular diffusion heterogeneity index ($\alpha$) and distributed diffusion coefficient (DCC) were calculated by using a stretched-exponential model. Mean diffusivity (MD) and mean kurtosis (MK) was calculated from diffusion kurtosis images. All values were compared between benign and malignant breast lesions and different proliferative breast cancer. Student t test, Wilcoxon signed-rank test, ROC curves, and Spearman correlation were used for statistical analysis.

**Results**

ADC, D, DCC, and MD were significantly lower in malignant lesions than in benign lesions (respectively; $P < .0001$). $\alpha$, D* and MK were
CONCLUSION

DKI model may provide additional information and improve the characterizing of breast lesions compared with conventional diffusion parameters. The kurtosis and water molecular diffusion heterogeneity index derived from DKI and stretched Exponential DWI may be helpful for the preoperative differentiation of proliferative activity of breast cancer.

CLINICAL RELEVANCE/APPLICATION

Non-Gaussian water diffusion with use of DKI and SE, as compared with conventional mono- and bi-exponential DWI, could lead to a substantial improvement in the diagnosis of breast disease. The K and α value derived from the DKI and SE model may be helpful for the preoperative differentiation of proliferative activity of breast cancer.

RC315-17 Magnetic Resonance Spectroscopy of Breast Cancer for Assessing Early Treatment Response: Results from the ACRIN 6657 MRS Trial

Tuesday, Nov. 29 11:50AM - 12:00PM Room: Arie Crown Theater

Participants

Patrick J. Bolan, PhD, Minneapolis, MN (Presenter) Research Consultant, Breast-Med, Inc
Eunhee Kim, Chapel Hill, NC (Abstract Co-Author) Nothing to Disclose
Benjamin A. Herman, MS, Providence, RI (Abstract Co-Author) Nothing to Disclose
Gillian M. Newsstead, MD, Chicago, IL (Abstract Co-Author) Medical Advisory Board, Bayer AG Consultant, Three Palm Software LLC Consultant, VuCOMP Inc Medical Advisor, Quantitative Insights, Inc
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Michael G. Garwood, PhD, Minneapolis, MN (Abstract Co-Author) Stockholder, Steady State Imaging, LLC
Michael Nelson, MD, Minneapolis, MN (Abstract Co-Author) I hold license and patents on a breast marker named VizMark
Douglas Yee, MD, Minneapolis, MN (Abstract Co-Author) Nothing to Disclose
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David Newitt, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Savannah C. Partridge, PhD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Nola M. Hylton, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose

PURPOSE

To estimate the accuracy of predicting response to neoadjuvant chemotherapy (NACT) in patients with locally advanced breast cancer using magnetic resonance spectroscopy (MRS) measurements made very early in treatment.

METHOD AND MATERIALS

The HIPAA-compliant protocol and the informed consent process were approved by the American College of Radiology and local-site institutional review boards. 119 women with invasive breast cancer of 3 cm or greater undergoing NACT with a paclitaxel-based regimen in followed by an anthracycline-cyclophosphamide regimen were enrolled between September 2007 and April 2010. Each site received MRS-specific training and was required to submit MRS measurements with acceptable accuracy and spectral quality from a trial-specific spectroscopy phantom prior to enrolling patients. MRS measurements of the concentration of choline-containing compounds ([tCho]) were performed prior to the first chemotherapy regimen (time point 1, TP1) and 20-96 hours after the first cycle of treatment (TP2). The change in [tCho] was assessed for its ability to predict pathologic complete response (pCR) and radiologic response using the area under the receiver operating characteristic curve (AUC) and logistic regression models.

RESULTS

Of the 119 subjects enrolled, only 29 cases (24%) with 8 pCRs provided usable data for the primary analysis. Technical challenges in acquiring quantitative MRS data in a multi-site trial setting limited the capture of usable data. In this limited data set, the decrease in tCho from TP1 to TP2 had poor ability to predict either pCR (AUC = 0.53, 95% CI: [0.27, 0.79]) or radiologic response (AUC = 0.51, 95% CI: [0.27, 0.75]). An exploratory analysis found that water T2 (measured by MRS) was more easily measured (data yield 59%, 60/102) and was associated with pathologic complete response (p < 0.01).

CONCLUSION

The technical difficulty of acquiring quantitative MRS data in a multi-site clinical trial setting led to a low yield of analyzable data, which was insufficient to accurately measure the ability of early MRS measurements to predict response to NACT. These findings suggest that further technical developments are needed to produce more robust methods for breast MRS.

CLINICAL RELEVANCE/APPLICATION

The low data yield of this study suggests that current methods used for acquiring quantitative magnetic resonance spectroscopy data in the breast are not sufficiently robust for use in clinical practice.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying
educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Mitchell D. Schnall, MD, PhD - 2013 Honored Educator
Breast Tomosynthesis Reading Session: Siemens Healthineers Vendor Workshop

Tuesday, Nov. 29 10:15AM - 11:25AM Room: Booth 5534

Participants

PARTICIPANTS

Mahesh Shetty, Houston, Texas, USA

PROGRAM INFORMATION

During this hands-on workshop you will learn to evaluate 2D mammography and 3D Breast Tomosynthesis. An expert tutor will lead you through cases that will both fascinate and confound you! All cases have been acquired with Siemens Mammomat Inspiration and are displayed on syngo.Breast Care workplaces so you will also become familiar with the image quality and ease of use of our systems.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Automated Breast Volume Scanner (ABVS) Self-guided Reading Sessions: Siemens Healthineers Vendor Workshop

Tuesday, Nov. 29 10:30AM - 5:00PM Room: Booth 5534

Participants

PROGRAM INFORMATION

With syngo.Ultrasound Breast Analysis (sUSBA) Software, self guided reading sessions with real clinical cases will enable you to become familiar with the coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Participants

PARTICIPANTS
Dr. Debbie Lee Bennett

PROGRAM INFORMATION
A 60 minute hands-on workshop: Faculty will present initial case experience, including insights and challenges, from recent implementation of a new 3D™ image guided breast biopsy program with the Affirm™ Prone Biopsy System. The lecture portion will be followed by a hands-on demonstration of the Hologic 3D™ breast biopsy procedure using the Affirm™ Prone Biopsy System. (12 Attendees per session) (Affirm™ Prone Biopsy System)

Registration
http://www.hologic.com/rsna-hologic-workshop-sessions
Breast Tomosynthesis Self-guided Reading Sessions: Siemens Healthineers Vendor Workshop

Tuesday, Nov. 29 10:30AM - 5:00PM Room: Booth 5534

Participants

PROGRAM INFORMATION

You are invited to our self-guided reading sessions. With syngo Breast Care workstations configured especially to allow you to work at your own place at a time that suits you! A series of breast tomosynthesis cases presented as problem cases with a solution enables you to develop and test your tomosynthesis reading skills.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Invited Speaker: Proton Therapy for Breast Cancer

Tuesday, Nov. 29 10:30AM - 10:50AM Room: S103AB

An Abbreviated Interval Between Radiotherapy and Follow-up Mammography in Breast Conservation Surgery May Lead to Unnecessary Downstream Work-up

Tuesday, Nov. 29 10:50AM - 11:00AM Room: S103AB

Analysis of Radiation Lung Fibrosis after Hypo-fractionated Breast Radiotherapy: 3 Dimensional Volume Measurement

Tuesday, Nov. 29 11:00AM - 11:10AM Room: S103AB

Purpose

Surveillance mammography for breast conservation therapy (BCT) is frequently conducted within 6 months upon completion of adjuvant radiotherapy (XRT). We retrospectively analyzed the effect of post-XRT mammographic timing and radiation technique in relation to additional downstream workup for 569 BCT patients treated with adjuvant XRT following their initial surveillance mammogram (MMG).

Method and Materials

From January 2011 to December 2014, 1959 consecutive breast cancer patients were reviewed, 569 of whom had breast conservation surgery and adjuvant XRT with a follow-up MMG. Patients between the ages 31 and 91 (median 63) with stages 0(Tis) to IIIA of ductal, lobular, mixed, and metaplastic histologies were included. Patients were stratified by the time interval until their first post-XRT MMG, and by XRT technique – whole breast (472), accelerated partial breast (96), conventional fractionation (373), hypofractionation (94), surgical cavity boosts (407) or no boost (66). The primary endpoint was further imaging after the initial MMG. P values were generated from Chi square testing via MedCalc. IRB approval was received for this retrospective study.

Results

Additional workup for those receiving a MMG within 3 months of completing XRT was 51% (73/143), compared to 40% (84/210) with MMG between 3 to 6 months, and 34.5% (75/217) with MMG after 6 months (P = 0.04). Two of ten biopsies were positive for recurrence among those with surveillance MMG within 6 months, compared to 1 of 2 patients with MMG after 6 months. Accelerated partial breast irradiation, hypofractionation, and surgical cavity boosts did not correlate with further downstream imaging.

Conclusion

BCT patients who underwent screening MMG prior to 6 months after completion of XRT were more likely to undergo downstream workup, including additional biopsies. Comparatively aggressive radiation techniques were not associated with the need for supplementary workup. Further study is needed to assess appropriate selection of high risk patients and possible negative implications of earlier post-radiotherapy screening MMG such as healthcare costs and quality of life.

Clinical Relevance/Application

Premature surveillance mammography relative to adjuvant radiation in breast conservation therapy is common and likely results in excessive downstream workup, costs, and patient discomfort.

Analysis of Radiation Lung Fibrosis after Hypo-fractionated Breast Radiotherapy: 3 Dimensional Volume Measurement

Tuesday, Nov. 29 11:00AM - 11:10AM Room: S103AB

Participants
ABSTRACT

Purpose/Objective(s): Hypo-fractionated breast radiotherapy is widely accepted as an alternative treatment option for early stage breast cancer. However, long term clinical outcome of late toxicity is relatively scarce compared to conventional radiotherapy regime. To evaluate whether hypo-fractionated breast radiotherapy can cause more late lung toxicity, instead of using subjective grading system, we have directly measured volume of fibrotic lung tissues in the region of tangential radiation fields. Materials/Methods: Fifty-three early stage breast cancer patients who were treated with hypo-fractionated radiotherapy and the same number of early stage breast cancer patients with conventional radiotherapy were retrospectively analyzed. All patients had multiple follow up chest CT images for more than three years. With deformable registration with radiation treatment planning data, lung fibrosis tissues within radiotherapy fields were segmented and 3 dimensional volumes of lung fibrosis were directly measured. Radiation therapy techniques and protocols were the exactly same, but only dose scheme was different. Results: The volume of lung fibrosis appeared to be slightly larger in the group of hypo-fractionated breast radiotherapy. Mean volume of lung fibrosis in patients with hypo-fractionated radiotherapy arm was 14.1 cc, and the volume in patients with conventional radiotherapy arm was 12.3 cc. We compared histogram of volume distribution of each patient group. Conventional radiotherapy group appeared to show slightly smaller volume of lung fibrosis compared to hypo-fractionated radiotherapy group, however, which was not statistically significant. Conclusion: Even though the lung fibrosis in this study was subclinical, hypofractionated radiotherapy may cause slightly more lung fibrosis, caution is needed when patient irradiation lung volume is significantly exceeded as usual.

ABSTRACT

Purpose/Objective(s): Standard breast conserving therapy consists of lumpectomy followed by whole breast irradiation. Alternative strategies in appropriately selected patients (pts) include endocrine therapy (ET) alone, accelerated partial breast irradiation (ABPI), and hypofractionated radiation therapy (HFRT), which can limit treatment duration, and potentially reduce morbidity and cost. However, limited data are available on the percentage of pts eligible for these alternative treatments; therefore, a Surveillance Epidemiology and End Results (SEER) analysis was performed to assess candidacy for these alternative options in women with early stage breast cancer according to current consensus guidelines and trial eligibility criteria. Materials/Methods: Women treated for breast cancer between the years of 2010-2012 were identified in the SEER database. Pts with metastatic disease, T3/T4 disease, and node positive disease were excluded. Pts were defined as eligible for ET alone according to the CALGB 9343 inclusion criteria (Age =70 years; T1; Estrogen receptor positive [ER+]) and PRIME II inclusion criteria (Age =65 years; T1/T2; ER+ and/or Progesterone receptor positive [PR+]). Pts were defined as eligible for HFRT according to ASTRO consensus guidelines (Age =50 years; T1/T2). Pts eligible for APBI were evaluated based on ASTRO consensus guidelines (Age =60 years; T1; ER+), American Brachytherapy Society (ABS) and the GEC-ESTRO consensus guidelines (Age =50 years; T1/T2), and the GEC-ESTRO APBI trial criteria (Age =40 years; Tis-T2). Additional pathologic features, dosimetric data, and chemotherapy receipt were not available. Results: 110,858 women with early stage breast cancer who met aforementioned inclusion criteria were identified. Of these pts, 23,286 (21.0%) were eligible for ET alone according to CALGB 9343 criteria and 43,278 (39.0%) according to PRIME II criteria. Based on ASTRO consensus guidelines, there were 91,492 (82.5%) pts eligible for HFRT. There were 44,528 (40.2%) pts who were eligible for APBI according to ASTRO criteria, 88,945 (80.2%) pts eligible according to ABS consensus guidelines, and 88,945 (80.2%) pts eligible according to the GEC-ESTRO consensus guidelines. There were 107,235 (96.7%) pts who were eligible for APBI according to the GEC-ESTRO APBI trial criteria. Conclusion: This SEER analysis demonstrates there is a substantial proportion of women with early stage breast cancer who may be eligible for ET alone, HFRT, and/or APBI following breast conserving surgery according to consensus guidelines and prospective trial criteria. Moving forward, with incorporation of additional pathologic, dosimetric, and chemotherapy data, quality assurance pathways may use such data to help ensure pts are receiving appropriate risk stratified treatment recommendations.
Breast (Tomosynthesis Diagnostic)

Tuesday, Nov. 29 10:30AM - 12:00PM Room: E451A

Purpose
Tomosynthesis can improve diagnostic confidence with potential fewer BI-RADS 3 (BR 3) mammographic follow-up recommendations. As this rate declines, the criteria and frequency of imaging lesions previously classified as probably benign may need to be re-defined. The purpose of this study is to determine the frequency, timing, and duration of follow-up imaging for probably benign lesions with tomosynthesis.

Method and Materials
A retrospective, IRB approved review of the breast imaging database was conducted to identify all diagnostic mammograms categorized as BR3 and performed with tomosynthesis over 3 years (1/12-1/15). 1-3 year follow-up data was collected. Biopsy outcomes of all studies re-classified as BR4 or 5 at follow-up were collected to determine malignancy rate, timing of cancers diagnosis (6,12,24 or 36 months) and mammographic features (focal asymmetries, masses, calcifications or architectural distortions).

Results
12611 diagnostic studies were performed with tomosynthesis and 2535 (20%) were categorized as BR3. 12-36 month follow up data was available in 2212 patients (87%). 145 patients were re-classified as BR4 or 5 at follow-up resulting in 25 malignancies (1.0%): 16 invasive cancers & 9 DCIS. 24/25 malignancies were node negative and presented as masses (12), calcifications (11) or distortions (2). No asymmetries resulted in malignancy. A majority of cancers 22 (88%) were diagnosed at the first follow up study: 15 at 6 month interval, 3 at 12 months and 4 at 24 months. Three were diagnosed during the second follow up imaging: 1 invasive, 2 DCIS. The only node positive case was in a 52 year old woman with new onset nipple retraction and a new mass diagnosed as invasive lobular carcinoma at the 6 month interval.

Conclusion
The BR3 malignancy rate remained low at 1.0% with most cancers manifesting as masses or calcifications, suggesting that focal asymmetries may be categorized as benign. Most malignancies were diagnosed at the first follow up study, indicating that continued surveillance for 2-3 years may be unnecessary when the diagnostic work-up is performed with tomosynthesis.

Clinical Relevance/Application
Mammography with tomosynthesis may alter diagnostic workflow patterns and may ultimately also re-define the imaging features and follow up intervals for probably benign lesions.

Detection of Non-Calcified T1-stage Invasive Breast Cancer using Digital Breast Tomosynthesis and Full-field Digital Mammography: Factors Affecting Tumor Visibility and the Effect on Diagnostic Performances

Tuesday, Nov. 29 10:40AM - 10:50AM Room: E451A

Purpose
To identify the significant variables associated with visibility of non-calcified T1-stage invasive breast cancer on digital breast imaging, and to evaluate the impact of these factors on diagnostic performance.
To identify the significant variables associated with visibility of non-calcified T1-stage invasive breast cancers on digital breast tomosynthesis (DBT) interpretation combined with 2D full-field digital mammography (FFDM), and to evaluate the effect of variables on diagnostic performance.

METHOD AND MATERIALS

This retrospective study was approved by our institutional review board, and the requirement to obtain informed consent was waived. Between January 2012 and December 2014, a total of 265 patients (106 non-calcified T1-stage invasive breast cancers and 159 negative controls) who underwent FFDM and DBT were included. The visibility scores (1-3; poorly, fairly, definitely visible) of 106 cancers were assessed on DBT+FFDM and FFDM images in a separate session. Independent variables associated with poorly visible tumors were identified using the logistic regression model. In a total of 265 patients stratified by the independent variable, diagnostic performances of DBT+FFDM and FFDM were compared using the McNemar's test.

RESULTS

For 106 cancers, the mean visibility score was higher in DBT+FFDM compared to FFDM (2.5 vs.1.8; P=0.001). Extremely dense breast was the only independent factor associated with poorly visible tumors (odds ratio, 0.02; P<0.001). In 55 patients with extremely dense breasts, sensitivity (63.6% vs.59.1%; P=.642) and specificity (84.8%vs.75.8%; P=.078) were not improved by addition of DBT compared to FFDM, whereas were significantly improved (94.0%vs.69.0%; P<.001), (98.4%vs.81.7%; P=.002) in 210 patients with the other mammographic densities.

CONCLUSION

Extremely dense breast was associated with poor visibility in interpreting DBT combined with FFDM for non-calcified T1-stage invasive breast cancers, and no additional diagnostic yield was observed compared to FFDM in women with extremely dense breasts.

CLINICAL RELEVANCE/APPLICATION

Our study supports the benefit of adding DBT to FFDM for detection of non-calcified T1 breast cancers in non-extremely dense breast, whereas the role is minimal in extremely dense breasts.

SSG01-03 Tomosynthesis Increases Detection of Invasive Lobular Carcinoma and Less Aggressive Breast Cancer

Tuesday, Nov. 29 10:50AM - 11:00AM Room: E451A

Participants
Serine E. Baydoun, MD, Iowa City, IA (Presenter) Nothing to Disclose
Limin Yang, MD, PhD, Iowa City, IA (Abstract Co-Author) Nothing to Disclose
Jinhui Xiong, Iowa City, IA (Abstract Co-Author) Nothing to Disclose
Laurie L. Fajardo, MD, MBA, Park City, UT (Abstract Co-Author) Consultant, Hologic, Inc; Scientific Advisory Board, Hologic, Inc; Consultant, Koninklijke Philips NV; Advisory Board, Koninklijke Philips NV; Consultant, Siemens AG; Consultant, FUJIFILM Holdings Corporation; Advisory Board, Galena Biopharma, Inc

PURPOSE

To evaluate the added benefit of using Tomosynthesis (3D) in invasive breast cancer detection on screening and diagnostic mammograms with correlation to pathology, receptor status and breast density.

METHOD AND MATERIALS

An IRB approved retrospective review of all mammogram reports from October 2012-May 2015 was performed to identify biopsy-proven invasive breast cancer cases. Cancer detection rate on screening and diagnostic mammograms by digital 2D only versus 2D+3D was compared. Correlation with breast density, pathology and receptor status was performed.

RESULTS

Of 22238 screening mammograms & 7848 diagnostic mammograms, 2D+3D was used in 12543 screening & 4093 diagnostic cases. 177 cases were biopsy proven invasive breast cancer; 59 detected on exams performed with 2D only (24 screening, 35 diagnostic) & 118 detected on exams performed with the adjunct use of 3D (53 screening, 65 diagnostic). 3D significantly improved cancer detection rate in both screening & diagnostic mammograms (4.2 vs 2.5 per 1000; 15.9 vs 9.3 per 1000, p<0.01). Of the 118 cancers diagnosed on 2D+3D exams, the malignancy was either only or better detected by 3D in 62 patients. Characteristics of cancers depicted on 3D included: higher frequency of invasive lobular carcinoma (ILC) (12/118 vs 3/118, p<0.01); higher frequency of less aggressive invasive carcinoma (Grade 1, grade 2, ER/PR positive, Her2 negative, cancers, p<0.01); similar frequency of aggressive carcinoma (Grade 3, positive Her2, triple negative). Tomosynthesis also detected more invasive carcinoma in patients with dense breasts (p<0.01).

CONCLUSION

Tomosynthesis increases breast cancer detection in both the screening and diagnostic population. Depiction of ILC & less aggressive invasive cancer (low and intermediate grade, ER/PR positive, Her2 negative) was higher by tomosynthesis. Compared with 2D mammography, tomosynthesis demonstrates enhanced detection of architectural distortion and subtle asymmetries, a feature commonly seen in less aggressive, slower growing tumors as well as invasive lobular carcinoma.

CLINICAL RELEVANCE/APPLICATION

Tomosynthesis improves the detection of subtle asymmetries and architectural distortions associated with ILC and less aggressive cancers, as well as in patients with dense breasts.

SSG01-04 Usefulness of Synthetic MMG (SMMG) and Thick Slab Images with DBT (Digital Breast Tomosynthesis) for Optimization of Clinical Workflow

Tuesday, Nov. 29 11:00AM - 11:10AM Room: E451A

Participants
Nachiko Uchiyama, MD, Tokyo, Japan (Presenter) Nothing to Disclose
Concurrent usage of 2D MMG (MMG) and DBT is inevitable in diagnostic usage currently. The number of images with MMG and DBT increases by dozens of times compared with MMG only. The reprocessing of DBT data to generate a 2D MMG-like image and thick slab images of DBT will provide decrease of radiation dose and number of images. In this study, we evaluated the diagnostic accuracy of MMG with or without DBT and compared with MMG and compared the diagnostic accuracy between two different DBT slab thickness settings.

METHOD AND MATERIALS

The pixel pitch of the MMG and the DBT images was 0.085 × 0.085 mm. The SMMG images were reconstructed from the 25 raw and processed projection images utilizing 3D volume ray casting method. With one-view MMG and DBT, the radiation doses, utilizing the ACR phantom 156, were 1.20 and 1.80 mGy. All patients received a full two-view MMG and DBT. MMG, SMMG, and SMMG plus DBT images from 108 cases (38 cases of breast cancer and 70 cases of normal or benign) were analyzed and the mean age was 57.0 y.o. The images were evaluated independently by four readers utilizing ROC analysis with the BI-RADS and POM (Probability of Malignancy) scale. In addition, the diagnostic performance between images of 2mm slice thickness with 1mm overlap as current setting and that of 6mm thick synthetic slabs with 3mm overlap reconstructed with a special edge preserving algorithm were compared respectively utilizing ROC analysis.

RESULTS

With DBT, the AGDs were 1.65 mGy in CC view and 1.59 mGy in MLO view. With BIRADS, the average AUC for MMG, SMMG, and SMMG plus DBT were 0.817, 0.813 and 0.892. With POM scale, those were 0.822, 0.813, and 0.898. SMMG plus DBT demonstrated superior diagnostic accuracy compared with MMG and SMMG alone (p<0.01). On the other hand, between SMMG and MMG alone, there were no statistical differences in each (p>0.05). The average AUC for 2mm and 6mm slab images with BIRADS were 0.893 and 0.893. With POM scale, those were 0.896 and 0.895. There were no statistical differences between 2mm and 6mm slab images (p>0.05).

CONCLUSION

SMMG plus DBT will offer the benefit of increased diagnostic accuracy compared with MMG and a 40% decrease of radiation dose compared with MMG plus DBT. Thick slab DBT images will contribute to decrease reading overload compared with current setting without impairing diagnostic accuracy.

CLINICAL RELEVANCE/APPLICATION

SMMG and thick slab images with DBT will be useful to optimize clinical workflow.
Participants
Nicole Berger, MD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Andrea Luparia, Trento, Italy (Abstract Co-Author) Nothing to Disclose
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Marco Ali, Milan, Italy (Abstract Co-Author) Nothing to Disclose
Francesco Sardenelli, MD, San Donato Milanese, Italy (Abstract Co-Author) Speakers Bureau, Bracco Group Research Grant, Bracco Group Speakers Bureau, Bayer AG Research Grant, Bayer AG Research Grant, IMS International Medical Scientific

PURPOSE
To compare the diagnostic accuracy of synthetic digital mammography (SM) with additional digital tomosynthesis (DBT) to full-field digital mammography (FFDM) with DBT.

METHOD AND MATERIALS
IRB approved retrospective study including consecutive patients with FFDM, which were recalled after a suspicious mammogram for screening at our institution between March and November 2015; they all performed a DBT exam (Giotto Tomo system, IMS, Italy) and an ultrasound as work up. Three breast imagers rated FFDM with DBT and SM with DBT independently for Breast Imaging Reporting and Data System (BI-RADS) and density (ACR). Inter-reader agreement was used to compare the two techniques for negative (BI-RADS 1-2) and positive (BI-RADS 3-5) findings. Bland-Altman Plots of each reader were assessed to compare the BI-RADS and ACR rating of both techniques. P<0.05 was regarded as significant. Radiations doses for FFDM vs. DBT were noted and compared.

RESULTS
146 patients were evaluated. Inter-reader agreement was substantial for both FFDM 0.69 (95% coefficient interval, 95%Ci 0.62 – 0.76) and SM 0.73 (95%Ci 0.66 – 0.79) regarding positive and negative rating. Comparing FFDM to SM reading all readers, the differences were not statistically significant (P=0.054). Out of 11 cancers diagnosed at work up, one cancer was undetected by all both at FFDM and SM. Only one reader showed a significant higher rating (P=0.009) of BI-RADS for using FFDM compared to SM. All three readers showed no difference (P>0.058) between both methods by rating the density rated by using the ACR and >85% of all measurements lay between the 95%Ci showing a good comparision between the two techniques. Radiation dose for FFDM vs. DBT was for the cranio-caudal projection 1.49±0.56 mGy vs. 1.97±0.87 mGy (P<0.001) and for the medio-lateral oblique projection 1.73±0.67 mGy vs. 2.09±0.87 mGy (P<0.001).

CONCLUSION
Overall, no statistically significant differences were found between SM with DBT and FFDM with DBT readings regarding BI-RADS- and ACR, with just a 21-32% increase in radiation dose.

CLINICAL RELEVANCE/APPLICATION
Synthetic digital mammography (SM) plus tomosynthesis (DBT) is comparable to digital mammography (FFDM) plus DBT regarding BI-RADS- and ACR-ratings and could be applied in screening programs.

Participants
Su Hyun Lee, MD, PhD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Jung Min Chang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sung Ui Shin, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
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Nariya Cho, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Woo Kyung Moon, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

Purpose
To evaluate imaging features of breast cancers on digital breast tomosynthesis according to the subtypes.

Method and Materials
This study was approved by our institutional review board and the requirement for written informed consent was waived. Between December 2011 and February 2014, a retrospective database review identified 277 invasive breast cancers in 273 women who underwent DBT for preoperative evaluation. Three blinded radiologists independently reviewed DBT images to determine the visibility of cancers and morphologies in terms of mass and microcalcification. Visibility score of each breast cancer was determined by the three readers. Reporting and Data System (BI-RADS) and an ultrasound as work up. Three breast imagers rated FFDM with DBT and SM with DBT independently for Breast Imaging

Results
The median age was 49 years (range, 22-78). Breast density was almost entirely fatty in 4% (11/273), scattered fibroglandular in 16% (44/273), heterogeneously dense in 58% (159/273), and extremely dense in 22% (59/273). Of 277 invasive cancers (mean size 2.2 cm; range, 0.2-9.5 cm), 186 (67%) were HR(+)/HER2(-), 47 (17%) were HR(+)/HER2(+), and 44 (16%) were HR(-)/HER2(-). The most common findings on FFDM was spiculated mass for HR(+)HER2(-) cancers; fine linear branching microcalcifications with non-spiculated mass for HR(+)HER2(+) cancers; and non-spiculated mass without microcalcification for HR(-)/HER2(-) cancers (P<0.001). Low visibility of breast cancers on DBT was more frequent in extremely dense breasts (P=0.020), small pathologic tumor...
size (P<.001). Breast cancer subtype was not a significant factor associated with the visibility on DBT.

**CONCLUSION**

Breast cancers showed different imaging findings on DBT according to the subtypes, however, it did not affect the visibility of breast cancers.

**CLINICAL RELEVANCE/APPLICATION**

Typical findings of breast cancers on DBT according to the subtypes may help to interpret DBT.

**SSG01-08  Use of Digital Breast Tomosynthesis (DBT) as a Guide in a Consecutive Series of 178 Vacuum Assisted Biopsies (VAB): Feasibility and Clinical Usefulness**

**Tuesday, Nov. 29 11:40AM - 11:50AM Room: E451A**

**Participants**

Vincenzo Sabatino, MD, Trento, Italy *(Presenter)* Nothing to Disclose

Anna Ventriglia, MD, Verona, Italy *(Abstract Co-Author)* Nothing to Disclose

Marco Pellegrini, MD, Trento, Italy *(Abstract Co-Author)* Nothing to Disclose

Paolina Tuttobene, MD, Trento, Italy *(Abstract Co-Author)* Nothing to Disclose

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Marvi Valentini, MD, Trento, Italy *(Abstract Co-Author)* Nothing to Disclose

Andrea Luparia, Trento, Italy *(Abstract Co-Author)* Nothing to Disclose

Daniela Bernardi, MD, Trento, Italy *(Abstract Co-Author)* Nothing to Disclose

**PURPOSE**

To analyze the diagnostic accuracy and clinical usefulness of DBT-guided VAB in the assessment of suspicious mammographic nonpalpable lesions

**METHOD AND MATERIALS**

The study included 178 consecutive breast lesions that, after IRB approval, between January and December 2013, underwent mammographic-guided VAB biopsy. Inclusion criteria: non palpable mammographic findings, suspicious grades R3-R5 acccording to European Guidelines, biopsied using DBT-guide. Esclusion criteria: lesions biopsied using standard stereotactic-guide, 7/178. The study considered 166 subjects (average age, 55 years; range, 31-83) with 171 lesions. Sampplings were performed using 9G needles and an added on system. Patient were in sitting position (144/171) or lateral decubitus (27/171). Specimen radiographs were performed in 133/171 cases. Age of women (59 years), degree of suspicious (R3,R4,R5), lesion morphology (microcalcifications, opacity, distortion) and size (2 cm) were analysed, checking their possible correlation with VAB histological outcomes (B1-B5) by chi-square test. Procedure time for all DBT-guide biopsies was measured. Reference standards were surgical histology and/or a follow-up at least of 12 months

**RESULTS**

67,8% of the women were 50 years and older. Lesions had at imaging a level of suspicionclassified R3 in 91, R4 in 60 and R5 in 20 cases. Lesions were microcalcifications (141, 82.5%), small opacities (6, 3.5%), distortions (24, 14%) with sizes 2cm in 67/171 cases. VAB histology report was negative (B1=4; B2=49) in 53 (31%) cases; borderline (B3) in 47 (27,5%) cases, 33 of them with atypia; suspicious (B4) in 4 (2,3%) cases; positive (B5) in 66 (38,6%) cases. 1/171 (0,6%) was a lymphoma. Age and suspicious grades significantly correlated with VAB histology (p <0.005). 102 patients underwent surgery without any downgrading of VAB histology. In the remaining cases during follow up there was no development of carcinoma. On average DBT biopsy time was 9 minutes, lower than that reported in literature

**CONCLUSION**

DBT-guided VAB showed an high diagnostic accuracy and an excellent clinical performance proving to be a fast and feasible system for sampling suspicious mammographic nonpalpable lesions

**CLINICAL RELEVANCE/APPLICATION**

In the future DBT-guide may replace standard stereotactic-system for the assessment of suspicious non palpable lesions

**SSG01-09  Added Cancer Yield of Screening Breast MRI in the Modern Era of Digital Breast Tomosynthesis**

**Tuesday, Nov. 29 11:50AM - 12:00PM Room: E451A**

**Awards**

Student Travel Stipend Award

**Participants**

Ashley A. Roark, MD, Boston, MA *(Presenter)* Nothing to Disclose

Pragya A. Dang, MD, Boston, MA *(Abstract Co-Author)* Nothing to Disclose

Bethany L. Niell, MD, Tampa, FL *(Abstract Co-Author)* Nothing to Disclose

Elkan F. Halpern, PhD, Boston, MA *(Abstract Co-Author)* Research Consultant, Hologic, Inc; Research Consultant, Real Imaging Ltd; Research Consultant, Gamma Medica, Inc; Research Consultant, K2M Group Holdings, Inc

Geoffrey M. Rutledge, MD, Boston, MA *(Abstract Co-Author)* Nothing to Disclose

Constance D. Lehman, MD, PhD, Boston, MA *(Abstract Co-Author)* Research Grant, General Electric Company; Medical Advisory Board, General Electric Company

**PURPOSE**

To compare the added cancer yield and performance of screening breast MRI in high-risk women screened with digital breast tomosynthesis (DBT) versus digital mammography (DM).

**METHOD AND MATERIALS**

Following IRB approval, medical record review identified 4,418 screening breast MRI exams: 2,127 performed 1/2013-1/2015 with a
negative DBT exam in the prior year (DBT group) and 2,291 performed 1/2010-1/2012 with a negative DM exam in the prior year (DM group). Specific MRI exam indications (genetic mutation, family history, prior chest irradiation, personal history of breast cancer or of high-risk lesion) were recorded. Added cancer yield, abnormal interpretation rate (AIR) and positive predictive values (PPV1,2,3) were calculated using ACR BI-RADS 5th edition definitions. Logistic regression analysis was used to compare the groups, adjusting for differences in patient demographics (age, exam indication, mammographic breast density, presence of prior MRI exam).

RESULTS

Mean patient age was 52 years (range 25-86 years). 34 cancers were identified by MRI in the DBT group with an added cancer yield of 16 cancers/1000 screens (30/1000 prevalence screens and 14/1000 incidence screens) compared to 11 cancers/1000 MRI screens in the DM group (7/1000 prevalence screens and 12/1000 incidence screens). No significant differences were found in cancer detection before or after adjusting for differences in patient demographics (age, exam indication, mammographic breast density, presence of prior MRI exam) (p= 0.20 vs. p= 0.23). The AIR (BI-RADS 0, 3, 4, 5) was 7.3% (155/2127) in the DBT group and 7.4% (170/2291) in the DM group. PPV1, PPV2, and PPV3 were 22% (34/155), 33% (32/98) and 35% (32/92) in the DBT group and 15% (26/170), 23% (18/77), and 28% (18/64) in the DM group. Of the cancers detected in the DBT group, 79% (27/34) were invasive; of these, 74% (20/27) were <1 cm in size and 85% (23/27) node negative.

CONCLUSION

In high-risk women screened with DBT, the added cancer yield with supplemental MRI screening is similar to the added cancer yield of MRI after DM, with most cancers being invasive, sub-centimeter and node negative.

CLINICAL RELEVANCE/APPLICATION

In the modern era of screening mammography with DBT, MRI continues to be an important supplemental screening modality for high-risk women and detects otherwise occult early-stage invasive cancers.
Practitioners

Georgia Giakourmis Spear, MD

Program Information

In changing times of legislative mandates and informed patients, Dr. Spear discusses how Invenia ABUS proves to be an effective adjunctive screening tool for detection of breast cancer in women with dense breast tissue. She will review clinical relevance, practice guidelines and how to successfully implement ABUS into a hybrid academic/private practice.

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop/event-summary-b904d22132614dc2b7633ee3b34f22de.aspx
Automated Breast Volume Scanner (ABVS) Physician Training Workshop - An Interactive Learning Experience: Siemens Healthineers Vendor Workshop

Tuesday, Nov. 29 11:40AM - 12:50PM Room: Booth 5534

Participants

PARTICIPANTS

Erin Neuschler, Chicago, Illinois, USA

PROGRAM INFORMATION

Under the guidance of a breast imaging expert you will develop your skills in the interpretation of 3D breast ultrasound acquired with the ACUSON S2000™ Automated Breast Volume Scanner (ABVS), HELX Evolution with Touch Control and displayed on workstations equipped with syngo. Ultrasound Breast Analysis (sUSBA) Software. Active participation in real clinical cases will enable you to become familiar with the coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Participants

Dr. Wade Hedegard

PROGRAM INFORMATION

An advanced 75 minute hands-on workshop: Optimizing tomosynthesis using a multifaceted approach to improve mammographic outcomes. Subsequent to a brief lecture, participants will review and score challenging cases. A Faculty led review with practical solutions and correlate ancillary imaging results will follow. (24 Attendees per session) (Hologic Selenia® Dimensions® system with C-View™ software).

Registration

http://www.hologic.com/rsna-hologic-workshop-sessions
**PURPOSE**
To evaluate the correlation between the presence of Choline peak on MR spectroscopy at 3T and prognostic factors in patients with biopsy proved breast cancer.

**METHOD AND MATERIALS**
Breast MR spectroscopy was performed at 3T in patients with biopsy proved malignant lesions measuring 8 mm or larger at MR imaging. Single-voxel MR spectroscopy data were collected from a single volume of interest that encompassed the lesion. Findings were considered positive in case of signal/noise ratio of Choline peak greater or equal to 2 and negative in all other cases. MR spectroscopy findings were then compared with histologic findings, lesion size, histotype, nuclear grade, receptor status (ER, PgR), Ki67 and HER2 expression were evaluated.

**RESULTS**
102 patients with BI-RADS 6 lesions (94/102 IDC; 8/102 ILC) were evaluated. Choline peak was detectable in 48/102 cases. The average dimension of the lesions was 26.29mm (8-60mm). There was a statistically significant association between the choline peak (p=0.005) and the lesions size and between Choline peak with Ki-67 (p=0.003). We observed a statistically significant association between choline peak and grade 3 (p=0.001) and between choline peak and HER2 (p=0.04). No statistically significant association of choline peak with receptor status (ER, PgR) and Luminal A, B1 and B2 was detected, as well as, between choline peak and triple negative.

**CONCLUSION**
3T breast MR spectroscopy, can be a tool to predict tumour aggressiveness and the correlation between choline peak and prognostic factors such as Ki67, HER2 and grading 3, may have a clinical relevance.

**CLINICAL RELEVANCE/APPLICATION**
To evaluate the role of Choline peak as a prognostic factors in biopsy proved breast cancers using MR spectroscopy at 3T.
or missing BPE assessment. Exams were grouped by BPE into minimal, mild, or moderate/marked. Cancer diagnosis was defined as a tissue diagnosis of invasive or in situ carcinoma within twelve months of the MRI or before the next screening MRI, whichever occurred first. Performance measures were defined according to the ACR BI-RADS Atlas, Fifth Edition. BPE impact on sensitivity was compared with a Fisher's exact test, on specificity with a chi-square test.

RESULTS

The study cohort included 4935 screening MRIs performed in 2581 women, grouped by BPE into minimal (1850/4935, 37.5%), mild (2308/4935, 46.8%), or moderate/marked (777/4935, 15.7%). Eighty cancers were diagnosed overall (rate of 16.2 per 1000); BPE was assessed in these cases as minimal (20/80, 25%), mild (40/80, 50%), or moderate/marked (20/80, 25%). Descriptive performance measures across the three groups (minimal, mild, moderate/marked) were as follows: abnormal interpretation rate (5.6%, 9.8%, 13.4%), biopsy rate (2.7%, 4.2%, 5.9%), cancer detection rate per 1000 exams (9.7, 14.3, 19.3), PPV2 (26.0%, 29.9%, 28.3%), PPV3 (30.2%, 35.8%, 30.2%). Across the three groups (minimal vs. mild vs. moderate/marked), there was no statistically significant difference in sensitivity [90.0% (exact confidence interval 68.2-98.8) vs. 82.5% (67.2-92.7) vs. 75.0% (50.9-91.3), p=0.48], but there was a statistically significant decrease in specificity [95.4% (94.3-96.3) vs. 91.4% (90.2-92.6) vs. 88.2% (87.0-91.5), p<0.001].

CONCLUSION

Increased BPE does not impact the sensitivity of screening MRI to detect breast cancer, but does decrease specificity, with trends toward increased abnormal interpretation and biopsy rates.

CLINICAL RELEVANCE/APPLICATION

With increased BPE, sensitivity of screening MRI to detect cancer remains high, but specificity is decreased. Methods to help distinguish BPE from suspicious lesions may reduce false positive exams.

**BR242-SD-TUAS**

**Breast-Specific Gamma Imaging (BSGI)-guided biopsy for the Diagnosis of Breast Cancer**

**Station #3**

Participants

Jialu L. Yang, Washington, DC, DC (Abstract Co-Author) Nothing to Disclose
Jocelyn A. Rapelyea, MD, Washington, DC (Abstract Co-Author) Speakers Bureau, General Electric Healthcare Company; Research consultant, Q-view LLC.; Research consultant, QTUS

Christel Velasco, Washington, DC, DC (Abstract Co-Author) Nothing to Disclose
Rachel F. Brem, MD, Washington, DC (Presenter) Board of Directors, ICAD, Inc; Board of Directors, Dilon Technologies LLC; Stock options, ICAD, Inc; Stockholder, Dilon Technologies LLC; Consultant, U-Systems, Inc; Consultant, Dilon Technologies LLC; Consultant, Dune Medical Devices Ltd

PURPOSE

The purpose of this study was to evaluate the outcomes of BSGI-guided biopsy in women with abnormal BSGI findings and to determine the cancer detection rate.

METHOD AND MATERIALS

All patients who underwent BSGI-guided biopsy between April 2011 and October 2015 were retrospectively reviewed. 113 women (ages 32 to 78) had 116 BSGI-guided biopsies, 103 of which were successful. Patients with abnormal BSGI findings underwent BSGI-guided biopsy.

RESULTS

Of the 116 attempted biopsies, 103 were successful, and 13 were canceled. Of the canceled biopsies, 12 were canceled because the lesion was less conspicuous or no longer visible, and 1 because of a vasovagal reaction. The 13 canceled biopsies were followed for one year, and no cancers were found within that time frame. Of the 103 successful biopsies, 32 had abnormal findings: 8/32 invasive ductal carcinoma (25.0%), 1/32 invasive mammary carcinoma (3.13%), and 6/32 DCIS (18.8%). High risk lesions included 3/32 LCIS (9.38%), 5/32 ADH (15.6%), 2/32 ALH (6.25%), 1/32 flat epithelial atypia (3.13%), and 6/32 papillomas (18.8%). Of these 17 high-risk lesions, 2 cases of ADH were upgraded to DCIS at surgery, for an upgrade rate of 11.8% (2/17). The overall cancer detection rate for BSGI-guided biopsy was found to be 16.5% (17/103: 8 IDC and 9 DCIS). In this study, BSGI-guided biopsy was found to have a sensitivity of 100%, a specificity of 82.6%, a PPV1 (PPV of total positive BSGI exams) of 53.1%, a PPV3 (PPV of total successful biopsies) of 16.5%, and an NPV of 100%.

CONCLUSION

Of the 103 BSGI-guided biopsies performed for lesions not visible by mammography or ultrasound, biopsy demonstrated 17 cancers (16.5%), or a combined 32 cancers and high-risk lesions (31.1%) out of 103 successful biopsies.

CLINICAL RELEVANCE/APPLICATION

BSGI-guided biopsy is a reasonable and accurate approach to biopsy BSGI-detected lesions. Our results compare favorably to those reported for MRI guided biopsy.

**BR242-SD-TUAS**

**The Role of Strain Elastography in the Characterization of Lesions Detected during Second Look Ultrasound**

**Station #5**

Participants

Iulia Filip, MD, Montreal, QC (Presenter) Nothing to Disclose
Romuald Ferre, MD, Montreal, QC (Abstract Co-Author) Nothing to Disclose

Benoit D. Mesurolle, MD, Clermont-Ferrand, France (Abstract Co-Author) Nothing to Disclose

**Awards**

*Student Travel Stipend Award*

Participants

Iulia Filip, MD, Montreal, QC (Presenter) Nothing to Disclose
Romuald Ferre, MD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
IMPROVING LESION CONSPICUITY IN WOMEN WITH DENSE BREASTS USING COMPUTED HIGH b-VALUE DIFFUSION WEIGHTED MR IMAGING

PURPOSE
Evaluate strain elastography (SE) as a complementary tool for characterization of lesions during second look ultrasound (SLUS) after breast dynamic contrast material-enhanced (DCE) magnetic resonance imaging (MRI).

METHOD AND MATERIALS
This retrospective single center study received approval from the Institutional Research Ethics Board. We identified 75 patients with 83 lesions characterized by MRI, SLUS and strain elastography between November 2012 and June 2014. Two patients had three distinct lesions and five patients each had two lesions that were characterized separately. An ultrasound-guided biopsy was performed in all cases. Two breast radiologists reviewed the MRI and ultrasound characteristics of the lesions, as well as the elastography specific measurements: the elasticity score (ES) and the fat-to-lesion strain ration (FLR).

RESULTS
Mean patient age was 56 (range 33-85). At MRI, 40 (48.2%) lesions were described as masses (6-22mm), 30 (36.1%) as non-mass-like enhancement (NMLE) and 13 (15.7%) as focus of enhancement. At SLUS, 56 (67.5%) lesions were defined as masses (5-25mm) and 27 (32.5%) as non-masses. After histopathology review, 43 lesions (51.8%) were benign, 36 lesions (43.4%) were malignant and 4 (4.8%) were high-risk lesions. Amongst the 40 malignant and high-risk lesions, 23 (57.5%) had elasticity scores of 3 and higher, whereas 35 (81.4%) of the 43 benign lesions had elasticity scores of 1 and 2 (p=0.01). The mean FLR for benign lesions was 4.13±5.66 and 9.78±14.77 for malignant and high-risk lesions. The sensitivity and specificity for FLR was 0.35 and 0.86 (p=0.02) with 14 true positive (TP) cases and 26 false negative (FN). The sensitivity and specificity for ES was 0.58 and 0.81 (p=0.0) with 23 TP and 17 FN. For BI-RADS 4A lesions at MRI, both FLR and ES had a sensitivity of 0.263 and a specificity of 0.923 with 11 TP and 29 FN.

CONCLUSION
The results of this study show that the addition of strain elastography offers limited benefit in the characterization of lesions at SLUS after MRI. The elasticity score appears to perform better than FLR, however both tests have a low sensitivity with a large number of false negative results.

CLINICAL RELEVANCE/APPLICATION
The evaluation of MRI detected lesions with second look ultrasound can be challenging. Strain elastography could be a potentially helpful tool that can aid radiologists to characterize and guide management for these lesions.

BR243-SD-TU6
Improving Lesion Conspicuity in Women with Dense Breasts using Computed High b-value Diffusion Weighted MR Imaging

PURPOSE
Higher b-values on diffusion weighted imaging (DWI) can improve visibility of breast malignancies, but acquiring these b-values lengthens the scan time of this rapid non-contrast technique and degrades signal-to-noise. This study investigates the potential of a computed high b-value DWI approach for maximizing distinguishability of breast cancer in women with dense breasts.

METHOD AND MATERIALS
In this IRB-approved study, we retrospectively identified women with heterogeneously or extremely dense breasts on mammography that had a DCE-MRI detected invasive cancer between 1/2014 and 8/2015. MRI was performed on a 3T scanner and included DWI with multiple acquired b-values (0, 100, 600, 800, 1000 s/mm²). High b-value (1000, 1500, 2000, 2500, 3000 s/mm²) DW images were computed by fitting the acquired DWI signal to an IVIM model by a linear least-square technique and extrapolating values. Regions of interest (ROIs) were measured for lesion and contralateral tissue to calculate relative intensity (RI), a metric of conspicuity, as follows: RI=(µl-µt)/µt; µ = mean of signal intensity values within the ROI. RI was compared between b-values by Wilcoxon signed-rank test. The effects of lesion characteristics (size, histology, and morphology) on lesion conspicuity also were explored by Wilcoxon rank sum test.

RESULTS
The study included 25 invasive lesions (22 ductal; 3 lobular) detected on MRI in 23 women (median age, 58 yrs) with dense breasts. Lesion sizes ranged from 4-83mm (median, 12mm) with 18 masses and 6 non-mass enhancements. RI increased consistently with b-value up to the maximal value investigated of b=3000 s/mm² (p<0.05) and was observed to be reflective of qualitative visibility of the lesion. No significant differences in lesion RI were observed based on histology, morphology, or size (p>0.05).

CONCLUSION
Computed high b-value DW images generated with IVIM modeling can increase the contrast between tumor and normal tissue on DWI, which could save scan time, improve image quality, and facilitate a non-contrast screening method for women with dense breasts. Further validation in a larger clinical cohort is needed to better determine factors influencing conspicuity and optimal b-values.

CLINICAL RELEVANCE/APPLICATION
Computed high b-value DWI can extend the range of b-values without incurring scan time penalties and holds promise to improve conspicuity of invasive cancers.
Lobular Carcinomas in the Era of Digital Breast Tomosynthesis: Are Imaging Findings Changing?

Station #7

Awards
Student Travel Stipend Award

Participants
Tisha M. Singer, MD, Providence, RI (Presenter) Nothing to Disclose
Ana P. Lourenco, MD, Providence, RI (Abstract Co-Author) Nothing to Disclose
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Hai Wang, Providence, RI (Abstract Co-Author) Nothing to Disclose
Yihong Wang, Providence, RI (Abstract Co-Author) Nothing to Disclose
Martha B. Mainiero, MD, Providence, RI (Abstract Co-Author) Nothing to Disclose

PURPOSE
To compare presenting imaging findings for invasive lobular carcinomas (ILC) in patients imaged by digital breast tomosynthesis (DBT) vs digital mammography (DM).

METHOD AND MATERIALS
IRB approved, HIPAA compliant retrospective search of pathology databases of 2 tertiary breast centers identified 191 ILCs from 1/1/09 to 12/31/14. Patient identifiers, imaging modality and findings (architectural distortion (AD), focal asymmetry (FA), asymmetry (A), mass (M), calcification (CALC), negative (NEG)) and pathology results were recorded. Imaging findings for patients undergoing DBT vs DM were compared. Generalized linear modeling assuming a binomial distribution using least squares estimation were used to examine rates over time. Significance is .05 and all interval estimates are calculated for 95% confidence.

RESULTS
There were 191 ILCs in 189 women; 54 imaged with DBT and 135 with DM. Mean age for DBT was 60.8 and DM was 61.7. With DBT, AD rates were significantly higher than DM (36% [14-23] vs. 18% [9-19]) initially and later (53% [20-32] vs. 0), all p<.05. No differences were observed for FA (p=.3441) or M (p=.35). False negatives were lower for DBT (0%) than DM (7% [2-26]), p<.0001. Asymmetry was higher for DBT (15% [4-55]) than DM (10%[3-29]) initially and later (7% [1-44] vs. 0%), p<.001. CALC were higher for DBT (8% [1-50]) than DM (7% [2-25]), p<.001.

CONCLUSION
ILC presented more commonly as architectural distortion and asymmetry at DBT compared with DM. There were also fewer false negatives with DBT than DM.

CLINICAL RELEVANCE/APPLICATION
ILCs often present with subtle imaging findings. Awareness of how the presenting imaging findings may differ at DBT and DM may be helpful to breast radiologists.

Digital Breast Tomosynthesis Guided Biopsy Procedures: Why Now and How

Station #8

Awards
Identified for Radiographics

Participants
Helen Anne D’Alessandro, MD, Boston, MA (Presenter) Nothing to Disclose
Dorothy A. Sippo, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Leslie Lamb, MD, MSc, Boston, MA (Abstract Co-Author) Nothing to Disclose
Eric M. Blaschke, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Constance D. Lehman, MD, PhD, Boston, MA (Abstract Co-Author) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company

TEACHING POINTS
The use of digital breast tomosynthesis (DBT) is increasing given its benefits of improved sensitivity and specificity for lesion detection. Suspicious lesions seen only on DBT without a 2D mammographic, sonographic or MRI correlate require intervention. New methods of DBT guided intervention offer two distinct benefits: 1) The option of minimally invasive needle biopsy for lesions seen only on DBT and 2) An efficient, safe alternative to 2D mammographic-guided needle/wire localization. The goal of this educational exhibit is to review why and how to perform histologic tissue sampling of breast lesions seen on DBT and to review the indications, imaging workup and techniques required to perform DBT guided needle/wire localization for surgical excisional biopsies and DBT guided vacuum assisted biopsies. Imaging pearls, pitfalls and practicalities with relevant teaching cases from these two DBT tissue sampling techniques will be discussed and reviewed.

TABLE OF CONTENTS/OUTLINE
Reasons for DBT needle/wire localization and DBT vacuum assisted biopsy:Indications/Literature review/Advantages/ Diagnostic workup and principles of lesion localization/ Imaging techniques and access/Sampling methods/Surgical and core tissue specimen pathology evaluation/Comparison with prone stereotactic VAB/Patient care implications/Teaching cases

Enhancing Foci on Dynamic Breast MRI: What Should be our Diagnostic Strategy?

Station #9

Awards
Certificate of Merit

Participants
TEACHING POINTS

The Breast Imaging Reporting and Data System (BI-RADS) lexicon is now used worldwide for assessing breast lesions on dynamic MRI, and it demonstrates good correlation with the likelihood of malignancy in both mass and non-mass enhancement. According to BI-RADS MRI, “focus” is another enhancing lesion type, which is defined as tiny enhancing spots without specific findings on dynamic MRI. Currently, there are few reports about the diagnostic strategy of these foci. Thus, we do not yet have a solid idea as to how we should be managing these lesions. The aims of this exhibit are: To review which enhancing lesion should be defined as focus on MRI To learn how we should manage these foci

TABLE OF CONTENTS/OUTLINE

1. Focus which should be detected as abnormal enhancement on MRI Differentiation from background parenchymal enhancement
   - Solitary, unique tiny enhancing spot
   - Stronger enhancement than other foci in early phase
2. Key findings to differentiate malignant from benign focus
   Kinetic analysis: washout or persistent enhancement
   Signal intensity on T2WI: hyper-, hypo-intensity, or indistinct
   Interval change: size or kinetic pattern
3. Suggestion of adequate MR category classification in focus
Lunch & Learn: Advances in Mammography and Tomosynthesis through Photon-counting Spectral Technology: Supported by Philips Digital Mammography AB (invite-only)

Tuesday, Nov. 29 12:30PM - 1:30PM Room: S403B

Participants

PROGRAM INFORMATION

This course does not offer CME credit. Registration required.

RSVP

http://www.2.forms.healthcare.philips.com/LP=852
Computer-Aided Diagnosis: Effective Use of Computer-Aided Diagnosis in Clinical Practice

Tuesday, Nov. 29 12:30PM - 2:00PM Room: S501ABC

Participants
Hiroyuki Yoshida, PhD, Boston, MA, (yoshida.hiro@mgh.harvard.edu) (Moderator) Patent holder, Hologic, Inc; Patent holder, MEDIAN Technologies;

LEARNING OBJECTIVES
Learn about 1) the best uses of CAD in clinical practice, 2) current and upcoming reading paradigms for clinical use, 3) strengths and weaknesses of CAD systems, 4) characteristics and pitfalls of CAD prompts, 5) how to best incorporate CAD results into the diagnostic decision-making process.

ABSTRACT
Computer-aided diagnosis (CAD) has become a standard tool in diagnostic radiology. This refresher course will explain and demonstrate how to use three widely available CAD systems--breast CAD, lung CAD, and colon CAD--effectively in clinical practice. The purpose of CAD is to improve radiologists' diagnostic accuracy. A number of CAD systems have been made commercially available in the United States and worldwide, including CAD for the detection of breast cancer on mammograms and breast tomosynthesis, detection of lung nodules on chest radiographs and on thoracic CT, as well as detection of polyps on CT colonography. However, the use of CAD in clinical practice has not been well standardized, and its most effective use is not understood well by radiologists. Each CAD system has its own unique strengths and weaknesses depending on how it was developed and on the data that were used for its development. A good understanding of the intended use of CAD and its limitations in different modalities is important, because using CAD beyond its limitations can lead to ineffective or even harmful results. This course will provide the best CAD practices in clinical use, current and upcoming reader paradigms for clinical use, strengths and weaknesses of different CAD systems, characteristics of CAD prompts including pitfalls, and how to best incorporate CAD results into the diagnostic decision-making process.

Active Handout: Matthew T. Freedman
Breast Tuesday Poster Discussions

Tuesday, Nov. 29 12:45PM - 1:15PM Room: BR Community, Learning Center

BR
AMA PRA Category 1 Credit ™: .50

Participants
Bethany L. Niell, MD, Tampa, FL (Moderator) Nothing to Disclose

Sub-Events

BR245-SD-TUB1 Strain Elastography and Shear-wave Elastography for the Differentiation of Benign and Malignant Breast Lesions
Station #1

Awards
Student Travel Stipend Award

Participants
Nicola Di Leo, MD, Rome, Italy (Presenter) Nothing to Disclose
Vito Cantisani, MD, Rome, Italy (Abstract Co-Author) Speaker, Toshiba Corporation; Speaker, Bracco Group; Speaker, Samsung Electronics Co, Ltd;
Emanuele David, Roma, Italy (Abstract Co-Author) Nothing to Disclose
Giorgio Ascenti, MD, Messina, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Ferdinando D'Ambrosio, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Isabella Guerrisi, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Francesca Di Pastena, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Hektor Grazhdani, MD, PhD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Alfredo Bandino, Messina, Italy (Abstract Co-Author) Nothing to Disclose
Silvia Gigli, roma, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE
to evaluate the diagnostic performance of strain elastography (SE) and shear-wave elastography (SWE), in combination with B-mode US, in improving BI-RADS classification and differentiating benign and malignant breast lesions by using a qualitative and quantitative assessments.

METHOD AND MATERIALS
in this prospective study we included 145 histopathologically proven breast masses who were evaluated by using baseline US, CDUS, SE and SWE (Toshiba Apio 500 with a 7-15 MHz wide-band linear transducer). Each lesion was classified according to the BI-RADS lexicon, by evaluating the size, the B-mode and color-Doppler features, the SE qualitative (color-coded images) and SE semi-quantitative dynamic features (strain ratio), and SWE through a qualitative (color-coded) and quantitative approach (expressed by m/s and k/Pa). Results were correlated with pathologic findings. The area under the ROC curve was used to evaluate the diagnostic performance of B-mode ultrasound, SE and SWE, and their combination.

RESULTS
Histological examination revealed 83 benign and 64 malignant breast lesions US, SE and SWE, considered alone, showed respectively a sensitivity (Se) of 92%, 82% and 81% and a specificity (Spe) of 83%, 75% and 79%. SE, as an additional tool to B mode US examination (US+SE) significantly increased the diagnostic performance of breast US (Se: 96%, Spe: 88%, AUC: 0.9 p<0.004), while the addition of SWE (US+SWE), although was a valid tool in selected cases was lower (Se: 93%, Spe: 84%)

CONCLUSION
our experience suggest that SE and SWE in combination with B-mode US, are valid tool in clinical setting, improving BIRADS category assessment and may help in the differentiation of benign from malignant breast lesions. However SE shows more accuracy than SWE.

CLINICAL RELEVANCE/APPLICATION
Elastography, with both strain and shear wave, can increase the diagnostic confidence in assigning BIRADS category and discriminating benign from malignant breast lesions

BR246-SD-TUB2 Lobular Neoplasia of the Breast: A Stronger Statement on an Old Issue
Station #2

Awards
Student Travel Stipend Award

Participants
Bryan E. Ashley, MD, Chapel Hill, NC (Presenter) Nothing to Disclose
Sheryl G. Jordan, MD, Chapel Hill, NC (Abstract Co-Author) Nothing to Disclose
Thomas J. Lawton, MD, Chapel Hill, NC (Abstract Co-Author) Nothing to Disclose

PURPOSE
The management of pure lobular neoplasia of the breast remains inconsistent. While some institutions excise all cases of atypical lobular hyperplasia and lobular carcinoma in situ, other institutions excise only one or the other. Our institution pursues surgery for both diagnoses and the purpose of this study is to ascertain the advisability of this approach.

**METHOD AND MATERIALS**

IRB-approved, study retrospectively identified all patients with histologic confirmed diagnosis of pure lobular neoplasia from January 1, 2004 through December 30, 2013 in our CoPath database. Diagnoses of additional high risk lesions were excluded. Remaining cases N=109 were reviewed in multivariated manner. Further, detailed literature review from 1999-2013 identified 48 reports of lobular neoplasia upgrade on surgical excision. Each study was reviewed for the following confounding factors: missing radiologic-pathologic concordance assessment and/or including discordant cases; including another high risk biopsy lesion; assigning associated high risk lesion at excision as upgrade; no histologic review by breast pathologist and no comment on the distance of the upgrade from the original biopsy site.

**RESULTS**

109 patients with pure lobular carcinoma in situ or atypical lobular neoplasia were identified, 102 had complete data to include two year followup. Median age 53, range 36-87. Pathology results yielded pure ALH in 54, pure LCIS in 44, and both in 4. We had no instances of immediate upgrades on surgical excision. On additional surveillance, mucinous carcinoma was diagnosed at one year, DCIS at two years, and infiltrating ductal carcinoma at three years in three patients. Of note, 33 patients had a prior or coexistent history of malignancy in the contralateral breast defining them already as high risk patients. Published literature upgrade ranges are 0-61%, average 17% but ten studies with 2% or less. However, identification of one or more confounders previously described eliminates many of the upgrade articles.

**CONCLUSION**

Concordant pure lobular neoplasia on core needle biopsy should be assigned BI-RADS® Assessment Category 3: Probably Benign, as well as Management Recommendations: Short interval 6-month followup surveillance

**CLINICAL RELEVANCE/APPLICATION**

Lobular neoplasia of the breast is considered a risk lesion for which excision is recommended at many institutions; using appropriate criteria, these patients can avoid unnecessary surgery.

**METHOD AND MATERIALS**

HIPAA-compliant, IRB-approved retrospective study of 101 asymptomatic patients who received screening breast MRI; patients were at intermediate to high risk for breast cancer with concurrent negative or benign mammogram. Exams were performed on 3T or 1.5T Siemens scanners and protocolled in accordance with the ACR requirements for breast MRI accreditation. Aegis Sentinelle software was utilized for interpretation. Two experienced fellowship-trained breast radiologists, one breast imaging fellow and one PGY5 radiology resident individually reviewed all cases blinded to the original interpretation, prior studies, and outcome. Readers assigned a BI-RADS assessment category for each of three ‘protocols’ for every patient: subtracted first post-contrast Maximum Intensity Projection (MIP), pre- and first post-contrast T1W sequences with subtraction and source images (AP), and full protocol (FP). Accuracy was assessed using multiple-reader receiver operating characteristic (ROC) curve analysis, using histologic and clinical follow-up as the reference standard. Reliability was assessed with intraclass correlation coefficients (ICC).

**RESULTS**

On multiple-reader ROC curve analysis, overlapping 95% confidence intervals for mean accuracy were noted: MIP 0.794-0.914, AP 0.773-0.941, FP 0.734-0.964. No significant difference between accuracy of the three protocols was observed as assessed using a random-reader effects model (F = 0.028, p = 0.9725). Among readers, accuracy varied with years of experience (most experienced 0.816-0.942 versus least 0.784-0.874). Nonetheless, when malignancy was present, no cases were missed combining MIP and AP interpretations. A strong degree of reliability between readers for all protocols was also noted (ICC: MIP 0.786; AP 0.781; FP 0.715).

**CONCLUSION**

The abbreviated protocol (AP) for screening breast MRI provides similar accuracy and superior inter-reader reliability compared to the full protocol (FP).

**CLINICAL RELEVANCE/APPLICATION**

An abbreviated protocol for breast MRI may be successfully introduced in screening programs without sacrificing accuracy and with high reliability across readers of varying experience levels.

**METHOD AND MATERIALS**

IRB-approved, study retrospectively identified all patients with histologic confirmed diagnosis of pure lobular neoplasia from January 1, 2004 through December 30, 2013 in our CoPath database. Diagnoses of additional high risk lesions were excluded. Remaining cases N=109 were reviewed in multivariated manner. Further, detailed literature review from 1999-2013 identified 48 reports of lobular neoplasia upgrade on surgical excision. Each study was reviewed for the following confounding factors: missing radiologic-pathologic concordance assessment and/or including discordant cases; including another high risk biopsy lesion; assigning associated high risk lesion at excision as upgrade; no histologic review by breast pathologist and no comment on the distance of the upgrade from the original biopsy site.

**RESULTS**

109 patients with pure lobular carcinoma in situ or atypical lobular neoplasia were identified, 102 had complete data to include two year followup. Median age 53, range 36-87. Pathology results yielded pure ALH in 54, pure LCIS in 44, and both in 4. We had no instances of immediate upgrades on surgical excision. On additional surveillance, mucinous carcinoma was diagnosed at one year, DCIS at two years, and infiltrating ductal carcinoma at three years in three patients. Of note, 33 patients had a prior or coexistent history of malignancy in the contralateral breast defining them already as high risk patients. Published literature upgrade ranges are 0-61%, average 17% but ten studies with 2% or less. However, identification of one or more confounders previously described eliminates many of the upgrade articles.

**CONCLUSION**

Concordant pure lobular neoplasia on core needle biopsy should be assigned BI-RADS® Assessment Category 3: Probably Benign, as well as Management Recommendations: Short interval 6-month followup surveillance

**CLINICAL RELEVANCE/APPLICATION**

Lobular neoplasia of the breast is considered a risk lesion for which excision is recommended at many institutions; using appropriate criteria, these patients can avoid unnecessary surgery.

**METHOD AND MATERIALS**

HIPAA-compliant, IRB-approved retrospective study of 101 asymptomatic patients who received screening breast MRI; patients were at intermediate to high risk for breast cancer with concurrent negative or benign mammogram. Exams were performed on 3T or 1.5T Siemens scanners and protocolled in accordance with the ACR requirements for breast MRI accreditation. Aegis Sentinelle software was utilized for interpretation. Two experienced fellowship-trained breast radiologists, one breast imaging fellow and one PGY5 radiology resident individually reviewed all cases blinded to the original interpretation, prior studies, and outcome. Readers assigned a BI-RADS assessment category for each of three ‘protocols’ for every patient: subtracted first post-contrast Maximum Intensity Projection (MIP), pre- and first post-contrast T1W sequences with subtraction and source images (AP), and full protocol (FP). Accuracy was assessed using multiple-reader receiver operating characteristic (ROC) curve analysis, using histologic and clinical follow-up as the reference standard. Reliability was assessed with intraclass correlation coefficients (ICC).

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On multiple-reader ROC curve analysis, overlapping 95% confidence intervals for mean accuracy were noted: MIP 0.794-0.914, AP 0.773-0.941, FP 0.734-0.964. No significant difference between accuracy of the three protocols was observed as assessed using a random-reader effects model (F = 0.028, p = 0.9725). Among readers, accuracy varied with years of experience (most experienced 0.816-0.942 versus least 0.784-0.874). Nonetheless, when malignancy was present, no cases were missed combining MIP and AP interpretations. A strong degree of reliability between readers for all protocols was also noted (ICC: MIP 0.786; AP 0.781; FP 0.715).

**CONCLUSION**

The abbreviated protocol (AP) for screening breast MRI provides similar accuracy and superior inter-reader reliability compared to the full protocol (FP).

**CLINICAL RELEVANCE/APPLICATION**

An abbreviated protocol for breast MRI may be successfully introduced in screening programs without sacrificing accuracy and with high reliability across readers of varying experience levels.
Participants
Stephanie A. Lee-Felker, MD, Los Angeles, CA (Presenter) Nothing to Disclose
Leena Tekchandani, MD, Mineola, NY (Abstract Co-Author) Nothing to Disclose
Mariam Thomas, MD, Sylmar, CA (Abstract Co-Author) Nothing to Disclose
Denise M. Andrews-Tang, MD, Sylmar, CA (Abstract Co-Author) Nothing to Disclose
Antoinette R. Roth, MD, Sylmar, CA (Abstract Co-Author) Nothing to Disclose
Esha A. Gupta, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
James Sayre, PhD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Guita Rahbar, MD, Beverly Hills, CA (Abstract Co-Author) Nothing to Disclose

PURPOSE
To compare the diagnostic performance of contrast-enhanced spectral mammography (CESM) and breast magnetic resonance imaging (MRI) for presurgical imaging evaluation of extent of disease in newly diagnosed breast cancer, using histology as the gold standard.

METHOD AND MATERIALS
This IRB-approved, HIPAA-compliant, retrospective study included consecutive women with newly diagnosed unilateral breast cancer on core needle biopsy (CNB) who underwent presurgical CESM and MRI, followed by CNB of additional imaging-detected suspicious secondary cancer sites, at a single institution between April 2014 and October 2015. Exclusion criteria included: inflammatory breast cancer (n = 1) and contraindications for intravenous contrast administration (n = 3) or MRI (n = 2). Images were analyzed by 1 of 5 breast radiologists with 2-17 years of experience. Sensitivity (Sn), positive predictive value (PPV), and accuracy were calculated with 95% confidence intervals for both modalities. Specificity (Sp) and negative predictive value (NPV) were also calculated for CESM but not for MRI because the latter did not have true negative lesions. The number of false positive (FP) lesions for each modality was compared using the McNemar exact test. A p value <0.05 was significant.

RESULTS
52 women with 86 biopsy-proven breast lesions were included for analysis (mean age 50 years; range, 29-73 years). The performance of CESM was: Sn 98.4% [90.3%-99.9%], Sp 82.6% [59.9%-94.0%], PPV 93.9% [84.4%-98.0%], NPV 95.0% [71.9%-99.7%], and accuracy 94.2% [86.8%-98.0%]. In comparison, the performance of MRI was: Sn 98.4% [90.3%-99.9%], PPV 72.9% [62.9%-82.5%], and accuracy 72.1% [62.2%-82.0%]. Of 8 additional biopsy-proven secondary cancer sites, CESM detected all 8 of 8 (100.0%) and MRI detected 7 of 8 (87.5%). CESM and MRI each had 1 false negative for DCIS in 2 different women. CESM had significantly fewer FPs than MRI (p <0.001): 4 FPs (2 high risk lesions, 1 fibroadenoma, and 1 non-high risk benign lesion) on CESM and 23 FPs (8 high risk lesions, 4 fibroadenomas, and 11 non-high risk benign lesions) on MRI.

CONCLUSION
In this limited study, CESM was as sensitive and more specific than MRI for detecting breast cancer.

CLINICAL RELEVANCE/APPLICATION
In the appropriate clinical setting, CESM may substitute for breast MRI in presurgical imaging evaluation for extent of disease in newly diagnosed breast cancer.

TUB6
Quantitative Heterogeneity Analysis of DCIS Grades and Types on Breast MRI

Awards
Student Travel Stipend Award

Participants
Shinhuey S. Chou, MD, Boston, MA (Presenter) Nothing to Disclose
Eva C. Gombos, MD, Boston, MA (Abstract Co-Author) Royalties, Reed Elsevier
Sona A. Chikarmane, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Catherine S. Giess, MD, Wellesley, MA (Abstract Co-Author) Nothing to Disclose
David Z. Chow, MD, Cambridge, MA (Abstract Co-Author) Nothing to Disclose
Jayender Jagadeesan, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE
Determining DCIS imaging biomarkers in the era of precision medicine is increasingly crucial. We aim to develop MRI biomarkers to predict DCIS grades and types.

METHOD AND MATERIALS
Informed consent was waived in this HIPAA-compliant IRB-approved study. Case inclusion was conducted from a database containing 7332 breast MRI studies from 1/1/2009-12/31/2012. After excluding MRI studies with benign assessments, pathology without DCIS, pathology with invasive disease, and MRI without DCIS visualization, 52 MRI studies with pathology-proven DCIS seen on dynamic contrast-enhanced MRI were reviewed. Regions-of-interest representing DCIS were segmented on the open-source 3D Slicer software by a radiologist using semi-automatic algorithms. Fifty-seven quantitative metrics of each DCIS were obtained, including distribution statistics, shape, morphology, Renyi dimensions, geometrical measure and texture, using the open-source HeterogeneityCAD module in 3D Slicer. Statistical correlation of heterogeneity metrics with DCIS grade and receptor status was performed using the univariate Mann-Whitney test.

RESULTS
The 52 studies included 31 (60%) high-grade and 21 (40%) non-high-grade DCIS. Among them, 41 (79%) were ER+ and 11 (21%) were ER-. HER2 amplification results were unavailable in 3 cases and equivocal in 8 cases. Of the 41 cases with known HER2 status, 10 (24%) were HER2+ and 31 (76%) were HER2-. One metric, surface area-to-volume ratio, showed significant difference (p<0.05)
between high-grade and non-high-grade DCIS on pre-contrast, first post-contrast, and first post-contrast subtraction images. No metric significantly differentiated ER+ from ER- DCIS. However, multiple metrics showed significant differences between HER2+ and HER2- DCIS (7 on pre-contrast, 7 on first post-contrast, 8 on first post-contrast subtraction, 1 on fourth post-contrast, and 2 on fourth post-contrast subtraction images).

**CONCLUSION**

Quantitative MRI heterogeneity analysis of DCIS identified significant metrics in predicting high-grade DCIS and HER2 amplification. Validation of these metrics with larger sample sizes and prospective studies is needed to translate these results into clinical applications.

**CLINICAL RELEVANCE/APPLICATION**

Quantitative heterogeneity analysis of DCIS identified MRI biomarkers that differentiated high-grade and HER2+ DCIS, providing prognostic significance in the era of precision medicine.

**Honored Educators**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Catherine S. Giess, MD - 2015 Honored Educator

**Participants**

Benjamin Q. Huynh, Chicago, IL (Presenter) Nothing to Disclose
Karen Drukker, PhD, Chicago, IL (Abstract Co-Author) Royalties, Hologic, Inc
Hui Li, MD, PhD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Maryellen L. Giger, PhD, Chicago, IL (Abstract Co-Author) Stockholder, Hologic, Inc; Stockholder, Quantitative Insights, Inc; Co-founder, Quantitative Insights, Inc; Royalties, Hologic, Inc; Royalties, General Electric Company; Royalties, MEDIAN Technologies; Royalties, Riverain Technologies, LLC; Royalties, Mitsubishi Corporation; Royalties, Toshiba Corporation

**PURPOSE**

To explore properties of image descriptors extracted from clinical FFDM and breast ultrasound images with deep convolutional neural networks (CNNs) by comparing CNN-extracted features to computer-extracted, human-designed features in the task of distinguishing between benign and malignant lesions.

**METHOD AND MATERIALS**

Two large clinical datasets were used: a breast ultrasound dataset containing 1125 breast lesions and 2393 regions of interest (ROIs) containing the lesions, and a full-field digital mammography (FFDM) dataset with 219 breast lesions and 607 ROIs. The ultrasound ROIs had been categorized as benign solid, benign cystic, or malignant; the FFDM ROIs as either benign or malignant. Each region was subjected to two analyses: (i) direct input to a CNN and (ii) input to computer segmentation and feature extraction. Outputs from (i) the CNN and (ii) the human-designed features were input to support vector machine (SVM) classifiers and five-fold cross validation (by lesion) was used to assess performance in the task of distinguishing between benign and malignant breast lesions, with area under the receiver operating characteristic curve (AUC) as performance metric.

**RESULTS**

SVMs trained on CNN-output features had similar high-level performances compared to those trained on the computer-extracted human-designed features (AUC = 0.81 vs 0.80 (SE = 0.01) for FFDM, AUC = 0.90 vs 0.90 (SE = 0.01) for ultrasound), but the outputs were only moderately correlated (r = 0.46 for FFDM, r = 0.62 for ultrasound), implying the potential for gains when both are used.

**CONCLUSION**

The moderate correlations between the high-performing outputs suggest that CNN-extracted features may complement conventional CADx features, allowing for a benefit of improved performance when combined. Comparison between methods facilitates the interpretation of image properties of CNN-extracted features, which would otherwise be unintuitive.

**CLINICAL RELEVANCE/APPLICATION**

Deep learning techniques show extreme promise in improving computer-aided diagnosis, and combination with conventional CADx may yield interpretation of otherwise unintuitive outputs.

**TEACHING POINTS**

1. Breast edema presents as diffuse breast enlargement, skin thickening and increased interstitial markings on imaging.
2. Unilateral breast edema (UBE) has a limited differential diagnosis, including mammary, non-mammary, and systemic etiologies, which radiologists should be familiar with in order to accurately diagnose and guide treatment. History and physical exam are important in
narrowing the differential. 3. UBE should be considered as a rare presentation of congestive heart failure. 4. Breast infection/mastitis can mimic the clinical signs and imaging appearance of inflammatory breast cancer. 5. In a post lumpectomy surveillance period, when consecutive mammograms demonstrate no change or increasing breast edema, recurrent cancer should be considered.

**TABLE OF CONTENTS/OUTLINE**

1. Overview of the pathophysiology and differential diagnosis of unilateral breast edema.
2. Imaging findings related to breast edema on mammography, ultrasound, CT, and breast MRI.
3. Case based approach of pathologies that result in unilateral breast edema with attention to correlation between various imaging modalities.
   - a. Low oncotic pressure states.
   - b. Abscess/infection and inflammation.
   - d. Mechanical problems.
   - e. Neoplastic.
4. Diagnostic Workup, Pitfalls, Management and Summary

**TEACHING POINTS**

Phyllodes tumor typically has a rapidly growing breast mass and high incidence of local recurrence and shows malignant potential in 15–40%. However, radiologic differential diagnosis of benign and malignant phyllodes tumors are difficult. In this exhibit, the purpose of to correlate the imaging findings of phyllodes tumor with histologic grades and to suggest imaging clues to distinguish malignant phyllodes tumor from benign in breast MRI.

**TABLE OF CONTENTS/OUTLINE**

1. Retrospective review of MR findings according to pathologic subtypes of phyllodes tumor in consensus of 2 radiologists Tumor size Shape (round, oval, irregular) Margin (smooth, irregular, spiculated) Internal haemorrhage or cystic change Smooth or irregular wall Dynamic enhancement pattern (Type I, II, III)
2. Statistics Tumor size and histologic grade: Spearman correlation coefficient analysis Tumor shape, margin, internal haemorrhage/cystic change, enhancement pattern and histologic grade: Fisher exact test.
3. Conclusions The tumour size, shape, margin, and internal enhancement pattern were not correlated with histologic grade in phyllodes tumours Internal haemorrhage or cystic change with irregular wall are suggestive of the malignant phyllodes tumour of the breast.
Participants

PARTICIPANTS

Sean Leong, MD

PROGRAM INFORMATION

Contrast enhanced spectral mammography (CESM) is a new technology. Learn how Dr. Sean Leong has been implemented CESM into private practice as an alternative to Breast MRI for women with indeterminate mammograms.

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop/event-summary-b904d22132614dc2b7633ee3b34f22de.aspx
Breast Tomosynthesis Reading Session: Siemens Healthineers Vendor Workshop

Tuesday, Nov. 29 1:05PM - 2:15PM Room: Booth 5534

Participants

PARTICIPANTS

Maria Bernathova, Vienna, Austria

PROGRAM INFORMATION

During this hands-on workshop you will learn to evaluate 2D mammography and 3D Breast Tomosynthesis. An expert tutor will lead you through cases that will both fascinate and confound you! All cases have been acquired with Siemens Mammatom Inspiration and are displayed on syngo.Breast Care workplaces so you will also become familiar with the image quality and ease of use of our systems.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Patient Centered Approach to Breast Imaging (Sponsored by the Associated Sciences Consortium) (An Interactive Session)

Tuesday, Nov. 29 1:30PM - 3:00PM Room: S105AB

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Denise D. Collins, MD, Detroit, MI, (denisec@rad.hfh.edu) (Moderator) Nothing to Disclose
Kathleen Kath, Livonia, MI (Moderator) Nothing to Disclose
Denise D. Collins, MD, Detroit, MI, (denisec@rad.hfh.edu) (Presenter) Nothing to Disclose
Patricia A. Miller, MD, Bingham Farms, MI (Presenter) Nothing to Disclose
Lisa Brown, West Bloomfield, MI (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Assess collaborative reviews/relevant clinical practice regarding application to realign workflow. 2) Compare new electronic media designed for patient’s needs. 3) Recommend technological innovations/advances that enhance timely diagnosis and reporting. 4) Apply principals of critical thinking from experts and peers. 5) Define new techniques for specific populations of breast patients.

ABSTRACT
Focus on a patient centered approach to healthcare delivery provided an opportunity to develop a new paradigm for delivery of breast imaging care. This course will review assessment of patient needs and our approach to the delivery of personalized healthcare. The program emphasizes screening based on personal and family history, diagnostic evaluation including core biopsy based on patient need, delivery of results to patients in an efficient, empathetic manner, and coordination of radiology care with surgery, oncology and primary care physicians.
The Phenomenon of Ambiguous Location on Tomosynthesis: Contributing Factors and Practical Solutions: Hologic Vendor Workshop

Tuesday, Nov. 29 1:45PM - 3:00PM Room: Booth 5521

Participants

PARTICIPANTS

Dr Linda Greer

PROGRAM INFORMATION

An advanced 75 minute hands-on workshop: Clinical Insights exploring day-to-day location dilemmas associated with tomosynthesis imaging. Subsequent to a brief lecture, participants will review and score challenging cases. A Faculty led review with practical solutions and correlate ancillary imaging results will follow. (24 Attendees per session) (Hologic Selenia® Dimensions® system with C-View™ software).

Registration

http://www.hologic.com/rsna-hologic-workshop-sessions
Participants

PARTICIPANTS

A. Thomas Stavros, MD

PROGRAM INFORMATION

In an era of supplemental screening options, it is time to look differently at breast ultrasound. This session will discuss philosophy, false positives, learning curve, auditing, and health economics of incorporating breast ultrasound into today's clinical practice.

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop/event-summary-b904d22132614dc2b7633ee3b34f22de.aspx
Automated Breast Volume Scanner (ABVS) Physician Training Workshop - An Interactive Learning Experience: Siemens Healthineers Vendor Workshop

Tuesday, Nov. 29 2:30PM - 3:40PM Room: Booth 5534

Participants

PARTICIPANTS

Erin Neuschler, Chicago, Illinois, USA

PROGRAM INFORMATION

Under the guidance of a breast imaging expert you will develop your skills in the interpretation of 3D breast ultrasound acquired with the ACUSON S2000™ Automated Breast Volume Scanner (ABVS), HELX Evolution with Touch Control and displayed on workstations equipped with syngo.Ultrasound Breast Analysis (sUSBA) Software. Active participation in real clinical cases will enable you to become familiar with the coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Personalized Breast Screening: What's Next?: GE Vendor Workshop

Tuesday, Nov. 29 3:00PM - 4:00PM Room: Booth 5528

Participants

PARTICIPANTS

Symposium Faculty

PROGRAM INFORMATION

Meet and ask a global panel of expert breast imagers how they have optimized workflow, implemented risk stratification, and utilized a multi-modality, multi-disciplinary approach to improve overall clinical performance.

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop/event-summary-b904d22132614dc2b7633ee3b34f22de.aspx
Participants
Melissa L. Pilewskie, MD, New York, NY (Presenter) Nothing to Disclose
Shari Goldfarb, MD, New York, NY (Presenter) Nothing to Disclose
Karen Y. Oh, MD, Portland, OR (Presenter) Nothing to Disclose
Jean L. Wright, MD, New York, NY (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Improve basic knowledge and skills relevant to radiation therapy use in breast cancer patients. 2) Apply information learned from provided breast cancer case scenarios to clinical practice. 3) Assess technological innovations and advances which can enhance clinical practice and problem-solving in the breast cancer population. 4) Apply principles of critical thinking to ideas from breast oncology experts and peers in the radiologic sciences.
PURPOSE

Investigate whether CESM can be used to safely rule out or rule in malignancy in patients with suspicious architectural distortion seen on standard mammography or DBT.

METHOD AND MATERIALS

This IRB-approved retrospective study reviewed 410 consecutive CESM examinations from a 17-month period ending January 2016. Study cases included AD in patients with BIRADS 4 or 5 on mammograms and with available pathology. CESM was performed utilizing standard protocol. The AD descriptors, sonographic correlates and enhancement characteristics were recorded from the radiology reports. Pathology results were collected from the biopsy and/or surgical excision reports and divided into benign, radial scar, high-risk and malignant.

RESULTS

Final data set included 49 lesions in 45 patients (4 of the patients had 2 qualifying lesions). The histopathology demonstrated 29 invasive carcinomas and one case of DCIS, ranging in size from 0.4 cm to 4.7 cm (histologic measurements). There were 16 cases of invasive ductal carcinomas, 12 cases of invasive lobular carcinoma and 1 case of low-grade adenosquamous carcinoma. There were 9 radial scars and 10 benign lesions. Two of the radial scars also contained high-risk lesions (ADH and FEA). Thirty-seven of the 49 cases (75.5%) of AD were shown to enhance on CESM. Of these 29/37 were positive for carcinoma, with a PPV of enhancement of 78.4%. The sensitivity of enhancement on CESM for AD was 96.7% (29/30), the specificity was 57.9% (11/19) and the NPV was 91.7% (11/12). The false positive rate was 21.6% (8/37) and the false negative rate was 8.3% (1/12). Accuracy of enhancement on CESM for AD was 81.6% (40/49).

CONCLUSION

A PPV of enhancement on CESM of 78% leads us to conclude that any enhancing area of AD should be biopsied. Our small study included a sensitivity of 97% with one non-enhancing malignant lesion of 4 mm in a patient with significant background enhancement, potentially obscuring enhancement of the malignancy. Further research is needed on the importance of timing CESM with menstrual cycles. Within our data, 29 of the 30 malignancies (96.7%) associated with enhancement and architectural distortion were invasive, highlighting the significance of AD as a finding associated with invasion.

CLINICAL RELEVANCE/APPLICATION

The high sensitivity (97%) and high NPV (92%) of CESM in AD lesions is promising of CESM serving as an adjunct modality to diagnose malignancy and avoid biopsy, respectively.
For many years magnetic resonance imaging (MRI) being a multislice soft tissue focused and contrast based modality was considered the method of choice in staging of breast cancer. In the current work we compared the performance of advanced applications of digital mammography: contrast-enhanced spectral mammography (CESM) and digital breast tomosynthesis (DBT) with that of MRI to detect the modality suitable for assessment of cancer extension.

**RESULTS**

CESM and MRI showed equal performance in estimating the accurate cancer size (accuracy: 95%). Tomosynthesis was superior in evaluating mass extension with an accuracy of 85% compared to 83% for MRI. Multiplicity was better demonstrated by CESM that showed an accuracy of 96% compared to 93% for that of MRI. The overall performance of digital mammogram aided by advanced applications (DBT and CESM) in staging of breast cancers was 95.7% sensitivity, 88% specificity and 93% total accuracy versus 95%, 76.5% and 91.3% respectively for MRI.

**CONCLUSION**

MRI breast was inferior to DBT in estimation of proper disease extent and to that of CESM in detection of multiplicity. The advanced applications of digital mammogram and MRI breast; both showed comparable estimation of the breast cancer size.
RESULTS were compared to post-operative histopathology (gold standard) through correlation (Pearson’s “r”). Shrinkage patterns were classified into: concentric (C), spotty (S), disappearance (D). Post-NAC CESM and MRI size measurements

Luminal B HER+, 12 Triple Negative and 9 HER2+. Patients underwent CESM and MRI before, during and after the end of NAC. Infiltrating Lobular Carcinoma (ILC) and 2 Metaplastic Carcinoma. Molecular characteristics were: 3 Luminal A, 16 Luminal B, 6 luminal B HER+, 12 Triple Negative and 9 HER2+. Patients underwent CESM and MRI before, during and after the end of NAC. Between October 2012 and December 2014, 54 consenting woman with breast cancer and indication of NAC were enrolled into this prospective study. 46 of them completed the study. Histological characteristics were: 40 Infiltrating Ductal Carcinoma (IDC), 2 Infiltrating Lobular Carcinoma (ILC) and 2 Metaplastic Carcinoma. Molecular characteristics were: 3 Luminal A, 16 Luminal B, 6 luminal B HER+, 12 Triple Negative and 9 HER2+. Patients underwent CESM and MRI before, during and after the end of NAC. Shrinkage patterns were classified into: concentric (C), spotty (S), disappearance (D). Post-NAC CESM and MRI size measurements were compared to post-operative histopathology (gold standard) through correlation (Pearson’s “r”).

METHOD AND MATERIALS

This is a prospective IRB approved trial recruiting asymptomatic women scheduled for a screening mammogram and WBUS within 30 days of one another. Once accrued to the trial, a CEDM was performed in place of the screening mammogram. Between December, 2014 – March, 2016, 126 women enrolled. The CEDM and WBUS were performed at the same visit and interpreted independently by 2 radiologists blinded to the other modality. For the CEDM, the low dose 2D FFDM images were first interpreted alone prior to being given the contrast-enhanced images. Once final recommendations for each modality were recorded, the patient was managed per standard institutional practice after integrating findings of both studies. For indeterminate findings seen on the contrast-enhanced images of the CEDM but not the low dose 2D or targeted ultrasound, an MRI was performed for further evaluation. If no suspicious correlate was present on the MRI, a 6 month follow up CEDM was recommended. The cancer detection rate (CDR), number of work ups generated for findings seen only on the contrast-enhanced images alone, and the PPV3 of biopsy were determined. Risk factors (breast density, family history (FH), personal history (PH), BRCA status, prior high risk lesion) were recorded.

RESULTS

The mean patient age was 54 (range: 30-72). 106/126 (84%) of women had dense breasts. 5 (4%) women had no additional risk factors, 50 (40%) a PH of breast cancer, and 41 (33%) a FH in a 1st degree relative. 5 cancers (1 IDC, 1 invasive adenosquamous carcinoma, 3 DCIS) were detected in 4 women for a CDR of 40/1000. Of the 5 cancers, 1 (DCIS) was seen on the 2D FFDM, 2 (1 IDC, 1 DCIS) on the WBUS, and all 5 cancers were detected on the CEDM. MRI was recommended for further evaluation of CEDM only findings in 9 (8%) of patients; of these 4 were negative. The PPV3 of biopsy was 42% of CEDM and 50% for WBUS.

CONCLUSION

The cancer detection rate of CEDM is higher than both 2D FFDM and WBUS. However, an MRI may be recommended in 8% of patients for further evaluation of CEDM only findings.

CLINICAL RELEVANCE/APPLICATION

Our early results suggest that CEDM has the potential to be a more sensitive alternative to WBUS for supplemental breast cancer screening.

METHOD AND MATERIALS

This is a prospective IRB approved trial recruiting asymptomatic women scheduled for a screening mammogram and WBUS within 30 days of one another. Once accrued to the trial, a CEDM was performed in place of the screening mammogram. Between December, 2014 – March, 2016, 126 women enrolled. The CEDM and WBUS were performed at the same visit and interpreted independently by 2 radiologists blinded to the other modality. For the CEDM, the low dose 2D FFDM images were first interpreted alone prior to being given the contrast-enhanced images. Once final recommendations for each modality were recorded, the patient was managed per standard institutional practice after integrating findings of both studies. For indeterminate findings seen on the contrast-enhanced images of the CEDM but not the low dose 2D or targeted ultrasound, an MRI was performed for further evaluation. If no suspicious correlate was present on the MRI, a 6 month follow up CEDM was recommended. The cancer detection rate (CDR), number of work ups generated for findings seen only on the contrast-enhanced images alone, and the PPV3 of biopsy were determined. Risk factors (breast density, family history (FH), personal history (PH), BRCA status, prior high risk lesion) were recorded.

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The mean patient age was 54 (range: 30-72). 106/126 (84%) of women had dense breasts. 5 (4%) women had no additional risk factors, 50 (40%) a PH of breast cancer, and 41 (33%) a FH in a 1st degree relative. 5 cancers (1 IDC, 1 invasive adenosquamous carcinoma, 3 DCIS) were detected in 4 women for a CDR of 40/1000. Of the 5 cancers, 1 (DCIS) was seen on the 2D FFDM, 2 (1 IDC, 1 DCIS) on the WBUS, and all 5 cancers were detected on the CEDM. MRI was recommended for further evaluation of CEDM only findings in 9 (8%) of patients; of these 4 were negative. The PPV3 of biopsy was 42% of CEDM and 50% for WBUS.

CONCLUSION

The cancer detection rate of CEDM is higher than both 2D FFDM and WBUS. However, an MRI may be recommended in 8% of patients for further evaluation of CEDM only findings.

CLINICAL RELEVANCE/APPLICATION

Our early results suggest that CEDM has the potential to be a more sensitive alternative to WBUS for supplemental breast cancer screening.
Overall correlation coefficients for CESM and MRI versus pathology post-NAC were $r=0.866$ and $r=0.728$, with mean underestimations in size of 4 mm and 8 mm, respectively. Main variances in correlation were seen in ILC ($r=0.628$ for CESM and $r=-0.298$ for MRI) and Luminal B ($r=0.750$ for CESM and $r=-0.003$ for MRI). Imaging shrinkage pattern overall were: 22 C, 15 S and 9 D. ILC presented 75% of S pattern and 25% of D; Luminal B presented 50% of C pattern, 44% of S and 6% of D. The mean underestimation in size versus histopathology differed between CESM and MRI only in S pattern both for ILC (30 mm on CESM vs 56 mm on MRI) and Luminal B (2 mm on CESM vs 18 mm on MRI). In D pattern it was respectively of 7 mm in ILC and of 5 mm in Lobular B for both CESM and MRI; in C pattern 3 mm in Lobular B for both CESM and MRI.

CONCLUSION

CESM may be more reliable than MRI in defining the response to NAC, in particular for challenging histological and molecular types of breast carcinomas as ILC and Luminal B. CESM is less influenced by the presence of the spotty shrinkage pattern, insidious to detect and define.

CLINICAL RELEVANCE/APPLICATION

Compared to MRI, CESM showed better results in defining the response after Neo-Adjuvant Chemotherapy in breast cancer, especially for challenging histological and molecular types like ILC and Luminal B.
**SSJ02**

**Breast Imaging (Ultrasound Advanced Applications)**

Tuesday, Nov. 29 3:00PM - 4:00PM Room: E450A

**AMA PRA Category 1 Credit ™: 1.00**
**ARRT Category A+ Credit: 1.00**

**FDA** Discussions may include off-label uses.

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**Participants**

Sughra Raza, MD, Boston, MA (Moderator) Nothing to Disclose
Ellen B. Mendelson, MD, Chicago, IL (Moderator) Medical Advisory Board, Delphinus Medical Technologies, Inc; Research support, Siemens AG; Consultant, Siemens AG; Speaker, Siemens AG; ; ;

**Sub-Events**

**SSJ02-01**  **Sub-Hertz Analysis of ViscoElasticity (SAVE) for Differentiation of Breast Masses**

Tuesday, Nov. 29 3:00PM - 3:10PM Room: E450A

**Participants**

Mahdi Bayat, PhD, Rochester, MN (Presenter) Nothing to Disclose
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**PURPOSE**

To evaluate the diagnostic performance of sub-Hertz analysis of viscoelasticity (SAVE) in differentiating breast masses.

**METHOD AND MATERIALS**

The study was conducted under a protocol approved by Institutional Review Board (IRB). Female patients with clinically suspicious breast masses participated in the study. HIPAA compliant written informed consent was obtained from each enrolled patient. The study included 42 women (mean age, 52.62 years; age range, 21–79 years) with 43 breast masses (18 benign, 25 malignant; mean mass size, 17.90mm); pathology results were available after the ultrasound test for all cases. Using a general purpose investigational ultrasound machine (Verasonics, Kirkland, WA) masses were first identified by an expert sonographer using conventional B-mode followed by acquiring SAVE data. This method consisted of applying a ramp-and-hold force on skin above the mass area for about 10 seconds using a custom-made automated compression device capable of ultrasound data acquisition. Sequences of raw ultrasound data obtained during the compression period were used for estimation of the strain-time curves. The resulting strain-time data were then used to calculate the viscoelastic properties of the tissue based on a general Klevin-Voigt model. Using registered B-mode images, regions of interests (ROI) were selected from the mass and surrounding normal tissue. Diagnostic performance of each viscoelasticity measure, including “retardation time”, T1, was evaluated using a receiver operating characteristic analysis.

**RESULTS**

The lesion to normal retardation time contrast in benign lesions was significantly higher than malignant (P<0.0001). Using retardation time contrast for diagnosis resulted in 88.9% specificity, 96.0% sensitivity and 96.9% negative predictive value (AUC: 0.98).

**CONCLUSION**

These results suggest that the SAVE method is a valuable diagnostic tool for differentiation of breast masses.

**CLINICAL RELEVANCE/APPLICATION**

The addition of viscoelasticity measures using SAVE method to ultrasound can greatly improve the specificity in differentiation of the breast masses; thus potentially can help reducing the number of unnecessary biopsies.

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**SSJ02-02**  **Effect of Calcifications on Shear Wave Elastography in Evaluating Breast Lesions**

Tuesday, Nov. 29 3:10PM - 3:20PM Room: E450A

**Participants**

Seung Hee Choi, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
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So Yoon Park, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To investigate the effect of calcifications on shear wave elastography (SWE) in evaluating breast lesions.
We retrospectively reviewed ultrasound (US) images of 807 consecutive patients who had breast US with SWE between October 2013 and March 2014. We excluded the patients who no mammography (n=54) or no measured Emean (n=51) or no follow up data (n=47), and the patients who had neoadjuvant chemotherapy before the US examination (n=24). Finally included 631 patients with 673 breast lesions were included in this study. We analyzed US findings of the lesions: type (mass or non-mass), size, Breast Imaging Reporting and Data System (BI-RADS) category and the elasticity score (Emean) measured at the stiffest area of the lesions. And we compared the UST between breast lesions with calcifications and without calcifications in three subgroups: benign lesions, in situ carcinoma, and invasive carcinoma. We also analyzed the influence of other US factors on the Emean of the breast lesions.

RESULTS
Breast lesions were confirmed by histologically (n=409) or by follow up images for more than 2 years (n=264). Calcifications were present in 25.3% (170/673) lesions and absent in 74.7% (503/673) lesions. Emean was 33.9 kPa in overall benign lesions; 62.8 kPa in benign lesions with calcifications and 29.8 kPa in benign lesions without calcifications (p= 0.000). In situ carcinoma showed 97.0 kPa; lesions with calcifications showed 114.6 kPa while lesions without calcifications showed 52.8 kPa (p=0.037). In invasive carcinoma, the overall Emean was 157.6 kPa, and Emean of lesions with calcifications and without calcifications were 146.4 kPa and 171.9 kPa (p=0.018). Other US factors such as lesion type (mass or non-mass), size, BI-RADS final category showed no statistically significant correlations with elasticity score in the lesions with same pathologic results.

CONCLUSION
The presence of calcifications significantly increased the Emean of breast lesions. Elastography should be carefully interpreted considering the presence of calcifications within the lesions.

CLINICAL RELEVANCE/APPLICATION
The presence of calcifications significantly increased the elasticity score of breast lesions in shear wave elastography.

METHOD AND MATERIALS
A HIPAA compliant, IRB approved study investigating Ultrasound Tomography (UST) to image the breast to compare the spatial resolution of UST reconstructions with contrast enhanced MRI due to its high sensitivity as well as the similar breast positioning ,i.e. pendant, uncompressed breast, and both yielding true 3-D volumetric imaging.A total of 50 women had MR imaging performed during their workup as well as UST imaging. The UST coronal images are separated by 2mm increments and compared with MR images reconstructed in the coronal plane. The UST and MRI images were synchronized to allow slice-by slice comparisons. Images were compared by a single experienced radiologist. The spatial resolution of the UST sound speed images and the MR images were measured by creating profile cuts across sub-mm sized parenchymal features and using a Gaussian fit to model the width of such features. The full-width–half maximum measure was used to determine the spatial resolution in the coronal plane. 50 measurements were made for both the UST and MR images and the spatial resolution was 0 determined by taking the average of the 50 measurements and determining the standard deviation.

RESULTS
The spatial resolution of the UST sound speed images was 0.7 +/- 0.1 mm. The MR resolution was 1.6 +/- 0.1 mm in the coronal plane. In the other planes, the resolution was 0.8 +/- 0.1 mm for MRI and 2.0 +/- 0.3 mm for UST sound speed. Examples of comparative images are shown in Figure 1.

CONCLUSION
A novel algorithm, based on waveform tomography, was applied to UST data to generate sound speed images that have comparable resolution to MRI.

CLINICAL RELEVANCE/APPLICATION
The similarity in spatial resolution between UST and MRI opens avenues to further develop high resolution 3D imaging using ultrasound for the detection of breast cancer. Waveform based UST imaging may become an important tool for future clinical use.
Participants
Naoko Mori, MD, PhD, Sendai, Japan (Presenter) Nothing to Disclose
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Li Li, MD, PhD, Sendai, Japan (Abstract Co-Author) Nothing to Disclose
Kei Takase, MD, PhD, Sendai, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE
To examine whether enhancement area ratios obtained by the new bubble-detection method correlate with histological microvessel density (MVD) in invasive breast cancer.

METHOD AND MATERIALS
The Institutional Review Board approved this retrospective study, and waived the requirement for informed consent. Between August 2014 and December 2015, consecutive 40 patients with invasive breast cancer lesions underwent contrast-enhanced ultrasound (US). Manual segmentation covering the entire tumor volume was made on precontrast US image. Ratios between enhanced areas and segmented tumor areas (enhancement area ratio) was obtained with the new method at peak and delayed phases (50–54, 55–59, 60–64, 65–69s). For each patient, we also analyzed time-intensity curves (TIC) in three regions of interest (ROI), with the supposed strongest enhancement, to obtain mean value of peak intensity (PI) and area under curve (AUC) of three ROIs. All parameters were measured by two observers independently and were correlated with histological MVD of surgical specimens.

RESULTS
Enhancement area ratios in both peak and delayed phases (50–54, 55–59, 60–64, 65–69s) were significantly correlated with histopathological MVD (r=0.57, 0.62, 0.68, 0.61 and 0.58; P=0.0001, <0.0001, <0.0001, <0.0001 and 0.0001, respectively) and almost perfect inter-observer reliability (0.971, 0.972, 0.961, 0.952 and 0.959, respectively). In TIC analysis, PI was significantly correlated (r=0.43; P=0.0073) with substantial inter-observer reliability (0.782), whereas AUC was not (r=0.29; P=0.0769).

CONCLUSION
Enhancement area ratios obtained by the new method were reliably correlated with MVD in invasive breast cancer.

CLINICAL RELEVANCE/APPLICATION
MVD information might be obtainable for multiple lesions during one session of contrast-agent injection changing scanning planes during delayed phases by using our new method.

Using BI-RADS Mismatches to Assess Clinical Differences in Interpretation Between Whole-Breast Physician-performed Handheld Ultrasound (HHUS) and Supine Automated Ultrasound (AUS) Compared for Equivalence in Lesion Detection

Participants
Ellen B. Radelson, MD, Chicago, IL (Presenter) Medical Advisory Board, Delphinus Medical Technologies, Inc; Research support, Siemens AG; Consultant, Siemens AG; Speaker, Siemens AG; ;
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Andy Milkowski, MS, Issaquah, WA (Abstract Co-Author) Employee, Siemens AG

METHOD AND MATERIALS
This 2-site IRB-approved, HIPAA-compliant prospective study aimed to compare HHUS lesion detection with AUS in 500 women. Order of HHUS and technologist-performed AUS was randomized. Performance & interpretation times were recorded.

RESULTS
744 lesions were identified in 501 study participants between 2012-2014. 285/501 (56.9%) had screening US; one site's 251 studies were all screens, the other site with 34 screens had 216 for other indications e.g. palpable mass, BI-RADS 3 f/u, FFD,
DBT or MRI findings, 2nd look after MRI, extent of disease, and prebiopsy cases. Using a cut point of BI-RADS ≥ 3 for clinical significance of mismatches, HHUS had 24.2% and AUS 28.6%. Mismatches in non-screening cases were related to misinterpretation of artifacts as lesions, investigator assignment of category 3 when protocol required BI-RADS 2, and interpretive error, explanations that decreased during the second year of the study. Screening:191 women had no lesions on AUS or HHUS. 94 women had 148 lesions, with 306 (90.3%) matching BI-RADS or BI-RADS ≥ 2.

CONCLUSION

BI-RADS mismatches between automated and handheld scans are few and clinically insignificant for screening. Complexity of cases and inexperience with automated display may result in clinically significant BI-RADS mismatches that with training and case experience, as with other new breast imaging modalities should be reduced, promoting acceptance.

CLINICAL RELEVANCE/APPLICATION

Automated US can be used for US screening as an option to handheld; for diagnosis, advantages of whole breast US coronal display in demonstrating multiple bilateral masses when palpable mass is benign appearing can reduce BI-RADS assessment from BI-RADS 3 to 2.

Feasibility of Microbubble Contrast-Enhanced Ultrasound (CEUS) Sentinel Lymph Node Imaging with Guided Biopsy in Breast Cancer Patients

Tuesday, Nov. 29 3:50PM - 4:00PM Room: E450A

Participants
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PURPOSE

To determine the feasibility of using microbubble contrast-enhanced ultrasound (CEUS) with fine needle aspiration biopsy (FNAB) to identify and pre-operatively evaluate sentinel lymph nodes (SLN) in breast cancer patients.

METHOD AND MATERIALS

Twenty-one patients with newly-diagnosed early-stage (clinical T1-T2, N0) invasive breast cancer who had pre-operative axillary gray scale ultrasound (US) with or without US-guided FNAB revealing benign results were enrolled in an IRB-approved prospective, single-institutional clinical trial. All patients underwent ipsilateral subareolar microbubble contrast injection, followed by CEUS of the axilla. The first CEUS-visualized node was subjected to FNAB, followed by I-125 radioactive seed localization (RSL) of the node. Contrast dose, contrast travel length, travel time, side effects and FNA results were recorded. All patients underwent standard of care (SOC) SLN biopsy using Tc99m with or without blue dye. Correlation of the CEUS-identified node with surgical SLN was performed. Pre-operative FNAB result [benign or malignant] was compared with the final pathologic assessment of that node.

RESULTS

Median patient age was 61yrs (range 37-72). Median cancer size on pre-operative imaging was 12mm (range 6-27). In 20 of 21 (95.2%) patients, CEUS was technically successful. Median node contrast uptake time was 3 min (range 1-10), and travel length was 13cm (range 9-19). All (100%) biopsied and localized nodes correlated with a SLN identified surgically. In 18 (90%) patients, the CEUS-identified, localized node correlated with the hottest SLN. Pathologic evaluation of the SLN(s) revealed metastasis in a single lymph node in 2 (10%) patients, one of which was pre-operatively identified with CEUS-guided FNAB. No significant side effects were recorded in the immediate or 30 day follow up periods.

CONCLUSION

Pre-operative CEUS-guided SLNB is a minimally invasive technique that does not involve radiation exposure, and has no significant side effects. In a first North American experience, this feasibility study confirmed the ability of using microbubble CEUS to identify the SLN in early stage breast cancer patients, suggesting that further evaluation of the technology in larger cohorts is warranted.

CLINICAL RELEVANCE/APPLICATION

CEUS and guided FNAB of SNL is a minimally invasive procedure which may be useful as an alternative to surgical lymph node staging in breast cancer patients.
Purpose/Objective(s): Accelerated Partial Breast Irradiation (APBI) by IORT is becoming an attracting alternative to external beam radiotherapy (EBRT) in early breast cancer treated by conservative surgery (BCS). One of the major issues for implementing a new treatment is the cost related to health results. Materials/Methods: The Breast IORT program started in our center in January 2013. Since then, 195 patients received BCS for early breast cancer until December 2014. The cost analysis was performed after the completion of the treatment of every patient. The full cost of the surgical procedure included: Operating Room (OR), physicians and other personnel, pharmacy, pathology, nuclear medicine, recovery and days in bed at hospital. Cost of the IORT administration were also calculated and included in the analysis: first consultation, preplanning CT scan, disposables, time of radiation oncologist, and other personnel, pharmacy, pathology, nuclear medicine, recovery and days in bed at hospital. Cost of the IORT administration was divided by the percentage of patients who received IORT treatment again. No difference was found between HF and CF in our patients in terms of cosmetic results. Great satisfaction regarding cosmetic outcome of cancer treatment is reported, given by 98% of excellent/acceptable cosmesis, and 94% of patients who would receive treatment again. Conclusion: No difference was found between HF and CF in our patients in terms of cosmetic results. Great satisfaction regarding cosmetic outcome of cancer treatment is reported, given by 98% of excellent/acceptable cosmesis, and 94% of patients who would receive treatment again.

ABSTRACT
Purpose/Objective(s): The aim of this study is to analyze the overall cosmetic outcome according to patient self-assessment and evaluate differences according to the fractionation received. Materials/Methods: A questionnaire was drawn up on the basis of subjective rating scales of cosmesis and it was applied at the start of treatment, at discharge and/or at follow-up visits to patients with early stage breast cancer who received radiotherapy (RT) with tangential fields between June/2014 and July/2015. Self-perception of cosmesis, pain, changes in the treated breast, and fractionation used (hypofractionation (HF) or conventional fractionation (CF)) were evaluated. Surgical bed boost and use of field in field technique (FIF) were also recorded. A descriptive analysis was performed to calculate proportions, frequencies and medians. Chi square and Kruskal Wallis tests were used when appropriate. Results: 352 questionnaires were obtained: 71 at enrolment, 80 at discharge and 201 at follow up visits (281 were considered as evaluation of RT effect). Median age was 58 yo. Forty-five percent (126/279) of patients reported “excellent” cosmesis, 53% (147/279) “acceptable”, and 2% (6/279) “poor” cosmesis. Cosmesis was considered “acceptable/excellent” by 98% (273/279) of patients. According to fractionation received, no statistically significant difference was found in overall cosmesis (p = 0.6), pain (p = 0.9), boost use or FIF. The alteration that occurred more frequently was “difference between the two breasts” (77%), followed by “alteration in shape of the breast” (56%) and then for “induration” (53%). Change in breast normal color was reported in 48%. Fifteen percent of patients younger than 58 yo reported change of normal breast color affecting cosmesis compared to 9% of patients older than 58 yo (p = 0.04). Patients under 58 yo had a greater frequency of breast induration (61% versus 49%, p = 0.03). Nine percent of patients with stage I-II referred complications affecting breast cosmesis compared with 2% with cancer in situ (DCIS) (p = 0.04). Fourteen percent in stage I-II referred color change affecting cosmesis compared with 6% of those with DCIS (p = 0.03). Pain was reported by 68% of patients, and in most of them it was occasional (62%), whereas only 6.4% reported permanent pain. When considering only the questionnaires before the start of RT and at the end of it, in both times the most frequent response was acceptable cosmesis (53.5% and 63.8% respectively), while 3% and 4% reported poor cosmesis at the beginning and at discharge respectively. Ninety-four percent of patients stated that they would accept treatment again. Conclusion: No difference was found between HF and CF in our patients in terms of cosmetic results. Great satisfaction regarding cosmetic outcome of cancer treatment is reported, given by 98% of excellent/acceptable cosmesis, and 94% of patients who would receive treatment again.

ABSTRACT
Purpose/Objective(s): The aim of this study is to analyze the overall cosmetic outcome according to patient self-assessment and evaluate differences according to the fractionation received. Materials/Methods: A questionnaire was drawn up on the basis of subjective rating scales of cosmesis and it was applied at the start of treatment, at discharge and/or at follow-up visits to patients with early stage breast cancer who received radiotherapy (RT) with tangential fields between June/2014 and July/2015. Self-perception of cosmesis, pain, changes in the treated breast, and fractionation used (hypofractionation (HF) or conventional fractionation (CF)) were evaluated. Surgical bed boost and use of field in field technique (FIF) were also recorded. A descriptive analysis was performed to calculate proportions, frequencies and medians. Chi square and Kruskal Wallis tests were used when appropriate. Results: 352 questionnaires were obtained: 71 at enrolment, 80 at discharge and 201 at follow up visits (281 were considered as evaluation of RT effect). Median age was 58 yo. Forty-five percent (126/279) of patients reported “excellent” cosmesis, 53% (147/279) “acceptable”, and 2% (6/279) “poor” cosmesis. Cosmesis was considered “acceptable/excellent” by 98% (273/279) of patients. According to fractionation received, no statistically significant difference was found in overall cosmesis (p = 0.6), pain (p = 0.9), boost use or FIF. The alteration that occurred more frequently was “difference between the two breasts” (77%), followed by “alteration in shape of the breast” (56%) and then for “induration” (53%). Change in breast normal color was reported in 48%. Fifteen percent of patients younger than 58 yo reported change of normal breast color affecting cosmesis compared to 9% of patients older than 58 yo (p = 0.04). Patients under 58 yo had a greater frequency of breast induration (61% versus 49%, p = 0.03). Nine percent of patients with stage I-II referred complications affecting breast cosmesis compared with 2% with cancer in situ (DCIS) (p = 0.04). Fourteen percent in stage I-II referred color change affecting cosmesis compared with 6% of those with DCIS (p = 0.03). Pain was reported by 68% of patients, and in most of them it was occasional (62%), whereas only 6.4% reported permanent pain. When considering only the questionnaires before the start of RT and at the end of it, in both times the most frequent response was acceptable cosmesis (53.5% and 63.8% respectively), while 3% and 4% reported poor cosmesis at the beginning and at discharge respectively. Ninety-four percent of patients stated that they would accept treatment again. Conclusion: No difference was found between HF and CF in our patients in terms of cosmetic results. Great satisfaction regarding cosmetic outcome of cancer treatment is reported, given by 98% of excellent/acceptable cosmesis, and 94% of patients who would receive treatment again.

ABSTRACT
Purpose/Objective(s): The aim of this study is to analyze the overall cosmetic outcome according to patient self-assessment and evaluate differences according to the fractionation received. Materials/Methods: A questionnaire was drawn up on the basis of subjective rating scales of cosmesis and it was applied at the start of treatment, at discharge and/or at follow-up visits to patients with early stage breast cancer who received radiotherapy (RT) with tangential fields between June/2014 and July/2015. Self-perception of cosmesis, pain, changes in the treated breast, and fractionation used (hypofractionation (HF) or conventional fractionation (CF)) were evaluated. Surgical bed boost and use of field in field technique (FIF) were also recorded. A descriptive analysis was performed to calculate proportions, frequencies and medians. Chi square and Kruskal Wallis tests were used when appropriate. Results: 352 questionnaires were obtained: 71 at enrolment, 80 at discharge and 201 at follow up visits (281 were considered as evaluation of RT effect). Median age was 58 yo. Forty-five percent (126/279) of patients reported “excellent” cosmesis, 53% (147/279) “acceptable”, and 2% (6/279) “poor” cosmesis. Cosmesis was considered “acceptable/excellent” by 98% (273/279) of patients. According to fractionation received, no statistically significant difference was found in overall cosmesis (p = 0.6), pain (p = 0.9), boost use or FIF. The alteration that occurred more frequently was “difference between the two breasts” (77%), followed by “alteration in shape of the breast” (56%) and then for “induration” (53%). Change in breast normal color was reported in 48%. Fifteen percent of patients younger than 58 yo reported change of normal breast color affecting cosmesis compared to 9% of patients older than 58 yo (p = 0.04). Patients under 58 yo had a greater frequency of breast induration (61% versus 49%, p = 0.03). Nine percent of patients with stage I-II referred complications affecting breast cosmesis compared with 2% with cancer in situ (DCIS) (p = 0.04). Fourteen percent in stage I-II referred color change affecting cosmesis compared with 6% of those with DCIS (p = 0.03). Pain was reported by 68% of patients, and in most of them it was occasional (62%), whereas only 6.4% reported permanent pain. When considering only the questionnaires before the start of RT and at the end of it, in both times the most frequent response was acceptable cosmesis (53.5% and 63.8% respectively), while 3% and 4% reported poor cosmesis at the beginning and at discharge respectively. Ninety-four percent of patients stated that they would accept treatment again. Conclusion: No difference was found between HF and CF in our patients in terms of cosmetic results. Great satisfaction regarding cosmetic outcome of cancer treatment is reported, given by 98% of excellent/acceptable cosmesis, and 94% of patients who would receive treatment again.
SSJ24-05  VMAT as Treatment Technique in Complex Radiotherapy Breast including IMC, L3 and L4 Nodes

Tuesday, Nov. 29 3:20PM - 3:30PM Room: S104A

Participants
Antonia Lavorato, Oxford, United Kingdom (Presenter) Nothing to Disclose
Asadulla Khan, Oxford, United Kingdom (Abstract Co-Author) Nothing to Disclose
Sileida Oliveros, Oxford, United Kingdom (Abstract Co-Author) Nothing to Disclose

ABSTRACT
Purpose/Objective(s): The aim of the present study is to demonstrate the validity of the volumetric modulated arc therapy technique (VMAT) for the whole breast, internal mammary nodal chain (IMC) and medial supraclavicular fossa (SCF) in deep inspiration and compare its dosimetric results to the standard tangential field-in-field (FinF) combined with an anterior beam technique.

Materials/Methods: A complex case was chosen for this study. A 31 years old lady presented with a self-detected lesion in the medial aspect of the left breast. She was diagnosed with an invasive ductal carcinoma of the left breast grade 3, ER 3/8, PR negative (0/8), HER-2 negative. BRCA 1 and 2 negative as well as panel gene testing negative. CT showed no evidence of metastatic disease or enlarged internal mammary nodes. The patient had undergone a total of six cycles of chemotherapy and left breast wide local excision with complete pathological response. Adjuvant breast radiotherapy and boost to the tumour bed was recommended (Px 40Gy/15#, 16Gy in 8#). Risks versus benefits of irradiating the IMC and SCF were evaluated by the oncologist who concluded that in this clinical case the benefits would outweigh the risks providing an optimised plan could be achieved minimising, as much as possible, the dose to the ipsilateral lung and to the heart. The oncologist delineated the relevant CTVs following the ESTRO consensus guideline. The patient central lung dose for tangential beams was 4.5cm.

A total of three plans were generated for this patient: two VMAT partial arcs with different gantry angles and a standard tangential FinF with a combined anterior beam. The plans were created with Pinnacle, treatment planning system.

Results: Treatment Technique
Left Lung
V20Left Lung V10Left Lung V5Heart V25Heart V10Heart Mean GySpinal Canal Max GyTangential FinF + Ant Beam
34.9%43.6%54.3%60.6%238.4VMAT Gantry 150-300 degrees23%42.2%64.3%80.1%5.229.9VMAT Gantry 178-300 degrees25%3%57%04.6%4.426.9

Both VMAT plans better V20 and V10 to the Left (Ipsilateral) Lung was achieved; also better coverage and dose homogeneity were achieved with VMAT when compared with FinF techniques. There was no significant difference to the mean contralateral breast between the two VMAT techniques. The dose coverage (V38Gy) to the breast and L3 and L4 nodes was quite comparable across the techniques but IMC coverage using tangential beams was inferior.

Conclusion: The results support the hypothesis that VMAT technique is feasible and in this specific case perhaps the only solution. The results showed that the dose to the ipsilateral lung can be reduced and the dose homogeneity can be improved without increasing the dose to the contralateral breast or lung.

SSJ24-04  Effect of Adjuvant Radiotherapy on Survival in Male Breast Cancer: A Population-Based Analysis

Tuesday, Nov. 29 3:30PM - 3:40PM Room: S104A

Awards
Trainee Research Prize - Resident

Participants
Matthew J. Abrams, MD, Boston, MA (Presenter) Nothing to Disclose
Paul Koffer, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Jaroslaw Hepel, MD, Providence, RI (Abstract Co-Author) Nothing to Disclose

PURPOSE
There are no randomized trials providing evidence for or against adjuvant radiation for male breast cancer because of its rarity. This study examines the impact of post-lumpectomy (PLRT) and post-mastectomy radiation (PMRT) in male breast cancer patients in the National Cancer Institute’s Surveillance Epidemiology and End Results (SEER) database.

METHOD AND MATERIALS
The SEER database 8.3.1 was queried for men ages 20+ diagnosed with localized or regional non-metastatic grade I-III invasive ductal/lobular carcinoma from 1998-2011. Included patients were treated with a lumpectomy or modified radical mastectomy (MRM) with or without post-surgical external beam radiation. Univariate and multivatate analyses evaluated predictors for PMRT use after MRM. Overall survival (OS) curves were calculated by the Kaplan-Meier method and compared by the log-rank test. Cox-regression was used for multivariate survival analyses.

RESULTS
A total of 1,980 patients were followed for a maximum of 10 yrs (median follow up = 56 months). 349 patients underwent lumpectomy while 1,631 underwent MRM. Of those who underwent lumpectomy, PLRT improved 10 yr OS (68% vs. 57% p=0.001). Of those who underwent MRM, PMRT had no impact on neither the entire group 10 yr OS (54% vs. 53% vs PMRT) p=0.585 nor on the subset of node negative patients 10 yr OS (60% vs 62% p=0.736). However, there was a benefit in 10 yr OS for 1-3 nodes positive 55% PMRT vs. 46% no PMRT, p=0.033 and for 4+ nodes positive (49% vs. 21% p=0.001). Using cox-regression analysis, increasing number of nodes positive, larger size and older age were all associated (p<0.001) with a survival detriment.

CONCLUSION
The use of post-lumpectomy radiation is associated with a survival benefit. After a modified radical mastectomy, PMRT improves survival in those with positive nodes. There may be a subset of node negative patients who derive a survival benefit and more study of this group is needed.

CLINICAL RELEVANCE/APPLICATION
After a diagnosis of male breast cancer, post-lumpectomy radiation should be considered for all patients and post-mastectomy radiation should be considered for node positive patients.

SSJ24-05  Assessment of Cosmetic Outcome Following Intra-operative Radiation Therapy during Breast
ABSTRACT

Purpose/Objective(s): Intra-operative radiation therapy during breast-conserving surgery is increasingly being used as a treatment for early breast cancer. A variety of techniques are used, and many have been shown to be safe and effective. Another important aspect is the long-term cosmetic (aesthetic) results of treatment, as most women will survive for decades. In order to determine the variety and extent of methods currently being used to assess cosmetic outcome, a review of the literature was performed. In particular, the results obtained from objective assessment methods were sought.

Materials/Methods: PubMed was searched using the terms (ioert[All Fields] OR IORT[All Fields] OR intraoperative[All Fields]) AND ("breast"[MeSH Terms] OR "breast"[All Fields]) AND (cosmesis[All Fields] OR cosmetic[All Fields] OR ("esthetics"[MeSH Terms] OR "esthetics"[All Fields]) OR ("esthetic"[MeSH Terms] OR "esthetic"[All Fields] OR "esthetic"[All Fields])). Abstracts of all articles were read to eliminate those not relevant to this study. Review articles were read in their entirety to determine if any articles were missed from the initial PubMed search. From the final set of articles, the methods used for intra-operative radiation therapy cosmetic assessment, and results obtained from the assessment, were tabulated. The proportion of patients determined to have Excellent or Good outcome (EG), and the 95% confidence intervals, were calculated.

Results: A total of 184 items were identified by the search, of which 145 were determined from the abstract to be not relevant. 39 publications were read in detail, and included 10 reviews and editorials, 2 studies where either no assessment was made or no radiation therapy given. Of the remaining studies, only 4 reported the use of an objective method of assessment of cosmetic outcome, the others using either subjective or poorly specified methods. One study used a LINAC-based method of delivering the intra-operative radiation therapy, the other three used Intrabeam (the TARGIT technique). Results are shown in the Table.

Conclusion: A minority of reports assessing cosmetic outcomes following intra-operative radiation therapy use objective methods. Such methods should be required as they provide unbiased estimates of outcome.

<table>
<thead>
<tr>
<th>Publication</th>
<th>Method</th>
<th>Proportion EG (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cracco et al (2015)</td>
<td>LINAC-IORT</td>
<td>84 (8) % EBRT</td>
</tr>
<tr>
<td>Keshtgar et al (2013)</td>
<td>Intrabeam-IORT</td>
<td>186 (5) % EBRT</td>
</tr>
<tr>
<td>Grobmyer et al (2013)</td>
<td>Intrabeam-IORT</td>
<td>17186 (5) % EBRT</td>
</tr>
<tr>
<td>Kraus-Tiefenbacher et al (2006)</td>
<td>Intrabeam-IORT</td>
<td>1788 (15) %</td>
</tr>
</tbody>
</table>

SSJ24-06 Evaluation of Axillary Dose Coverage following Whole Breast Radiotherapy: Variation with the Different Radiotherapy Field

Participants
Rong Cai, Oak Brook, IL (Presenter) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): To evaluate dose distribution and coverage of the axilla levels I–III, superior axillary vein lymph nodes(Sup-AV) and inferior axillary vein lymph nodes(infer-AV) area, according to AMAROS field(A), high tangent field(HT), standard tangent field(ST).

Materials/Methods: We retrospectively delineated the axillary levels I–III, Sup-AV and Infer-AV on planning CT-images of 10 patients who treated with breast conservation and whole breast radiotherapy along 2015 in our institution. Every patients were treated using the AMAROS(A), high tangent field(HT), standard tangent field(ST). Mean dose levels and V90(volume receiving at least 90% of the prescribed dose) of every axillary lymph nodes, Sup-AV and Infer-AV were evaluated.

Results: The median dose delivered to level I using A, HT and ST were 42.96Gy, 37.3Gy, 27.9Gy. The median dose delivered to level II using A, HT and ST were 46.4Gy, 26.6Gy, 18.5Gy. The median dose delivered to level III using A, HT and ST were 50.9Gy, 19.1Gy, 10.3Gy. The mean dose delivered to Sup-AV using A, HT and ST were 47.3Gy, 19.4Gy, 6.16Gy. The median dose delivered to Sup-AV using A, HT and ST were 38.8Gy, 17.4Gy, 16.4Gy. The dose of lung V20% using A, HT and ST were 38.8Gy, 16.4Gy, 16.4Gy. Conclusion: AMAROS provide high coverage of axilla I–III but high lung dose coverage. For level I, A and HT had similar dose distribution higher than ST; For level II, AMAROS and HT provide high dose coverage than ST.
Participants

PARTICIPANTS

Dr. Daniela Bernardi

PROGRAM INFORMATION

A 75 minute hands-on workshop: A Clinical Perspective on the use of Contrast Enhanced 2D (CE2D) Mammography. The session includes a brief lecture providing first-hand knowledge and experience in implementing CE2D in an actual clinical environment. Participants will review and score actual case sets, followed by a faculty led review session with correlate ancillary imaging results. (24 Attendees per session) (Hologic I-View™ software available on the Selenia® Dimensions® system)

Registration

http://www.hologic.com/rsna-hologic-workshop-sessions
Participants

PARTICIPANTS

Clemens Kaiser, Mannheim, Germany

PROGRAM INFORMATION

Throughout this interactive hands-on session, participants will develop their interpretive skills through extensive case reviews at workstations equipped with syngo.MR Brevis and under the guidance of an expert tutor. By actively practicing on real cases using different imaging techniques, participants will also learn to avoid pitfalls in interpreting breast MRI.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Participants
Cherie M. Kuzmiak, DO, Chapel Hill, NC, (Cherie_kuzmiak@med.unc.edu) (Moderator) Research Grant, FUJIFILM Holdings Corporation;

LEARNING OBJECTIVES

ABSTRACT

Sub-Events

RC415A  The Nuts & Bolts of DBT Technology

Participants
Stamatia V. Destounis, MD, Scottsville, NY, (sdestounis@ewbc.com) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

ABSTRACT

RC415B  Implementing DBT into Your Practice

Participants
Jocelyn A. Rapelyea, MD, Washington, DC (Presenter) Speakers Bureau, General Electric Healthcare Company; Research consultant, Q-view LLC.; Research consultant, QTUS

RC415C  DBT-Directed Breast Biopsy

Participants
Liane E. Philpotts, MD, New Haven, CT, (liane.philpotts@yale.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

ABSTRACT
Participants
Jean L. Wright, MD, New York, NY (Presenter) Nothing to Disclose
Atif J. Khan, MD, New Brunswick, NJ (Presenter) Consultant, Elekta AB; Consultant, Vertex Pharmaceuticals Incorporated; Speaker, Elekta AB; Speaker, Vertex Pharmaceuticals Incorporated; Research funded, Elekta AB; Research funded, Cianna Medical, Inc

LEARNING OBJECTIVES
1) Know where to locate the available resources for optimal contouring of breast cancer radiation targets. 2) Understand the contouring guidelines in contemporary breast radiation protocols and know standard contouring nomenclature currently used in these studies. 3) Understand how contouring represents a critical component for optimal planning in breast cancer. 4) Carry out contouring on representative CT images for two scenarios: intact breast, and chest wall and regional nodes.
Breast Wednesday Case of the Day

Wednesday, Nov. 30 7:00AM - 11:59PM Room: Case of Day, Learning Center

Participants
Phoebe E. Freer, MD, Salt Lake City, UT (Presenter) Nothing to Disclose
Matthew Stein, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Nicole S. Winkler, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Matthew B. Morgan, MD, Sandy, UT (Abstract Co-Author) Consultant, Reed Elsevier
Anna K. McGow, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Laurie L. Fajardo, MD, MBA, Park City, UT (Abstract Co-Author) Consultant, Hologic, Inc; Scientific Advisory Board, Hologic, Inc; Consultant, Koninklijke Philips NV; Advisory Board, Koninklijke Philips NV; Consultant, Siemens AG; Consultant, FUJIFILM Holdings Corporation; Advisory Board, Galena Biopharma, Inc
Maryam Rezvani, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Scott Harada, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose

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

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Maryam Rezvani, MD - 2015 Honored Educator
**MSES41 Essentials of Breast Imaging**

Wednesday, Nov. 30 8:30AM - 10:00AM Room: S100AB

**BR**

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50

**Participants**

**Sub-Events**

**MSES41A Personalized Breast Cancer Screening**

Participants
Margarita L. Zuley, MD, Pittsburgh, PA, (zuleyml@upmc.edu) (Presenter) Research Grant, Hologic, Inc;​

**LEARNING OBJECTIVES**

1) Understand the role of personal risk, density and age in selecting screening paradigms. 2) Understand the different modalities available for screening of the breast and the rationale of which is best in certain situations.

**MSES41B Case-based Review of Clinical Implementation of Tomosynthesis**

Participants
Emily F. Conant, MD, Philadelphia, PA, (emily.conant@uphs.upenn.edu) (Presenter) Consultant, Hologic, Inc; Consultant, Siemens AG;

**LEARNING OBJECTIVES**

1) Assess the role of tomosynthesis in improving the outcomes of screening and diagnostic breast imaging. 2) Develop strategies to interpret breast tomosynthesis images to improve imaging accuracy.

**ABSTRACT**

Using a case based approach, the author will discuss the clinical implementation of digital breast tomosynthesis for both screening and diagnostic imaging.

**MSES41C Management of High Risk Lesions**

Participants
Karen A. Lee, MD, New York, NY (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Define high risk lesions encountered in percutaneous breast biopsies and list their associated frequencies and upgrade rates. 2) Describe the imaging characteristics associated with high risk lesions. 3) Discuss the suggested management and clinical significance of high risk lesions.

**ABSTRACT**

Active Handout: Karen Ann Lee

**MSES41D Abbreviated Breast MRI: How to Get Started**

Participants
Christiane K. Kuhl, MD, Bonn, Germany (Presenter) Nothing to Disclose
Breast MR Imaging (An Interactive Session)

Wednesday, Nov. 30 8:30AM - 10:00AM Room: N227B

RC515A  Scanning Wisely: Breast MRI Protocols

Participants
Cherie M. Kuzmiak, DO, Chapel Hill, NC, (Cherie_kuzmiak@med.unc.edu) (Moderator) Research Grant, FUJIFILM Holdings Corporation;

LEARNING OBJECTIVES

1) Understand the definition and criteria used to designate a lesion as BI-RADS 3 on MRI. 2) Review the literature on outcomes of lesions designated as BI-RADS 3 on MRI.

ABSTRACT

RC515B  MR BI-RADS 3

Participants
Mary C. Mahoney, MD, Cincinnati, OH (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize common artifacts on breast MRI that may lead to interpretation errors. 2) Review common pitfalls of cross-modality breast imaging.

ABSTRACT

RC515C  Challenging Cases

Participants
Dorota J. Wisner, MD, PhD, San Rafael, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize common artifacts on breast MRI that may lead to interpretation errors. 2) Review common pitfalls of cross-modality breast imaging.
Participants

PARCEIPANTS

Maria Bernathova, Vienna, Austria

PROGRAM INFORMATION

During this hands-on workshop you will learn to evaluate 2D mammography and 3D Breast Tomosynthesis. An expert tutor will lead you through cases that will both fascinate and confound you! All cases have been acquired with Siemens Mammomat Inspiration and are displayed on syngo.Breast Care workplaces so you will also become familiar with the image quality and ease of use of our systems.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Automated Breast Volume Scanner (ABVS) Self-guided Reading Sessions: Siemens Healthineers Vendor Workshop

Wednesday, Nov. 30 10:30AM - 5:00PM Room: Booth 5534

Participants

PROGRAM INFORMATION

With syngo.Ultrasound Breast Analysis (sUSBA) Software, self guided reading sessions with real clinical cases will enable you to become familiar with the coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Contrast Enhanced Mammography: A Practical Perspective: Hologic Vendor Workshop
Wednesday, Nov. 30 10:30AM - 11:45AM Room: Booth 5521

Participants

PARTICIPANTS

Dr. John Lewin

PROGRAM INFORMATION

A 75 minute hands-on workshop: A Practical Perspective on the use of Contrast Enhanced 2D (CE2D) Mammography. The session includes a brief lecture providing an overview of CE2D and its relevance in the diagnosis and treatment of breast cancer. Participants will review and score actual case sets, followed by a faculty led review session with correlate ancillary imaging results. (24 Attendees per session) (Hologic I-View™ software available on the Selenia® Dimensions® system)

Registration

http://www.hologic.com/rsna-hologic-workshop-sessions
Breast Tomosynthesis Self-guided Reading Sessions: Siemens Healthineers Vendor Workshop
Wednesday, Nov. 30 10:30AM - 5:00PM Room: Booth 5534

Participants

PROGRAM INFORMATION

You are invited to our self-guided reading sessions. With syngo Breast Care workstations configured especially to allow you to work at your own place at a time that suits you! A series of breast tomosynthesis cases presented as problem cases with a solution enables you to develop and test your tomosynthesis reading skills.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
RSNA/ESR Hybrid Imaging Symposium: Hybrid Imaging in the Female (An Interactive Session)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: S402AB

BR  GU  MR  NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Alexander Drzezga, MD, Cologne, Germany (Moderator) Consultant, Siemens AG; Consultant, Bayer AG; Consultant, General Electric Company; Consultant, Eli Lilly and Company; Consultant, The Piramal Group; Speakers Bureau, Siemens AG; Speakers Bureau, Bayer AG; Speakers Bureau, General Electric Company; Speakers Bureau, Eli Lilly and Company; Speakers Bureau, The Piramal Group
Katrine Riklund, MD,PhD, Umeå, Sweden, (katrine.ahlstrom.riklund@umu.se) (Moderator) Nothing to Disclose

LEARNING OBJECTIVES

Sub-Events

MSSR42A  Pelvic Tumors

Participants
Farrokh Dehdashti, MD, Saint Louis, MO (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn about different tracers. 2) Understand how to interpret hybrid imaging examinations of the pelvis. 3) Learn about the role of hybrid imaging in staging, treatment evaluation and follow-up.

MSSR42B  Breast Cancer

Participants
Osman Ratib, MD, PhD, Geneva, Switzerland (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn about pathophysiology and relation to different tracers. 2) Understand how to interpret hybrid imaging examinations of the breast. 3) Learn about the role of hybrid imaging in staging, treatment evaluation and follow-up.

ABSTRACT

MSSR42C  Interactive Case Discussion

Participants
Farrokh Dehdashti, MD, Saint Louis, MO (Presenter) Nothing to Disclose
Osman Ratib, MD, PhD, Geneva, Switzerland (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand how to interpret hybrid imaging in female pelvic tumours. 2) Understand how to interpret hybrid imaging in breast cancer. 3) Learn how to avoid common pitfalls.
Breast Imaging (Intervention Path Correlation)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: E450A

AMAPRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Michael A. Cohen, MD, Atlanta, GA (Moderator) Nothing to Disclose
Michael N. Linver, MD, Albuquerque, NM (Moderator) Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, Real Imaging Ltd; Scientific Advisory Board, Seno Medical Instruments, Inc
Paul R. Fisher, MD, East Setauket, NY (Moderator) Research Grant, Siemens AG;

Sub-Events

Unwise Conventional Wisdom: Real Truths About Atypical and Malignant Solitary Papillomas of the Breast

Participants
Sheryl G. Jordan, MD, Chapel Hill, NC (Presenter) Nothing to Disclose
Niyati Mukherjee, MD, Chapel Hill, NC (Abstract Co-Author) Nothing to Disclose
Christine E. Bookhout, Chapel Hill, NC (Abstract Co-Author) Nothing to Disclose
Zane S. Jordan, Chapel Hill, NC (Abstract Co-Author) Nothing to Disclose
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PURPOSE
Radiologists continue to be taught breast atypical and malignant papillomas present with nipple discharge or palpable lump, are peripheral rather than central in locale, that symptomatic patients are at more risk for atypia/malignancy than asymptomatic patients hence require surgical excision, and that peripheral papillomas have predilection to be mammographically occult. Our clinical experience defies each of these; we hence studied characteristics of our institution's ten year experience with these diagnoses.

METHOD AND MATERIALS
IRB-approved, study retrospectively identified all patients with histologic confirmed diagnosis of solitary atypical or malignant papilloma from January 1, 2004 through September 3, 2014 in our CoPath and RadPathConf databases. Diagnoses of papillomatosis and nonsynchronous multiple intraductal papillomas excluded. Remaining cases (N=53) were reviewed multivariate manner. Then study cohort was analyzed against a comparison cohort (N=57) of all institution patients with solitary benign papillomas on core needle biopsy same time frame.

RESULTS
Study cohort solitary papilloma w/ atypia or malignancy on 53 CNB pts: median age 60, range 35-85. 39/53 screening mammo detected 11/53 palpable lump or nipple discharge 3/53 screening MRI. 16/53 central in breast, 37/53 peripheral. Based on CNB results, malignancy was more common central (31%) vs peripheral (19%) papillomas. Both central and peripheral most commonly presented as mammo new mass or asymmetry. 14/47 cases were upstaged to malignancy on surgical excision path. 4/16 central and 10/37 peripheral, with all invasive carcinomas favorable prognosis and luminal molecular subtypes. Comparison cohort solitary benign papilloma 57 CNB pts: median age 48, range 15-78, 30/57 nipple discharge or palpable lump, 10 bloody and 6 nonbloody. 27 screen-detected. 25/57 central and 32/57 peripheral.

CONCLUSION
Study debunks conventional wisdom on patient presentation and imaging findings for at-risk papillomas. Atypia and malignancy were detected more frequently in asymptomatic patients on screening exams, and malignancy in central papillomas. Erroneous physician bias should not hamper care.

CLINICAL RELEVANCE/APPLICATION
In an era of desired turnkey patient care, this study assists radiologists in refining pre- and post-biopsy assessment and management recommendations of breast patients with solitary papillomas.

Cryoablation as a Primary Treatment of Low Risk Breast Cancers in Women 65 and Older: Imaging Findings and Interim Update of the Ice 3 Trial

Wednesday, Nov. 30 10:40AM - 10:50AM Room: E450A

Participants
Kenneth R. Tomkovich, MD, Freehold, NJ (Presenter) Consultant, Scion Medical Technologies, LLC; Scientific Advisory Board, IceCure Medical, Inc; Speaker, Becton, Dickinson and Company, Consultant, Becton, Dickinson and Company
Alexander B. Sevrukov, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Randy D. Hicks, MD, Flint, MI (Abstract Co-Author) Nothing to Disclose

PURPOSE
The Ice3 trial is the first of its kind large scale multi-center trial to assess cryoablation as a primary treatment for breast cancer without surgical resection. We report interim results and imaging findings of this novel approach.

METHOD AND MATERIALS
The goal of this HPIA compliant IRB approved multi-center trial is cryoablation of approximately 150 patients with low risk invasive
The purpose of this HIPAA compliant, multi-center trial is cryoablation of approximately 150 patients with low risk invasive carcinoma of the breast. The study is limited to females age 65 and older with primary, unifocal, biopsy proven cancer measuring 1.5 cm or less. Tumors must be ER+/PR+ or ER+/PR-, HER 2-, and Nottingham grade 1 or 2 with an ultrasound visible target following core needle biopsy. All patients underwent ultrasound guided cryoablation using the IceSense 3 system (IceCure Medical, Ltd.) using local anesthesia. The goal was to create a 1cm visible margin of ice around the tumor during the freeze, thaw, freeze cycles. Patients have the option of post procedure hormone therapy, chemotherapy and radiation therapy as clinically indicated. Patients do not undergo surgical lumpectomy post cryoablation. Patients will be followed by mammography at 6 months then annually for 5 years following ablation.

RESULTS
The trial began enrollment in October 2014. To date, 69 patients have been treated with cryoablation at 11 institutions throughout the United States. Tumor sizes ranged from 3 to 14 mm. Ages ranged from 65-90. There have been no serious adverse events. There has been 100% procedural success to date. 30 patients have reached the 6 month follow up mark and 4 patients have had 12 month follow up imaging. There have been no imaging or clinical findings suggestive of residual or recurrent tumor following treatment. Most common mammographic findings post cryoablation include fat necrosis and “cryo-halo”. The fat necrosis is comparable to that seen post lumpectomy.

CONCLUSION
Cryoablation is safe, well tolerated and easily monitored. To date, there has been 100% initial procedural success. There has been no evidence of residual or recurrent tumor in patients with at least 6 month follow up imaging. Most common imaging findings include fat necrosis and the “cryo-halo” effect. This trial is ongoing.

CLINICAL RELEVANCE/APPLICATION
Interim results suggest that cryoablation is a safe and effective primary treatment for women with low-risk invasive breast cancer and a potential image guided alternative to surgical lumpectomy.

SSK01-03  Canceled MRI-Guided Breast Biopsies: Is Follow-Up Necessary?
Wednesday, Nov. 30 10:50AM - 11:00AM Room: E450A

Awards
Student Travel Stipend Award

Participants
Niveditha Pinnamaneni, MD, New York, NY (Presenter) Nothing to Disclose
Samantha L. Heller, MD, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
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Hildegar B. Toth, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Linda Moy, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE
The purpose of this study was to evaluate the frequency of ipsilateral breast malignancy in patients after a canceled MRI-guided breast biopsy due to nonvisualization of the original lesion.

METHOD AND MATERIALS
This retrospective study is Institutional Review Board approved. Electronic medical records from 1/2007-12/2013 were searched for patients with canceled MRI-guided breast biopsy due to lesion nonvisualization. Imaging studies and medical records were reviewed for patient demographics, MRI lesion characteristics and follow-up imaging. Patients without follow-up data were excluded.

RESULTS
We identified 1403 lesions detected at MRI and scheduled for MR biopsy. 89 (6.3%) were canceled due to nonvisualization of the lesion at biopsy. Follow up imaging was available for 85/89 patients (95.5%). Mean patient age was 47.1 years (range: 23.9-75.9 years). Average follow-up interval was 29.5 months (range: 2.8–80.2 months). In 71/85 patients (83.5%), the abnormality was not seen on follow-up exams. In 14/85 patients (16.5%), the lesion was seen on subsequent studies. For 6/14 patients (42.8%), upon reassessment, the MRI finding was felt to be secondary to background parenchymal enhancement. In 8/14 (57.1%) patients, the original MRI finding was re-identified and underwent biopsy. Six of 8 lesions (75%) were benign, 1/8(12.5%) lesions was high risk carcinoma of the breast. The study is limited to females age 65 and older with primary, unifocal, biopsy proven cancer measuring 1.5 cm or less. Tumors must be ER+/PR+ or ER+/PR-, HER 2-, and Nottingham grade 1 or 2 with an ultrasound visible target following core needle biopsy. All patients underwent ultrasound guided cryoablation using the IceSense 3 system (IceCure Medical, Ltd.) using local anesthesia. The goal was to create a 1cm visible margin of ice around the tumor during the freeze, thaw, freeze cycles. Patients have the option of post procedure hormone therapy, chemotherapy and radiation therapy as clinically indicated. Patients do not undergo surgical lumpectomy post cryoablation. Patients will be followed by mammography at 6 months then annually for 5 years following ablation.

CONCLUSION
Cancer detection rate was 1/85 (1.2%). The incidence of subsequent malignancy is low in patients who have had a canceled MRI biopsy due to nonvisualization, but continued follow-up imaging is warranted.

CLINICAL RELEVANCE/APPLICATION
Although cancer detection rate is low in patients with canceled MRI-guided breast biopsies due to nonvisualization, short-term follow-up MRI within 6-12 months is recommended.

Wednesday, Nov. 30 11:00AM - 11:10AM Room: E450A

Participants
Jose Maria Oliver-Goldaracena, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Carolina Martinez Gamarr, MD, Madrid, Spain (Presenter) Nothing to Disclose
Agustin Andres Mateo, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Vicenta Cordoba Chicote, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Ana Veron Sanchez, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Maria Jose Roca Navarro, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
**PURPOSE**

To review the long-term outcome of percutaneous management of breast papillomas by US-Guided Vacuum-Assisted Removal (US-VA), Sonographic follow-up and US-VA reexcision of residual or recurrent lesions.

**METHOD AND MATERIALS**

Between April 2010 and June 2015, 133 lesions (mean size 11 mm, range 3-43 mm) were removed with US-VA: 90 probably intraductal papillomas (benign intraductal mass within a dilated duct or cyst with Color-Doppler signal or correlation on ductography) and 43 benign papillomas (BP) diagnosed at US-CNB in a consecutive series of 112 patients (mean age 64, range 22-85). Pathological discharge was present in 70 patients while 42 patients were asymptomatic. Patients underwent US follow-up at 1-2 months, 6-8 months and 12-14 months after US-VA and later annual US follow-up. When a residual or recurrent suspicious papilloma (SP) was detected at US follow-up, reexcision by US-VA was performed. Clinical, US follow-up and pathologic outcomes were recorded.

**RESULTS**

At histology, there were 119 benign papillomas (BP), 7 atypical papillomas (AP), 1 papilloma with DCIS, 1 DCIS and 5 cases with no histologic lesions. US follow-up (range 10-72 months, mean 41) was performed in 99 patients with 119 BP and 6 patients with 7 AP. US showed 14 residual SP (range 1-6 months, mean 2) and 9 recurrent SP (range 8-24 months, mean 14) in 21 patients with 23 BP. Reexcision US-VA was performed in 20 SP in 18 patients. In 17 of them, histology showed BP and in 3 fibrosis. In 3 SP (3 patients) reexcision US-VA were not performed. 1 patient with 1 recurrent SP grew inside the nipple and underwent surgical excision that confirmed the diagnosis of BP and 2 SP (2 patients) developed many recurrent papillomas in different locations at 14 and 24 months. Nipple discharge disappeared in all but one of the symptomatic patients (68/69). In this series of 126 papillomas (105 patients), percutaneous management by US-VA removal, US follow-up and reexcision US-VA has been effective in 123 papillomas (102 patients). None were upgraded to DCIS at long term US follow-up or in the setting of residual or recurrent lesions.

**CONCLUSION**

US-VA removal, US follow-up and US-VA reexcision of residual or recurrent lesions allow percutaneous long-term management in most of patients with papillomas.

**CLINICAL RELEVANCE/APPLICATION**

US-VA removal, US follow-up and US-VA reexcision of residual or recurrence lesions is appropriate for the percutaneous management of patients with papillomas at long term.

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**SSK01-05**

**Does Mammographic Calcification Determine Surgical Outcome in HER2 Positive Breast Cancers rather than the response to Neo-Adjuvant Chemotherapy Itself?**

Wednesday, Nov. 30 11:10AM - 11:20AM Room: E450A

Participants

Fayyaz A. Mazari, MSc, PhD, Sheffield, United Kingdom (Abstract Co-Author) Nothing to Disclose
Nisha Sharma, MBChB, Leeds, United Kingdom (Presenter) Nothing to Disclose
Kieran Horgan, Leeds, United Kingdom (Abstract Co-Author) Nothing to Disclose
David Dodwell, Leeds, United Kingdom (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Neo-adjuvant chemotherapy (NAC) is frequently used in treatment of HER2+ breast cancer to downstage the disease and for breast conservation. Mammographic calcification usually represents DCIS and does not resolve after NAC. We wanted to investigate whether HER2+ cancers with mammographic calcification behave differently in their response to NAC.

**METHOD AND MATERIALS**

This was a retrospective review of HER2+ breast cancer patients who underwent NAC from 2007-2015. Data recording included demographics, mammographic appearance, radiological response, surgery & pathological response. Subgroup analysis was performed for presence of mammographic calcification & cancer subtype.

**RESULTS**

89 patients were included. Median age was 49 years (IQR 41-58). 60.7% (N=54) had mammographic calcification. 62.9% (N=56) were luminal B and 37.1% (N=33) were non-luminal HER2+ cancers. Significant radiological response was observed in 53.9% (N=48). 95.5% (N=85) had surgery with 29.5% (N=25) undergoing breast conservation. Pathological complete response (pCR) was observed in 27.1% (N=23) of these patients. 17.6% (N=15) showed residual DCIS only, and 54.1% (N=46) had residual invasive cancer. **a) Subgroup analysis for mammographic calcification:** A significantly low (P=0.033, X2) pCR rate was observed in patients with mammographic calcification (19.2%, N=10) compared to those without it (40.6%, N=13). **b) Subgroup analysis for cancer subtype:** pCR rates in non-luminal HER2+ cancers (46.7%, N=14) were significantly higher (P=0.003, X2) compared to luminal B cancers (16.7%, N=9). Presence of mammographic calcifications significantly reduced the pCR rates in luminal B (9.4% vs 27.3%) and non-luminal (35.0% vs 70.0%) cancers. Likewise, residual DCIS was three times more likely after NAC in luminal B (31.3% vs 9.1%) and non-luminal HER2+ (33.3% vs 10.0%) cancers with mammographic calcification.

**CONCLUSION**

HER2+ cancers with mammographic calcification behave differently to NAC. It is argued that all HER2+ breast cancers should be offered breast conserving surgery at the outset given its response to anti-HER2 & chemotherapy. Our study shows mammographic calcifications should drive the type of surgery rather than the response to chemotherapy.

**CLINICAL RELEVANCE/APPLICATION**

This paper explores the significance of mammographic calcification in treatment planning of HER2+ breast cancer. This can provide the basis for developing breast conservation algorithms in this patient group.

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**SSK01-06**

**Digital Breast Tomosynthesis Vacuum Assisted Biopsy for Tomosynthesis-Detected Sonographically Occult Lesions**

Wednesday, Nov. 30 11:20AM - 11:30AM Room: E450A
To assess the utility of Digital Breast Tomosynthesis Vacuum-Assisted Biopsy (DBT VAB) and pathological results of DBT-detected abnormalities that are occult on 2D mammography and breast ultrasound (US).

**METHOD AND MATERIALS**

This is a HIPAA compliant retrospective review of a prospectively-maintained database of 1116 consecutive stereotactic biopsies performed over 27 months (12/1/13-2/29/16). Two breast radiologists independently assessed each case for the technical feasibility of sampling under DBT VAB versus standard stereotactic (prone or upright) biopsy. DBT VAB was performed in 38 consecutive patients (age range 38-76; mean age 55 years) for 38 non-calcified lesions which were solely detected using DBT and not observed on US. Imaging findings and pathology results were reviewed.

**RESULTS**

Technical success was achieved in 38 of 38 (100%) lesions using DBT VAB. The densities of the patients’ breast tissues were: fatty (5), scattered fibroglandular densities (15), heterogeneously dense (12), and extremely dense (6). The lesion types were: masses (16), architectural distortion (16), and asymmetry (6). Pathologic findings were malignant in 8 of 38 lesions (21%; 95% confidence interval: 8.1%, 33.9%), including 6 invasive malignancies. The malignant lesions appeared on tomosynthesis as masses (5) and distortion (3). High-risk findings (radial scars, ADH, LCIS and papillomas) were found in 14 of 38 lesions, in which 3 were masses and 11 presented as distortion.

**CONCLUSION**

DBT VAB may be easily and successfully performed for the primary evaluation of tomosynthesis-detected lesions that are not readily visible on US or conventional 2D mammography. Furthermore, the majority of DBT VAB cases yield actionable pathologies including high-risk lesions, DCIS, or invasive carcinomas. Therefore, it is paramount to perform DBT VAB primarily when available, or proceed to breast MRI or needle localization to further pursue these tomosynthesis-detected lesions.

**CLINICAL RELEVANCE/APPLICATION**

Digital breast tomosynthesis vacuum-assisted biopsy reliably samples lesions seen only on tomosynthesis and occult on ultrasound and 2D mammography, with the majority of these lesions yielding malignant or high risk pathologies.

**SSK01-07 Clinical, Imaging, and Intervention Factors Associated with Atypia Upgrade in the Setting of Vacuum Assisted Core Needle Biopsy**

**Wednesday, Nov. 30 11:30AM - 11:40AM Room: E450A**

**Awards**

Student Travel Stipend Award

**Participants**

Nikki S. Ariaratnam, MD, Voorhees, NJ (Presenter) Nothing to Disclose
Sherrell T. Little, MD, Glen Mills, PA (Abstract Co-Author) Nothing to Disclose
Markus Whitley, MD, Voorhees, NJ (Abstract Co-Author) Nothing to Disclose
Kristy Ferguson, Voorhees, NJ (Abstract Co-Author) Nothing to Disclose

**METHOD AND MATERIALS**

Between 2012-2015, 363 patients had atypia on VAB, including ultrasound, MRI and stereotactic guided. Patients were excluded if surgical excision was not completed, mastectomy was performed, or if the surgical specimen included the biopsy site for a simultaneously diagnosed malignancy on a separate VAB. An upgrade was defined as obtaining ductal carcinoma in situ (DCIS) or invasive carcinoma on excision. Demographic, imaging, biopsy and pathology characteristics were analyzed for association with upgrade among the 254 cases included in the final review.

**RESULTS**

Of the 254 atypia lesions, 34 (12%) were upgraded at resection. Upgrade rates for each atypia are: 8% (14/160) for FEA, 10% (9 of 80) for ALH, and 17% (25/123) for ADH. The 34 upgraded patients included 25 DCIS, 3 invasive cancers, and 1 mucoepidermoid cancer. 8 patients upgraded had a simultaneously diagnosed cancer in either the same or opposite breast. 11 upgraded patients had core biopsy pathology known to be associated with upgrade, including papilloma and severe ADH. After exclusion of these 19 high-risk patients, only 4 FEA upgrades remain (3%, 4/151). Imaging findings associated with upgrade included segmental distribution of calcifications (45% vs 6%, p < 0.0001) and the presence of a mass (38.3% vs 17.8%, p = 0.006). For stereotactic biopsy of calcifications, having only 0-24% of calcifications removed during biopsy was associated with upgrade (42% vs 9.8%, p=0.0008). Patients with a personal history of breast cancer were more likely to be upgraded (20.6%), compared to those without a cancer history (11%, p=0.018).

**CONCLUSION**

In the absence of personal history of breast cancer, segmental calcifications, mass lesion, concurrent cancer or papilloma there is a
low FEA upgrade rate, which may allow follow-up without excision. ADH and ALH should be excised because of higher upgrade rates.

**CLINICAL RELEVANCE/APPLICATION**

The upgrade rate following vacuum assisted biopsy of Flat Epithelial Atypia is low. Clinical, imaging, and intervention characteristics are useful for determining which cases should be excised.

**SSK01-08 What Happens After a Diagnosis of High Risk Lesion at Stereotactic Biopsy? - A Look At Breast Imaging Compliance and Outcomes**

Wednesday, Nov. 30 11:40AM - 11:50AM Room: E450A

**Awards**

**Student Travel Stipend Award**

**Participants**

Marissa L. Albert, MD, MSc, New York, NY (Presenter) Nothing to Disclose

Yiming Gao, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

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Alana A. Lewin, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

Hildegard B. Toth, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

Samantha L. Heller, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To assess compliance for subsequent annual screening mammography following diagnosis of high risk lesions at stereotactic biopsy with or without surgical excision.

**METHOD AND MATERIALS**

This IRB-approved HIPAA compliant study included 208 patients (mean age 53, range 31-81) who underwent a stereotactic biopsy between 1/2012-12/2014, yielding high risk lesions. Subjects with upgrade to cancer at surgical excision who had mastectomies (n=5) were excluded. Post diagnosis compliance to annual mammography (defined as within 9-18 months of biopsy) was compared to date-matched baseline annual mammographic screening compliance acquired from a dataset of 34,339 studies performed during 1/2012-12/2014 at the same institution. Post biopsy clinical notes were reviewed to identify patient care by a breast surgeon. Statistical analysis was performed.

**RESULTS**

Of 34,339 screening mammograms, 831/34339 (2.42%) were recommended for stereotactic biopsy. 208/831 (25%) were high risk lesions at stereotactic biopsy (Table.1), 140 (67.3%) lesions underwent surgical excision with 11.4% (16/140) upgrade to cancer (12 DCIS, 4 IDC). Excluding five mastectomy patients, 135/203 (66.5%) underwent surgery and 68/203 (33.5%) did not. The overall post-high-risk-diagnosis compliance to annual mammography of 57.1% (116/203) is similar to 56.3% among control patients who had a normal screening mammogram. Of note, compliance is significantly higher (94/135; 69.6%) in the surgical group as compared to the non-surgical group (22/68; 32.4%)(p<0.001). Among non-surgical patients, those compliant with 1 year mammogram (17/22; 77.3%) are significantly more likely to have seen a breast surgeon than the non-compliant (10/29; 34.1%) (p=0.004).

**CONCLUSION**

Diagnosis of a high risk lesion at stereotactic biopsy did not compromise subsequent annual mammographic screening overall. Patients without surgical excision who did not undergo a surgical consultation had significantly lower subsequent imaging compliance as compared to their counterparts who underwent surgery, suggesting specialist care may be important in ensuring adherence to imaging recommendations.

**CLINICAL RELEVANCE/APPLICATION**

Patients with high risk lesions are at increased risk for breast cancer. Educating patients and physicians is important to ensure adherence to annual mammography in those who do not undergo surgery.

**SSK01-09 Non-Palpable Breast Lesion Localization and Excision Utilizing SAVI SCOUT: A Single Institution Analysis of Patient Outcomes**

Wednesday, Nov. 30 11:50AM - 12:00PM Room: E450A

**Participants**

Victoria Mango, MD, New York, NY (Presenter) Nothing to Disclose

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Lauren C. Friedlander, MD, White Plains, NY (Abstract Co-Author) Nothing to Disclose

Ameer Gomberawalla, New York, NY (Abstract Co-Author) Nothing to Disclose

Sheldon Feldman, New York, NY (Abstract Co-Author) Nothing to Disclose

Richard S. Ha, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To evaluate outcomes of SAVI SCOUT guided localization and excision of non-palpable breast lesions.

**METHOD AND MATERIALS**

An IRB approved HIPAA compliant retrospective review of 77 SAVI SCOUT (® Cianna Medical) cases was performed. A non-radioactive, infrared-activated, electromagnetic wave reflector was percutaneously inserted adjacent to/within 77 non-palpable breast targets in 68 patients utilizing image guidance 0-8 days preoperatively. Target/reflector were surgically localized utilizing an electromagnetic wave/infrared light emitting handpiece. Target/reflector removal was verified with handpiece specimen
interrogation, specimen radiography and pathology. Distance between target and reflector on mammogram and specimen radiograph was recorded in addition to reflector distance from the skin. Final specimen pathology including margins was reviewed. Re-excision rates and complications were recorded.

RESULTS

77 reflectors were placed using sonographic (22/77) or mammographic (55/77) guidance. Mean target-reflector distance on mammography was 0.3 cm. 77/77 (100%) targets/reflectors were excised. Final pathology yielded 42 malignancies (avg 0.9 cm; 25 IDC, 1 ILC, 15 DCIS, 1 papillary ca), 20 high risk lesions and 15 benign results. 67/77 (87%) specimen radiographs demonstrated a target-reflector distance compared with post-procedure mammogram within 0.5 cm. 3/77 (4%) specimens demonstrated a >1.2 cm increased target-reflector distance on specimen radiograph compared with post-procedure mammogram. Average reflector depth on post-procedure mammogram was 2.6 cm (range 0.3-6.3 cm) and 1.3 cm (range 0.5-2.8 cm) on ultrasound. No procedural complications were identified. 3 patients required re-excision for positive margins. 7 patients had 2 reflectors placed in one breast, 1 patient had 3 reflectors placed in one breast. Reflectors were placed at minimum 2.6 cm apart.

CONCLUSION

The SAVI SCOUT surgical guidance system is an accurate method to localize and excise non-palpable breast lesions with acceptable margin positivity and re-excision rates. Bracketing is possible with reflectors as close together as 2.6 cm. Reflector migration is observed in a small percentage of cases; however targets were still successfully excised.

CLINICAL RELEVANCE/APPLICATION

Wire guided excision of non-palpable breast lesions has disadvantages overcome with I-125 seed localization. SAVI SCOUT provides a non-radioactive alternative with comparable patient outcomes.
Participants
Regina J. Hooley, MD, New Haven, CT (Moderator) Consultant, FUJIFILM Holdings Corporation; Consultant, Siemens AG
Paula B. Gordon, MD, Vancouver, BC (Moderator) Stockholder, OncoGenex Pharmaceuticals, Inc; Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, Real Imaging Ltd
Nariya Cho, MD, PhD, Seoul, Korea, Republic Of (Moderator) Nothing to Disclose

SUB-EVENTS

SSK02-01 Breast Imaging Keynote Speaker: Update on Screening Ultrasound

Participants
Regina J. Hooley, MD, New Haven, CT (Presenter) Consultant, FUJIFILM Holdings Corporation; Consultant, Siemens AG

SSK02-02 Should the Axilla Be Included in Screening Ultrasound?

Participants
Su Hyun Lee, MD, PhD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Ann Yi, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jung Min Chang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Nariya Cho, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Woo Kyung Moon, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the outcome of routine bilateral axillary scanning while performing supplemental screening ultrasound (US).

METHOD AND MATERIALS
This retrospective study was approved by our institutional review board and the requirement for written informed consent was waived. Between January 2012 and December 2014, 20327 supplemental screening US examinations were performed in 13056 women with negative mammograms at a single health screening center. Bilateral whole breast US examinations were performed with a handheld device by experienced radiologists and bilateral axillary regions were routinely scanned and representative images were documented. The abnormal interpretation rates, cancer detection rates, and positive predictive values (PPVs) of supplemental screening US for the breasts only and both breasts and axillae were calculated, respectively.

RESULTS
Of 13056 women, 12624 (97%) were at low risk and 432 (3%) were at intermediate-to-high risk for breast cancer. Bilateral whole breast US showed positive results in 1715 exams (abnormal interpretation rate, 8.4% [1715/20327]) and detected 27 breast cancers (cancer detection rate, 1.3 per 1000 exams) with PPV1 (abnormal interpretation) of 1.6% (27/1715) and PPV3 (biopsy performed) of 7.8% (23/295). Bilateral axillary US showed positive results in 46 exams (with negative results on bilateral whole breast US in 34 exams; positive results on bilateral whole breast US in 12 exams) which yielded no malignancy by follow-up (n=33), core needle biopsy (n=12), or fine needle aspiration (n=1). The abnormal interpretation rate of supplemental screening US for the both breasts and axillae minimally increased to 8.6% [1749/20327]. The PPVs slightly decreased (PPV1, 1.5% [27/1749]; PPV3, 7.5% [23/307]) without changes in the cancer detection rate.

CONCLUSION
Routine bilateral axillary scanning had no effects on the cancer detection rates of supplemental screening US, however increased false-positive findings.

CLINICAL RELEVANCE/APPLICATION
Routine bilateral axillary scanning is unnecessary for supplemental screening US. Automated breast volume scanner, which cannot cover axillary regions, could be used for supplemental breast screening.

SSK02-03 Decreasing Short-term Interval Follow-up and Biopsies by Following BI-RADS Category 3 Lesions at 1 Year, A Prospective Study: Preliminary Results

Participants
Richard G. Barr, MD, PhD, Youngstown, OH (Presenter) Consultant, Siemens AG; Consultant, Koninklijke Philips NV; Research Grant, Siemens AG; Research Grant, SuperSonic Imagine; Speakers Bureau, Koninklijke Philips NV; Research Grant, Bracco Group; Speakers Bureau, Siemens AG; Consultant, Toshiba Corporation; Research Grant, ESAOTE SpA; Research Grant, B and K Ultrasound; Research Grant, Hitachi Aloka Ultrasound
Federica Manzoni, PhD, Pavia, Italy (Abstract Co-Author) Nothing to Disclose
Annalisa DeSilvestri, PhD, Pavia, Italy (Abstract Co-Author) Nothing to Disclose
Carmine Tinelli, MD, MSC, Pavia, Italy (Abstract Co-Author) Nothing to Disclose
Supplemental breast US in dense breasts can detect cancers not identified on mammography. However the large number of short-term interval follow-ups and low PPV3 are not cost effective. The majority of these are due to BI-RADS 3 (B3) lesions with an incidence of cancer of less than 1%. This prospective study evaluates the effect of following B3 lesions detected on supplemental ultrasound at 1 year.

**METHOD AND MATERIALS**

Patients with BI-RADS 1 or 2 screening mammogram with density 3 or 4 of any risk were asked to receive a free automated volume whole breast supplemental ultrasound (AVBS) in this HIPPA compliant study. The AVBS was performed on a Siemens S2000 using a 15cm L14-5 transducer. AVBS was read by a radiologist with 2 years experience with AVBUS and 20 years of breast US experience. AVBS scans were read as BI-RADS 1, 2, 3, or 0. Category 0 patients were scheduled for a hand held breast US (HH) of the abnormality. Patients were followed for 2 years.

**RESULTS**

Of 19,417 patients receiving a screening mammogram S333(30%) had density 3 or 4 breasts and asked to participate in the study. 1412 (24.2%) agreed to participate in the study (50 yo mean, range 31 to 90), (93.1% average risk (1314/1412), 6.9% (98/1412) high risk). The AVBS was interpreted as BI-RADS 1 (B1) in 748 (53%), BI-RADS 2 (B2) in 345 (24.4%), BI-RADS 3 (B3) in 265 (18.8%) and BI-RADS 0 (B0) in 54 (3.8%). Of the 265 B3 patients, 176 had 1-year follow-up and were cancer free 0% (95% CI: 0-2.1%), 85 had 2-year follow-up and were cancer free 0% (95% CI: 0-4.2%). Of the 54 B0 patients, (recall rate 3.8%; 95% CI: 2.9-5.0%) on HH 9 (16.7%) were B1 (artifacts), 39 (72.2%) were B2, 0 (0%) were B3, 4 (7.4%) were B4, and 2 (3.7%) were B5. The B4 and 5 lesions were biopsied and 2 B4A lesions were fibroadenomas, 2 B4C lesions were IDC, and 2 B5 lesions were IDC. The biopsy rate was 0.4% (6/1412) (95% CI: 0.2-0.9%) with a positive biopsy rate (PPV3) of 66.7% (4/6). The supplemental ultrasound detected 2.8/1000 additional cancers (4/1412) (95%CI: 0.7-7.2/1000).

**CONCLUSION**

Following B3 lesions at 1 year substantially decreases the recall rate (8.8% (233/2637) ACRIN 6666 to 3.8% (54/1412)) (p<0.001) and increases the PPV3 (8.9% (21/235)ACRIN 6666 to 66.7% (4/6)) (p<0.001) without substantial cancer misses.

**CLINICAL RELEVANCE/APPLICATION**

Following B3 lesions at 1 year interval substantially decreases the recall rate and increases the PPV without cancer misses.

**SSK02-04 Faster Evaluation of Automated 3D Breast Ultrasound using Computer Aided Detection without Compromising Accuracy**

**Wednesday, Nov. 30 11:00AM - 11:10AM Room: E451A**

**Participants**

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**PURPOSE**

Automated 3D breast ultrasound (ABUS) has been shown to increase cancer detection as a supplement to mammography. Nevertheless, ABUS consists of multiple views per breast and therefore reading ABUS may be relatively time-consuming and cancers may be overlooked. We investigated whether dedicated computer aided detection software improves reading performance and reduces reading time (RT) of breast radiologists reading ABUS.

**METHOD AND MATERIALS**

The need for informed consent was waived by the IRB. 120 unilateral ABUS exams (378 views) (SIEMENS, Erlangen, Germany) of women with heterogeneously or extremely dense breasts were randomly selected from a large imaging archive. We included 30 malignant cases (two-third mammography negative), 30 benign cases and 60 normal exams. All cases had histological verification or >2 years of negative follow up. Eight dedicated breast radiologists, with 0-7 years of experience with ABUS, were asked to read all cases once conventionally and once using a CAD-based (Qview, Medical, Los Altos, Ca, USA) step-by-step screening workflow in a dedicated workstation developed for this study. Readers underwent a short training in using the CAD-software. Reading sessions were at least 8 weeks apart and the reading modes and order of the cases were randomized for each reader. Suspicious findings were scored using the BI-RADS scoring system and a likelihood scale from 0-100. Multi-case-multi-reader AFROC analysis was used to evaluate reader performance. T-tests were used to compare RT. McNemar test was used to compare sensitivity and specificity.

**RESULTS**

The mean AUC for conventional ABUS reading was 0.82 and this remained unchanged at 0.83 using CAD (p=0.29). Specificity improved in 7/8 readers (p<0.0001) while sensitivity decreased minimally in 2/8 readers. Mean RT decreased from 153.8s (SD 78.6) to 133.4 (SD 61.9) (p<0.001).

**CONCLUSION**

Evaluating ABUS examinations using a CAD-based reading workflow is significantly faster than conventional ABUS reading, while the accuracy is maintained.
CLINICAL RELEVANCE/APPLICATION

Using dedicated CAD-software for automated 3D breast ultrasound may improve the efficiency of supplemental ABUS screening in women with dense breasts.

SSK02-05  Large 1000 Case Reader Study of Radiologists' Performance in Reading Automated Breast Ultrasound (ABVS) Images with the Aid of a Computer Aided Detection (CADe) System

Wednesday, Nov. 30 11:10AM - 11:20AM Room: E451A

Participants
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PURPOSE

We investigated the effectiveness of using a CADe system as an aid for radiologists in reading ABVS images (Siemens).

METHOD AND MATERIALS

The study was conducted as a retrospective observer study. A total of 1000 cases were selected from ABVS exams acquired in our institution in 2012. Among those cases were 206 cancer, 486 benign, and 308 normal cases. The cancer cases were consecutive, the benign and normal cases were randomly selected. All cancer and benign cases were confirmed by biopsy or surgery and normal cases were confirmed by 2-year follow-up.

The CADe system used was the QVCAD System from QView Medical, Inc, Los Altos, California, USA. It is designed to aid radiologists in searching for suspicious areas in the ABVS images. The QVCAD results are presented to the reader simultaneously with the ABVS images, i.e. the radiologist read the ABVS images concurrently with the QVCAD results.

RESULTS

The AUC of all readers were 0.784 for reading with QVCAD and 0.747 without QVCAD. AUCs with and without QVCAD are 0.833 and 0.829 for A, 0.757 and 0.696 for B, 0.759 and 0.718 for C. All the differences in AUCs are statistically significant (p < 0.05), except for A. The average reading time was 10% faster with the aid of QVCAD for all readers.

CONCLUSION

QVCAD improves radiologist performance in both accuracy and reading time for the detection of breast cancer using ABVS, especially for those inexperienced with ABVS.

CLINICAL RELEVANCE/APPLICATION

QVCAD can potentially improve breast cancer detection using ABVS.

SSK02-06  Patient Risk Analysis of Malignancy Initially Identified at Screening Breast Ultrasound

Wednesday, Nov. 30 11:20AM - 11:30AM Room: E451A

Participants
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PURPOSE

To determine whether screening breast ultrasound is predominantly finding malignancy in high or average risk women.

METHOD AND MATERIALS

A retrospective chart review was conducted from 6/1/2013 to 3/10/2016 of malignant lesions identified on a screening ultrasound examination. Women with dense breast tissue were notified of their density and made aware that additional screening with breast ultrasound was available. All women who were found to have sonographically detected malignancies were further analyzed by determining their lifetime risk of breast cancer calculated at the time of diagnosis using the Tyrer-Cuzick risk calculator version 7.02. Lifetime risk of breast cancer was also calculated for a random sample of 50 age-matched screening mammography detected malignancies, normal screening breast ultrasound patients and normal screening mammogram patients. The risk factors were evaluated to determine if a correlation could be found between US only cancers and patients at increased risk of breast cancer.

RESULTS

6,706 screening ultrasound procedures were performed from 6/1/2013 to 3/10/2016. 29 sonographically detected cancers were found in 27 women with an average patient age of 62. Our cancer detection rate was 4.3 / 1000 with 29 of 141 biopsies (20.6%) revealing malignancy. Cancer diagnoses included 20 invasive ductal carcinoma, 5 invasive lobular carcinoma, 1 ductal carcinoma in-situ, and 3 metastatic axillary lymph nodes. 37.5% of the malignancies were found in women with a 20% or higher lifetime breast cancer risk on the Tyrer Cuzick model. An additional 6 malignancies occurred in women with a personal history of breast cancer.
Comparison with age-matched patients showed 17.7% of patients undergoing screening mammography and 18.4% of patients electing to undergo screening ultrasound at our facility had a 20% or higher lifetime risk of breast cancer. Additionally, 33.3% of screening mammography detected malignancies were found in women at an elevated lifetime risk greater than 20% and another 7 women had a personal history of malignancy.

**CONCLUSION**

Screening breast ultrasound finds malignancy in average and high risk patients in a similar fashion to screening mammography, with 37.5% and 33.3% of cancers occurring in high risk patients, respectively.

**CLINICAL RELEVANCE/APPLICATION**

Screening breast ultrasound performed for dense breast tissue finds mammographically occult cancer in both high risk and average risk women.

**SSK02-07 Can Acoustic Radiation Force Impulse Imaging Aid in the differentiation of Benign from Malignant Breast Lesions?**

**Participants**

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**PURPOSE**

To evaluate the added value of Acoustic Radiation Force Impulse (ARFI) imaging with Virtual Touch IQ (VTIQ) compared to B-mode breast ultrasound as well as to identify “rule-in” and “rule-out” thresholds for the probability of malignancy.

**METHOD AND MATERIALS**

189 patients with 196 sonographically evident lesions were included in this retrospective, IRB-approved study. B-mode and quantitative ARFI images with VTIQ of each lesion were obtained. 4 radiologists independently reviewed all B-mode images and assigned a BI-RADS score. Subsequently the VTIQ images were reviewed and a new BI-RADS score for each lesion was assigned. ROC-curve analysis was used to calculate the diagnostic performance of B-mode and ARFI imaging as well as to specify “rule-in” and “rule-out” thresholds for the probability of malignancy. The standard of reference was either histopathology or follow-up stability for >18 months.

**RESULTS**

84 lesions were malignant and 112 benign. The combined B-mode and ARFI imaging reading showed a tendency towards better accuracy for most of the readers (AUC 0.873-0.914 vs. 0.851-0.900 respectively), a finding that didn't reach statistical significance. All readers reported a higher diagnostic confidence through the combined reading. The application of a “rule-out” Shear Wave Velocity (SWV) cutoff value of 1.9m/s led to a sensitivity of 98%, whereas a “rule-in” SWV cutoff value of 6.5m/s suggested a probability of malignancy of >95%.

**CONCLUSION**

ARFI imaging with VTIQ can aid in the differentiation of malignant from benign breast lesions and raise the diagnostic confidence of the examiner. The application of “rule-in” and “rule-out” thresholds is feasible.

**CLINICAL RELEVANCE/APPLICATION**

ARFI imaging with VTIQ, a novel sonographic elastography technique, provides data, valid for the differentiation of benign and malignant breast lesions. Application of “rule-in” and “rule-out” cutoff values has the potential to reduce unnecessary breast biopsies.

**SSK02-08 Outcomes of Screening US-detected Breast Cancers**

**Participants**

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**PURPOSE**

To investigate outcomes of mammography-negative and ultrasound (US)-detected breast cancers in asymptomatic women.

**METHOD AND MATERIALS**

Among women who received surgery for breast cancers from Jan 2004 to Mar 2011 at three institutions, asymptomatic women who had mammography-negative and US-detected breast cancers were identified. Women with personal history of breast or other organ cancer or women with <5 years of follow-up period after surgery were excluded. Finally, a total of 438 women (mean age, 48.0 years; range, 27-74) were included. Three hundred and sixty six (83.6%) had invasive cancers and 72 (16.4%) had ductal carcinoma in situ (DCIS). Three hundred and eighty five (87.9%) received breast conserving, 53 (12.1%) received total...
mammary and 362 (82.6%) received adjuvant endocrine therapy. Of 366 invasive cancers, 51 (13.9%) had lymph node metastases and 176 (48.1%) received chemotherapy. Of 366 invasive cancers, 291 (79.5%) were TNM stage I, 65 (17.8%) were stage II, and 10 (2.7%) were stage III. Invasive cancers were classified as 291 (79.5%) hormone receptor (HR)-positive/HER2-negative, 22 (6.0%) HR-positive/HER2-positive, 17 (4.6%) HR-negative/HER2-positive, and 36 (9.8%) triple negative. Kaplan-Meier analysis was performed to calculate recurrence-free survival (RFS). Cox proportional hazard analysis was performed to determine the patient and disease characteristics associated with recurrence.

RESULTS

At a median follow-up of 7 years (range, 5-12 years), there were 13 recurrences. The 5-year RFS was 98.2% and 10-year RFS was 97.0%. Among 13 recurrences, 10 were invasive cancers (6 in contralateral breast, 2 in remnant breast and 2 distant metastasis in lung), and 3 were DCIS (2 in contralateral breast and 1 in remnant breast). There were no deaths. In women with invasive cancers, triple negative (Hazard ratio, 4.742; 95% confidence interval, 1.215-18.515, P=0.025) was independently associated with recurrence in multivariate analysis adjusting for TNM stage and histologic grade.

CONCLUSION

Clinical outcome of mammography-negative and US-detected breast cancers was favorable. Triple negative subtype was independently associated with recurrence in women with invasive breast cancers.

CLINICAL RELEVANCE/APPLICATION

Most women with US-detected breast cancers have an excellent outcome. Tumor subtype may identify patients with high risk for recurrence.

PURPOSE

To prospectively evaluate the clinical utility of whole breast screening ultrasound (WBUS) in women undergoing digital breast tomosynthesis (DBT.)

METHOD AND MATERIALS

This is a prospective IRB approved trial recruiting asymptomatic women scheduled for a screening DBT and WBUS within 30 days of one another. Between July 2014 – March, 2016, 560 women enrolled. The DBT and WBUS were performed at the same visit and interpreted independently by 2 radiologists blinded to the other modality. Once final recommendations for each modality were recorded, the patient was managed per standard institutional practice after integrating findings of both studies. The cancer detection rate, PPV3 of biopsy, and risk factors (breast density, family history (FH), personal history (PH), BRCA status, prior high risk lesion) were recorded.

RESULTS

Mean patient age was 56 years (range: 30-84). 417/560 (74%) of women had dense breasts. 184 (33%) had no additional risk factors, 127 (23%) a PH of breast cancer, and 96 (17%) a FH in a 1st degree relative. 75 (13%) women had >1 additional risk factor. 3 cancers (2 IDC, 1 DCIS) were detected for a cancer detection rate of 5/1000. The two node negative IDCs (mean size: 0.7 cm) were seen on the 2D images, tomosynthesis images, and WBUS. 1 case of DCIS was detected only on the tomosynthesis images and WBUS. The PPV3 was 19% for DBT and 27% for WBUS. The addition of tomosynthesis views reduced the number of recalls from the 2D mammographic views by 15%.

CONCLUSION

Both DBT and WBUS increase the cancer detection rate compared to a 2D mammogram. However, no additional cancers were detected on WBUS compared to DBT. The addition of tomosynthesis images had the added benefit of reducing the recall rate by 15%.

CLINICAL RELEVANCE/APPLICATION

The clinical value of WBUS may be reduced in women undergoing DBT compared to a 2D mammogram.
**PURPOSE**

The current technology of intravenous 3D digital subtraction angiography (IV 3D-DSA) requires a pre-contrast mask scan and a contrast-enhanced (i.e. filled) scan, which prolongs the total data acquisition time, making the images more sensitive to involuntary patient motion and potentially increasing radiation dose. In this work, a new technique was developed to generate high quality IV 3D-DSA images from a single sweep C-arm cone beam CT (CBCT) data acquisition without the mask scan.

**METHOD AND MATERIALS**

A newly developed image reconstruction technique, Synchronized Multi-Artifact Reduction with Tomographic Reconstruction (SMART-RECON), enables four sub-image volumes to be generated from a single 200 degree filled scan. Each sub-image volume corresponds to a super short segment of the projection data, but without suffering from limited view angle artifacts. The first virtual nonenhanced sub-image volume is subtracted from the sub-image volume corresponding to peak contrast enhancement, generating the desired IV 3D-DSA images without the mask scan. The proposed method was applied retrospectively to filled standard-of-care (SOC) IV-DSA datasets of 15 human subjects with various neurovascular pathologies such as aneurysms; SOC images generated with both mask and filled scans were used to benchmark imaging performance.

**RESULTS**

Mask-free IV 3D-DSA images of the 15 human subjects were successfully generated with no noticeable limited view angle artifacts. Requiring just half the radiation dose, these images demonstrated arguably better image quality, as they were less prone to artifacts arising from inter-scan involuntary patient motions and mis-registration. The noise standard deviations measured in the mask-free SMART-RECON images are 3±1 HU, compared with 13±5 HU of SOC images. The CNR values of SMART-RECON and SOC images are 38±10 and 9±3, respectively. The subjective conspicuity of neurovascular abnormalities such as aneurysms was improved in the SMART-RECON images.

**CONCLUSION**

High quality IV 3D-DSA can be generated from a single C-arm CBCT data acquisition to reduce overall image acquisition time, reduce artifacts associated with inadvertent patient motion, and reduce radiation dose by a factor of two.

**CLINICAL RELEVANCE/APPLICATION**

Intraoperative IV 3D DSA plays an important role in neurointerventions. The proposed method relaxed the need for two separate (mask+fill) scans, therefore reducing motion artifacts and radiation dose.
to estimate organ doses and the associated radiation-induced risks for a cohort of orthognathic patients, referred for a head CT either in a multi slice CT scanner (MSCT) or in a dental cone beam CT (CBCT) scanner for surgery planning purposes.

**METHOD AND MATERIALS**

An EGSnrc-based-Monte-Carlo (MC) framework was used to calculate organ doses in the ICRP-female voxel phantom for a dedicated photon-counting breast CT system (Somatom Definition Flash, Siemens, DE) and for full skull protocols in dental CBCT systems (Promax-3D-Max, Planmeca, FI and VGi-evo, Newtom, IT). The maximum organ dose protocol was carried out at 120 kVp, with a collimation of 64x.0.6mm, a pitch of 0.8 and 3D tube-current-modulation (TCM) mode with a quality reference 125mA (CareDose4D). Promax-3D-Max employs a 230x260 mm² FOV (diameter x height) along with a stitching technique and fixed current during rotation at 96 kW whereas VGi-evo (Newtom, IT) employs a 240x190 mm² FOV and rotational TCM at 110Kv. An anthropomorphic phantom (SK 150, The Phantom Laboratory) was scanned to extract the TCM curves in Somatom Definition Flash and in VGi-Evo. TCM was implemented in the MC-framework via dose-integral weighting factors. Doses were calculated for the aforementioned quality reference mAs in MSCT, for the entire range of available modes (mAs levels) of the specific protocol in Promax-3D-Max and for the Normal /regular dose mode in VGi-evo.

**RESULTS**

The effective dose (ED) in Somatom Definition Flash was 1.13mSv. The dose to thyroid (245µSv), salivary glands (183µSv) and oral mucosa (181µSv) contributed most to the total risk. In Promax-3D-Max the ED ranges from 85µSv to 1.09 mSv depending on the operation mode (mAs-settings), whereas for VGi-evo the ED was 265µSv. Compared to MSCT, the dose delivered to most radiosensitive organs in dental CBCT, for normal dose operation modes, was three times lower. The absorbed dose to eye lenses was 13.5 mGy in MSCT, 1.8S to 24 mGy in Promax-3D-Max and 5.0S mGy in VGi-evo.

**CONCLUSION**

Full-head dental CBCT scans deliver lower organ doses and are associated with lower EDs compared to MSCT scanners.

**CLINICAL RELEVANCE/APPLICATION**

For orthognathic surgery planning purposes, switching from MSCT imaging to CBCT imaging is justified, since head CBCT exams deliver lower radiation doses and are associated with lower risks.

**SSK16-03 Comparative Assessment of High- and Low-Contrast Detectability Performance in Digital Mammography, Breast Tomosynthesis, and Dedicated Photon-Counting Breast Computed Tomography: A Phantom Study**

*Wednesday, Nov. 30 10:50AM - 11:00AM Room: S403B*

**Participants**

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**PURPOSE**

Projection imaging such as digital mammography (DM) suffers from superimpositions, especially in dense breasts. Breast tomosynthesis (BT) and dedicated breast computed tomography (BCT) try to overcome this disadvantage. The study compared the performance of DM, BT, and BCT in detecting high- and low-contrast objects with and without superimposing structures as a function of average glandular dose (AGD).

**METHOD AND MATERIALS**

The performance of DM and BT using standard clinical systems and protocols was compared to a novel photon-counting BCT (pcBCT). Two breast-equivalent phantoms mimicking a compressed breast (for DM/BT) and a pendant breast (for pcBCT) were used. Both phantoms offer cubic (4 cm)³ cavities to be filled with up to 64 cubic (1 cm)³ breast equivalent inserts. Structures of varying size (130–530 µm calcifications (µCa), 1–8 mm lesions) and shape (spheres and fibrils) were embedded in 16 inserts. These 16 test structures were arranged randomly in one or two transverse planes of interest (POI). The positions of the POIs were varied in different distances to the phantom border and to each other. Superimpositions were simulated by placing organic structures above and below the POIs. Images were acquired with and without superimpositions using AGD levels from 1 to 10 mGy. Receiver operating characteristics were determined for five observers with respect to the detectability of the test structures.

**RESULTS**

The detection rates for test structures without superimpositions were similar in DM, BT and pcBCT for AGD below 5mGy: detection of 2 mm lesions in BT and pcBCT, 4 mm in DM; detection of 160 µm µCa in pcBCT, 250 µm in DM and BT. When superimposing structures were present the detection rates remained constant in pcBCT. They were superior compared to DM and BT especially regarding low contrast objects: detection of 2 mm lesions in pcBCT, no lesion detection in DM and BT; detection of 160 µm µCa in pcBCT, 250 µm in BT, and 530 µm in DM.

**CONCLUSION**

BT showed higher performance than DM. pcBCT outperformed DM and BT due to superior detectability performance for calcifications and low-contrast objects owing to higher image contrast and the absence of superimpositions.

**CLINICAL RELEVANCE/APPLICATION**

pcBCT offers the opportunity to increase sensitivity and specificity in early detection of breast cancer and thus the potential to improve the diagnostic accuracy compared to DM and BT.
To evaluate technical and patient dose indicators and to provide dosimetry approaches for high-resolution photon-counting spiral breast CT (pcBCT).

**METHOD AND MATERIALS**

Measurements were performed on a pcBCT (CT Imaging GmbH, Erlangen, Germany), using 60 kV, 3 mm Al filtration, 30 mm axial collimation and spiral scan mode offering 100 µm spatial resolution. As technical dose indicator, the weighted computed tomography dose index (CTDIw) was measured according to IEC 60601-2-44 using a PMMA phantom 160 mm in diameter and 150 mm in length and a calibrated 100 mm long pencil ionization chamber (type 30009, PTW, Freiburg, Germany). From this, volume CTDI (CTDIvol) and dose length product (DLP) were calculated. Additionally, the CTDI free in air (CTDIAir) and air kerma in the isocenter were assessed. As patient dose indicators, the average glandular dose (AGD) and the effective dose (E) according to ICRP publication 103 were determined. For this, conversion factors of AGD per air kerma and E per air kerma were calculated for different breast phantoms using Monte Carlo software (ImpactMC, CT Imaging GmbH, Erlangen, Germany) taking the system geometry, x-ray spectrum, scan trajectory, breast size and patient body size into account. Using measured air kerma values, AGD and E for the scan protocol in question were calculated for the individual breast examined.

**RESULTS**

Measurements of technical dose indicators: CTDIw was 10.6 mGy per 100 mAs, and CTDIAir was 20.5 mGy per 100 mAs. Simulations of patient dose indicators: AGD was 0.29 to 0.48 mGy and E was 0.039 to 0.059 mSv per 1 mGy air kerma, respectively, depending on breast size and composition. E.g., for a breast of 140 mm in diameter, 105 mm in length and 20% glandular tissue the investigation revealed: CTDIvol of 6.8 mGy, DLP of 71.4 mGy * cm, AGD of 4.8 mGy and E of 0.61 mSv for our protocols.

**CONCLUSION**

Technical concepts established in clinical CT are suitable for dose assessment in pcBCT. Patient-specific dose can be estimated based on Monte Carlo simulations. AGD of about 5 mGy and E less than 1 mSv for bilateral examinations in pcBCT are low, acceptable and confirm photon-counting technology. Dose to all other organs not directly exposed appears negligible.

**CLINICAL RELEVANCE/APPLICATION**

Dedicated high-resolution photon-counting spiral breast CT potentially offers higher sensitivity and specificity for breast cancer detection without increasing dose levels significantly.

In this preliminary study, BCBCT was found to accurately identify malignant breast masses and calcifications in a diagnostic setting. CE-BCBCT provided additional information and improved cancer diagnosis in dense breasts compared to the use of BCBCT, US, or MG alone.

**Background**

Breast cone-beam computed tomography (BCBCT) is a flat-panel detector (FPD)-based X-ray imaging system that provides high-quality images of the breast. The purpose of this study was to investigate the ability to detect breast abnormalities using non-contrast BCBCT and contrast-enhanced BCBCT (BCBCT and CE-BCBCT) compared to ultrasound (US) and digital mammography (MG).

**Evaluation**

A prospective study was performed from May 2012 to August 2014. 120 patients with dense breast (270 lesions) underwent BCBCT and CE-BCBCT, all the patients underwent US and MG.

**Discussion**

Cancer diagnosis was confirmed pathologically in 102 patients (110 lesions). BCBCT identified 97 of 110 malignant lesions, whereas 93 malignant lesions were identified using MG and US. The areas under the receiver operating curves (AUCs) for breast cancer diagnosis were 0.861 (BCBCT), 0.856 (US), and 0.829 (MG). CE-BCBCT improved cancer diagnostic sensitivity by 20.3% (78.4-98.7%). The AUC values were 0.869 (CE-BCBCT), 0.846 (BCBCT), 0.834 (US), and 0.782 (MG).
The prototype has been deployed at our institution in preparation for clinical studies. Dose measured for the nominal scan protocol reconstruction was based on a penalized weighted least squares (PWLS) method with modified weights for artifact corrections. Scatter correction, Joseph-Spital beam hardening correction, and deconvolution of detector glare and lag effects. Image.

The prototype was designed for reliable detection of acute ICH (~2 mm diameter, 40-80 HU) in the ICU or other points of care for imaging intracranial hemorrhage (ICH) at the point of care.

To assess the imaging performance and suitability to clinical studies of a newly developed prototype cone-beam CT system for imaging intracranial hemorrhage (ICH) at the point of care.

Histology revealed 17 invasive cancers and 10 DCIS in the specimens (27 lesions in total). 16 of the specimens contained calcifications. 73 % of the specimens were rated as heterogeneously or extremely dense in DM. Mean time for image viewing was 77 s for DM, 122 s for BT and 131 s for bCT. Sensitivity for lesions was 41 % for DM, 52 % for BT and 70 % for bCT. Specificity for calcifications was 75 % for DM, 69 % for BT and 94 % for bCT. Specificity for lesions was 71 % for DM, 29 % for BT and 71 % for bCT. Specificity for calcifications was 67 % for all modalities.

For detection of lesions as well as calcifications, bCT showed superior sensitivity compared to DM and BT. Radiologists are not used to inspect bCT images in clinical routine, viewing times nevertheless were still comparable to those of BT. Sensitivity and specificity for lesion detection could potentially be increased further using contrast media.

Dedicated high-resolution low-dose bCT proved to be superior to DM and BT especially for detection of calcifications and lesions in dense breasts.

The prototype was designed for reliable detection of acute ICH (~2 mm diameter, 40-80 HU) in the ICU or other points of care for patients with brain injury. System design was guided by a task-based image quality model, yielding a mobile U-arm with 550 mm source-axis distance, 1000 mm source-detector distance, a 15 kW / 0.6 FS x-ray tube (IJM Monobloc), and a 0.14 mm pixel pitch / 43 x 43 cm2 detector (Varian PaxScan 4343CB). Nominal imaging technique involved 720 projections over 360° in 28 s at 100 kVp and 216 mAs with 3x3 pixel binning and dual-gain detector readout. Artifact correction included a fast, GPU-based Monte Carlo scatter correction, Joseph-Spital beam hardening correction, and deconvolution of detector glare and lag effects. Image reconstruction was based on a penalized weighted least squares (PWLS) method with modified weights for artifact corrections.

The prototype has been deployed at our institution in preparation for clinical studies. Dose measured for the nominal scan protocol.
CONCLUSION

The technical assessment indicates imaging performance and dose characteristics suitable to detection / monitoring of ICH at the point of care and provides important preclinical evidence in support of translation to clinical studies.

CLINICAL RELEVANCE/APPLICATION

A cone-beam CT system with image quality characteristics beyond that of existing mobile systems will enable detection and monitoring of acute ICH in applications such as the ICU, urgent care, concussion clinics, and field hospitals.

Mobile C-Arm Cone-Beam CT: A New Prototype Incorporating Model-Based Image Reconstruction and Soft-Tissue Contrast Resolution

Wednesday, Nov. 30 11:40AM - 11:50AM Room: S403B

Participants
Matthew W. Jacobson, Baltimore, MD (Presenter) Nothing to Disclose
Ali Uneri, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Tharindu De Silva, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
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Jeffrey H. Sieversen, PhD, Baltimore, MD (Abstract Co-Author) Research Grant, Siemens AG; Research Grant, Carestream Health, Inc; Advisory Board, Siemens AG; Advisory Board, Carestream Health, Inc; License agreement, Carestream Health, Inc; License agreement, Elekta AB; ; ;

PURPOSE

Mobile C-arms are often limited to high-contrast visualization suitable to bone applications. This work reports the cone-beam CT (CBCT) imaging performance of a new mobile platform incorporating model-based image reconstruction to improve contrast resolution suitable to soft-tissue visualization.

METHOD AND MATERIALS

The system is based on a fluoroscopic C-arm (Cios Alpha, Siemens) with an external controller providing motorized gantry movement (orbital, angular, and linear) synchronized with x-ray exposure and detector readout. Nominal scan protocol involved a 30°, 452-view propeller orbit rotation. Image quality and dose were measured in phantoms presenting tissue-equivalent simulated lesions as a function of dose (80 kV, CTDIw = 2.25-11 mGy). CBCT volumes were reconstructed using FDK and Huber Penalized Likelihood (PL). The FDK filter and PL regularization strength were set to match the ESF width (0.75 mm) in the brain-equivalent insert. The PL algorithm used 20 iterations of the OS-SOS algorithm with 10 subsets. Noise was derived from the standard deviation in ROIs in soft-tissue regions of interest. Contrast and ESF widths were measured by fitting a Gaussian error function to radial samples of the low-contrast inserts.

RESULTS

For FDK reconstructions, the CNR in brain (to polyethylene background) was 1.8-3.0 over the dose range tested, whereas PL yielded CNR of 2.9-4.0 over the same dose range at matched spatial resolution. Reconstructions of an anthropomorphic head phantom demonstrated clear visualization of low-contrast inserts and bony anatomy throughout the cranial vault, including the skull base. Residual ring and streak artifacts were evident from residual errors in gain correction and geometric calibration.

CONCLUSION

The mobile C-arm offers increased x-ray power and the potential to overcome traditional limitations in soft-tissue visibility via model-based reconstruction. Contrast resolution appears sufficient for visualization of 80 HU lesions, with further gains via improved artifact correction. Realizing such capability in a manner consistent with surgical workflow (<2 min) leverages accelerated reconstruction methods.

CLINICAL RELEVANCE/APPLICATION

Mobile C-arms with image quality suitable to soft-tissue visualization could advance 3D imaging in neurosurgical, thoracic, and abdominal surgery for improved evaluation of the surgical product and detection of complications.

Does Rotational Tube Current Modulation have Significant Impact on Organ Doses in Dental CBCT to Impose its Implementation in Dose Calculating Software Tools?

Wednesday, Nov. 30 11:50AM - 12:00PM Room: S403B

Participants
Andreas Stratis, Leuven, Belgium (Presenter) Nothing to Disclose
Guoli Zhang, Leuven, Belgium (Abstract Co-Author) Nothing to Disclose
Joris Awouters, Leuven, Belgium (Abstract Co-Author) Nothing to Disclose
Reinilde Jacobs, Leuven, Belgium (Abstract Co-Author) Nothing to Disclose
Ria Bogaerts, Herestraat 49, Belgium (Abstract Co-Author) Nothing to Disclose
Hilde Bosmans, PhD, Leuven, Belgium (Abstract Co-Author) Co-founder, Qaelum NV Research Grant, Siemens AG
PURPOSE

to compare organ doses and the associated radiation-induced risk for dental CBCT scanning with and without tube-current-modulation (TCM) with identical average tube loading (mAs).

METHOD AND MATERIALS

An EGSnrc-Monte-Carlo (MC) modelling system was used to simulate a VGi-evo (Newtom, Verona, IT) dental-CBCT-scanner with TCM. The scanner employs rotational TCM based on one antero-posterior and one lateral mA value defined from two scout exposures before the scan. Patient data and exposure parameters were retrieved from PACS for four cases; a 7 years old female undergoing a sinus jaw 8x5cm² Normal-resolution protocol; an 8 years old male undergoing an upper-jaw 5x5cm² Normal-resolution protocol; a 12 years old female undergoing a lower jaw 8x5cm² High-resolution and a full-jaw 12x8cm² normal-resolution-protocol. Age and gender-specific voxel models, based on head/neck CT image datasets, were designed (manually segmented) and were used in the simulations. TCM was simulated by applying projection-specific-weighting-factors when calculating the dose integral. The weighting-factors corresponded to the mA modulation at each projection. The constant-current scanning was modelled with a fixed weighting factor=1.

RESULTS

For the upper jaw protocol, TCM reduced the dose to oral mucosa (1.9mGy vs 2.1mGy), yet increased the dose to esophagus (80µGy vs 70µGy), to extra thoracic tissues (ET) (470µGy vs 400µGy) and to thyroid (70µGy vs 60µGy). In the lower jaw protocol TCM resulted in a lower dose to ET (1.5mGy vs 1.65mGy), to oral mucosa (2.9mGy vs 3.2mGy) and salivary glands (1mGy vs 1.1mGy), though the dose to the thyroid (710µGy vs 640µGy) and esophagus (1.1mGy vs 0.95mGy) increased. In full-jaw, except for the dose to RBM, all major radiosensitive organs received lower doses with TCM. In sinus protocols, there was a dose reduction to salivary glands with TCM (330µGy vs 400µGy), yet an increased dose to the brain (100µGy vs 80µGy). Organ dose differences didn't lead to significant changes in effective dose. All the above dose differences were beyond the overall statistical uncertainty (5%).

CONCLUSION

TCM results in different organ dose distributions and should be taken into account in software dosimetry tools.

CLINICAL RELEVANCE/APPLICATION

Accurate organ dose estimations for paediatric patients in dental CBCT imaging requires the implementation of TCM schemes in software tools and MC simulation frameworks.
Participants

PARTICIPANTS
Joesph Russo, MD

PROGRAM INFORMATION
This one-hour workshop led by a Peer Educator will introduce 3D Automated Breast Ultrasound (ABUS) interpretation, including how to navigate the coronal plane to efficiently highlight potential abnormalities and streamline the screening workflow. Attendees will:
- Learn how 3D ABUS screening helps increase cancer detection in women with Dense Breast Tissue
- See how quickly whole breast image volumes are acquired on the Invenia™ ABUS Scan Station
- Review clinical cases on the Invenia™ABUS Workstation during physician guided hands-on exam interpretation.

Registration
http://ge.cvent.com/events/ge-breast-health-advantage-workshop/event-summary-b904d22132614dc2b7633ee3b34f22de.aspx
Breast Tomosynthesis Reading Session: Siemens Healthineers Vendor Workshop

Wednesday, Nov. 30 11:40AM - 12:50PM Room: Booth 5534

Participants

PARTICIPANTS

Mahesh Shetty, Houston, Texas, USA

PROGRAM INFORMATION

During this hands-on workshop you will learn to evaluate 2D mammography and 3D Breast Tomosynthesis. An expert tutor will lead you through cases that will both fascinate and confound you! All cases have been acquired with Siemens Mammomat Inspiration and are displayed on syngo.Breast Care workplaces so you will also become familiar with the image quality and ease of use of our systems.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
3D™ Image Guided Prone Breast Biopsy: Initial Clinical Implementation: Hologic Vendor Workshop

Wednesday, Nov. 30 12:15PM - 1:15PM Room: Booth 5521

Participants

PARTICIPANTS

Dr. Debbie Lee Bennett

PROGRAM INFORMATION

A 60 minute hands-on workshop: Faculty will present initial case experience, including insights and challenges, from recent implementation of a new 3D™ image guided breast biopsy program with the Affirm™ Prone Biopsy System. The lecture portion will be followed by a hands-on demonstration of the Hologic 3D™ breast biopsy procedure using the Affirm™ Prone Biopsy System. (12 Attendees per session) (Affirm™ Prone Biopsy System)

Registration

http://www.hologic.com/rsna-hologic-workshop-sessions
A Pilot Study: Radiogenomics of Inflammatory Breast Cancer

Participants
Robert M. Strigel, MD, MS, Madison, WI (Moderator) Research support, General Electric Company

Sub-Events

PURPOSE
Inflammatory breast cancer (IBC) is one of the most aggressive rare breast cancer types with imaging features different from non-IBC such as non-mass enhancement or multicentric small masses, global skin thickening, extensive edema, and diffuse breast enlargement. It is unclear if these imaging features correlate with or can predict genomic characteristics. The objective of this study is to assess for any association between radiographic features and RNA expression in IBC patients.

METHOD AND MATERIALS
Retrospective analysis was performed of IBC patients who had available gene profile, between 2000 and 2005. Baseline ultrasound (US), mammography (MG), MRI, and CT were reviewed by 1 radiologist. Imaging features collected on target lesions were based on ACR BI-RADs descriptors. 21 patients had available data for analysis. Samples were run on Affymetrix HG-U133A platform with 506,944 probes corresponding to 22,283 genes. Frozen robust multiarray analysis was used to quantify and summarize array data. To test association between imaging features and gene expression, gene-by-gene 1-way ANOVA test was used for categorical variables and gene-by-gene linear model for continuous variables. Beta-uniform mixture models were used to estimate the number of significant genes at different false discovery rates (FDRs).

RESULTS
Among 21 imaging features, breast density, calcifications, and edema showed a peak of small p-values on histogram (tables 1-3). There are 2, 13 and 106 genes significantly associated with breast density on MG at FDRs of 0.05, 0.1 and 0.2, respectively. One and 5 genes were significantly associated with calcifications at FDRs of 0.25 and 0.3, respectively. There are 22 and 77 genes significantly associated with breast edema on US at FDRs of 0.2 and 0.25, respectively. The rest of the imaging features on all modalities do not show an obvious association with genomic data. Those genes associated with the above three features are various and there is no critical pathways regulating them such as PI3K/Akt/mTOR, MAPK, and TGF-β pathways.

CONCLUSION
Our analysis suggests some associations between gene expression profile and breast density and calcifications on MG, and tissue edema on US. Larger studies are necessary to confirm and identify additional subset of imaging features.

CLINICAL RELEVANCE/APPLICATION
Some gene expression profile are associated with breast density, calcifications, and edema on imaging of IBC patients.

Searching an Imaging Biomarker for Tamoxifen Resistance: Correlation between Background Parenchymal Enhancement (BPE) and CYP2D6 Genotype in Patients under Tamoxifen

Participants

PURPOSE
Tamoxifen is a pro-drug metabolized via cytochrome P450 2D6 (CYP2D6) into the active metabolite endoxifen. Mutations in genotype may lead to less effective CYP2D6 alleles resulting in slow metabolism contributing to tamoxifen resistance, which is an important clinical problem. Tamoxifen is known to substantially reduce the background parenchymal enhancement (BPE) in DCE MRI. We hypothesized that degree of BPE may serve as biomarker to indicate reduced tamoxifen efficacy and investigated the correlation between BPE in women under tamoxifen and changes in CYP2D6 genotype.
METHOD AND MATERIALS
Prospective study performed between 5/2014 and 7/2015 on 100 patients (mean age 53 years) with treatment for breast cancer and on regular dose tamoxifen for at least 3 months. BPH was classified according to the ACR-categories from MR-ACR1 (no BPE) to MR-ACR4 (strong BPE). At time of MRI genotypes the following CYP2D6 alleles were investigated: CYP2D6*4, a stop-codon, CYP2D6*5, leading to deletion, and CYP2D6*10, resulting in reduced enzymatic function. Degree of BPH was correlated with the respective CYP2D6 genotypes.

RESULTS
91/100 women exhibited no BPE (MR-ACR1), 8/100 minimal (MR-ACR2) and 1/100 moderate BPE (MR-ACR3). None of the 9 patients with noticeable BPE (MR-ACR2/3) had a pathogenic CYP2D6 genotype: Six had wildtype CYP2D6, the remaining 3 had heterozygous mutations that are not supposed to impact tamoxifen metabolism. Among the 91 women without noticeable BPE (MR-ACR1), 67 had a wildtype genotype and 22 exhibited minor genotype variations with single or combined heterozygous mutations of CYP2D6*4, *5 or *10. A total 2/91 patients without BPE (MR-ACR1) had a pathogenic mutation of CYP2D6. Accordingly there was no correlation between CYP2D6 genotypes and the degree of BPE (r=0.42).

CONCLUSION
The lack of correlation between BPE and CYP2D6 genotypes can be interpreted as follows: BPE in MRI may not be useful for identifying tamoxifen resistance, or CYP2D6 genotypes are not predictive. Since determination of the CYP2D6 genotype is not established for lack of evidence on correlation between genotypes and patient outcome, lack of correlation between BPE and genotypes may encourage further research on BPE as imaging biomarker for tamoxifen resistance.

CLINICAL RELEVANCE/APPLICATION
The lack of correlation between BPE in DCE-MRI and CYP2D6 genotypes in women under tamoxifen encourages further research on BPE as imaging biomarker for tamoxifen resistance.

BR254-SD-WEA3 Utility of Screening Mammography for Detecting Clinically Occult Malignancy in Autologous Myocutaneous Flap Reconstructed Breasts after Mastectomy

Station #3

Awards
Student Travel Stipend Award

Participants
Julia Savage, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Leah W. Carlson, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Mitra Noroozian, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Stephanie K. Patterson, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Deborah O. Jeffries, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Annette I. Joe, MD, Farmington Hills, MI (Abstract Co-Author) Research Consultant, Delphinus Medical Technologies, Inc
Colleen H. Neal, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Lubomir M. Hadjiiski, PhD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Mark A. Helvie, MD, Ann Arbor, MI (Abstract Co-Author) Institutional Grant, General Electric Company

PURPOSE
Screening mammography to detect clinically occult malignancy in autologous myocutaneous flap reconstruction (AMF) after mastectomy is controversial. We sought to determine the utility of screening these patients.

METHOD AND MATERIALS
This IRB-approved, HIPAA-compliant, retrospective, single institution study identified 485 women (mean age 58 years, range 26-88), who had mammography of the AMF from 1/1/2000 - 7/15/2015, and > one year clinical follow-up. Of 617 AMF (132 bilateral), 78% (483/617) followed mastectomy for cancer (CA-AMF) and 22% (134/617) followed prophylactic mastectomy (P-AMF).

RESULTS
4,159 screening mammograms (mean 6.7/AMF, median 8.5, range 1-16) were obtained. 3.1% (15/485) of patients developed 18 local-regional malignancies; 10 in-flap (8 invasive breast, 2 lymphoma), 1 overlying skin, 4 in axillary lymph node, and 3 in chest wall. 83% (15/18) of malignancies occurred in CA-AMF and 17% (3/18) in P-AMF (1 lymphoma and 2 axillary metastases). Difference between malignancy in CA-AMF & P-AMF p<0.001. Excluding in-flap lymphoma and recurrence confined to skin, the in-flap breast cancer recurrence rate in CA-AMF was 1.7% (8/483, CI 0.5%, 2.8%). Screening detected 4/8 non-palpable cancers, 1 was detected by MRI, and 3 were symptomatic interval cancers at time of diagnosis. The in-flap cancer detection rate of screening mammography in CA-AMF was 0.12%. The in-flap cancer detection rate of mammography in CA-AMF was 0.21%. Mean time to AMF malignancy was 7.6 years (median 8, range 0.8-16.2). Median invasive cancer size was 0.8 cm (range 0.6-1.2). Screening CA-AMF and P-AMF resulted in 0.63% (26/4159) FP biopsy recommendations. The PPV3 of screening mammography was 13% (4/30).

CONCLUSION
Screening detected some clinically occult breast cancer in CA-AMF, with in-flap breast cancer detection rate of 0.12% and a low false positive biopsy rate. No clinically occult breast cancer was detected in P-AMF.

CLINICAL RELEVANCE/APPLICATION
Screening mammography in CA-AMF detected some clinically occult in-flap breast cancer with low rate of FP biopsy recommendations. No breast cancer was detected from screening P-AMF.

BR255-SD-WEA4 3D Breast Tomosynthesis with Digital Mammography versus Digital Mammography Alone: Comparison of Performance Metrics at Prevalence versus Incidence Screens

Station #4
with histopathology, a few trends emerged. In 5/7 (71%) cancer cases, calcifications were located in the scar or same quadrant of
from RT completion to detection. Although univariate analysis did not identify any variable which showed significant association
(86%); partial breast irradiation in 1/7 (14%). Mean times were 15 months from BCS to detection of calcifications and 11 months
(14%, 1/7) and low-grade DCIS (14%, 1/7); all 7 had clear surgical margins (≥2mm). Whole breast irradiation was performed in 6/7
cases were high-grade invasive ductal carcinoma with DCIS (14%, 1/7), high-grade DCIS (57%, 4/7), intermediate-grade DCIS
94 patients met inclusion criteria and had 100 biopsies for suspicious calcifications, with cancer yield of 7% (7/100). The 7 cancer
RESULTS
mammographic findings.
Calcifications were characterized using ACR lexicon. Histopathology from biopsy was correlated with clinical and
included tumor characteristics, type of surgery and RT, imaging findings and time interval between treatment and calcification
METHOD AND MATERIALS
After IRB approval, electronic medical records review identified screening mammograms performed 1/2009-2/2011 before DBT
integration (DM), and performed 1/2013-2/2015 after DBT integration. DBT examinations were grouped into initial DBT examinations
(DBT1) and DBT examinations with one or two prior DBT exams (DBT2+). Women without documentation of any prior screening
mammography were excluded from analysis. Differences in recall rates, cancer detection rates, and biopsy rates were examined
using chi square statistics.
RESULTS
A total of 69,049 screening DM examinations were compared with 12,153 DBT1 screens and 43,267 DBT2+ screens. Recall rates
significantly decreased with DBT1 relative to DM (53 versus 62 recalls per 1,000; p<0.001), and DBT2+ remained significantly lower
than DM (56 per 1000; p<0.0001). Total cancer detection rate significantly increased with DBT1 relative to DM (6.4 versus 4.4 per
1,000; p=0.003), but decreased at DBT2+ exams and was no longer significantly different than DM (4.4 per 1,000; p=0.97). Invasive
cancer detection rate similarly increased at DBT1 exam compared to DM (4.4 versus 2.8 per 1,000, p=0.003) but
decreased at DBT2+ (3.0 per 1,000; p=0.53). A similar trend was observed with biopsy rates, which increased with DBT1 compared
with DM (12.1 versus 9.2 per 1,000; p=0.002) and decreased with DBT2+ exams (10.3 per 1,000; p=0.07).
CONCLUSION
Cancer detection rates increase with initial DBT examinations relative to DM but return to similar rates as DM at subsequent
examinations, suggesting an underlying prevalence screen effect. The benefit of recall reductions observed with initial DBT
screening persists on subsequent screens.
CLINICAL RELEVANCE/APPLICATION
The added value of DBT over time appears to be the benefit of improvements in recall rather than sustained increased cancer
detection rates that are found with initial DBT prevalence screens.
Analysis of Stereotactic Biopsies Performed on Calcifications Identified after Recent Completion of
Breast Conserving Therapy: Can Biopsy be Obviated?
Station #5
Participants
Palita Hansakul, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Rosalind P. Candelaria, MD, Houston, TX (Presenter) Nothing to Disclose
H. Carisa Le-Petross, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Monica L. Huang, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Lumarie Santiago, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Beatriz E. Adrada, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

PURPOSE
To determine the yield of cancer in stereotactic biopsies performed on suspicious calcifications identified within 24 months after
breast conserving surgery (BCS)

METHOD AND MATERIALS
An IRB-approved, single-institution retrospective review was completed on all stereotactic biopsies performed from 2009-2013 in
patients with history of breast cancer who underwent breast conserving surgery (BCS) and radiation therapy (RT). Data collected
included tumor characteristics, type of surgery and RT, imaging findings and time interval between treatment and calcification
detection. Calcifications were characterized using ACR lexicon. Histopathology from biopsy was correlated with clinical and
mammographic findings.

RESULTS
94 patients met inclusion criteria and had 100 biopsies for suspicious calcifications, with cancer yield of 7% (7/100). The 7 cancer
cases were high-grade invasive ductal carcinoma with DCIS (14%, 1/7), high-grade DCIS (57%, 4/7), intermediate-grade DCIS
(14%, 1/7) and low-grade DCIS (14%, 1/7); all 7 had clear surgical margins (≥2mm). Whole breast irradiation was performed in 6/7
(86%); partial breast irradiation in 1/7 (14%). Mean times were 15 months from BCS to detection of calcifications and 11 months
from RT completion to detection. Although univariate analysis did not identify any variable which showed significant association
with histopathology, a few trends emerged. In 5/7 (71%) cancer cases, calcifications were located in the scar or same quadrant of
the primary cancer with similar histopathology to the primary; in 2/7 (29%) cases, calcifications were in a different quadrant with different histopathology from the primary. Morphology for the 7 malignant calcifications was amorphous (43%, 3/7), coarse heterogeneous (29%, 2/7) and fine pleomorphic (29%, 2/7), with grouped distribution in all 7. Pathology primarily was post-therapeutic effect in the benign cases (70%; 65/93); no case of benign pathology developed ipsilateral malignancy with two-year followup.

CONCLUSION

Stereotactic biopsy of suspicious calcifications identified in the ipsilateral breast within 24 months of completing BCS has a cancer yield of 7%, which is above the 2% risk of malignancy allowed for imaging followup (BI-RADS 3).

CLINICAL RELEVANCE/APPLICATION

Although adjuvant RT reduces the risk of ipsilateral recurrence, metachronous malignancy should be suspected in patients presenting with new calcifications during early post-treatment surveillance.

PURPOSE

Assessment of primary tumor size is crucial for accurate staging and determination of treatment for breast cancer. A hyperechoic rim can be seen around primary breast carcinomas, but no clear guidelines exist on whether this echogenic halo should be included in the sonographic measurements. The purpose of this study is to clarify the impact of including and excluding the hyperechoic rim on preoperative sonographic tumor size assessments.

METHOD AND MATERIALS

A retrospective review of 115 patients with primary breast cancer was completed. In 39 of 115 (33.9 %) cases, a hyperechoic rim was detected on preoperative ultrasound (US). The maximal sonographic measurements of each mass was obtained, including and excluding the hyperechoic rim. These measurements were compared with the actual histopathological tumor size on excision. Bias was characterized by the mean difference between US measurements and pathologic size and a 95% confidence interval (CI) was provided.

RESULTS

Mean pathologic size of the 39 breast cancers demonstrating a hyperechoic rim was 2.1 cm (SD: 0.9, range: 0.3, 4.0). The maximal US measurement without the hyperechoic rim underestimated the pathologic size in 97% (38/39) of cancers, which translated in an underestimation of the tumor size/stage (T1 vs T2) for 10 cancers (25.6% of cases). Underestimation of size was 0.59 cm on average without the hyperechoic rim (95% CI: -0.02, 0.12). Tumor size/staging based on US measurements agreed with pathologic findings in 100% (39/39) of cancers when the hyperechoic rim was included in the measurement.

CONCLUSION

The hyperechoic rim should be included in the sonographic measurement of tumor size to ensure a more accurate preoperative T stage.

CLINICAL RELEVANCE/APPLICATION

Including the hyperechoic rim in the sonographic measurement of primary breast carcinomas is important in ensuring more accurate preoperative staging.

PURPOSE

To determine the CEUS and GS morphologic features of benign and malignant axillary sentinel lymph nodes (SLN) identified using microbubble contrast-enhanced ultrasound (CEUS).

METHOD AND MATERIALS

Twenty-one early stage breast cancer patients were enrolled on a prospective clinical trial evaluating microbubble CEUS of axillary nodes, followed by needle biopsy and I-125 seed placement. CEUS parameters included enhancement pattern (homogeneous versus heterogeneous), enhancement intensity (mild, moderate, significant). The following GS parameters were collected from the CEUS identified node: short axis (SA) size, length-width ratio (L/W), cortical (C) features, hilar (H) features, and C/H ratio. All patients underwent standard of care (SOC) SLN biopsy using Tc99m with or without blue dye, and removal of the localized node. Final
histopathology (malignant [M] versus benign [B]), number of M nodes, metastasis size, and the presence or absence of extranodal extension, was correlated with CEUS morphological features.

RESULTS

CEUS identified a single enhancing node in 20 of 21 (95.2%) cases. All enhancing nodes correlated with a SLN identified surgically; 2 (10%) M and 18 (90%) B. The mean SA size was 0.62 cm (range 0.3-1.1). The L/W was < 2 in 6 of 20 (30%), and >2 in 14/20 (70%) nodes. SLN GS features included homogeneous hilum (14, 70%), heterogeneous hilum (5, 25%) and focal hilum compression (1, 5%). All SLN had <3mm cortical thickness. The GS mean cortex-hilum ratio was 0.51 (0.11-1.0). Heterogeneous CEUS enhancement was noted in 12 (60%) of cases. Enhancement intensity was significant (8, 40%), moderate (5, 25%) and mild (7, 35%). Enhancement of all malignant SLN was mild. SLN enhancement patterns were cortical (1, 5%), thin (7, 35%) or thick paracortex (5, 25%) and diffuse hilar (7, 35%). Enhancement patterns of malignant SLN were diffuse hilar and thin paracortex.

CONCLUSION

CEUS contributes additional imaging features of lymph nodes reflecting their underlying architecture. Larger studies are needed to evaluate the ability of CEUS features to differentiate benign from malignant SLN.

CLINICAL RELEVANCE/APPLICATION

CEUS parameters of SLN may complement GS ultrasound features for non-invasive distinction of M versus B nodes.

A Practical Approach to the Radiological Diagnosis of Breast Calcifications for Resident Station #8

Participants
Karina Pesce, Vicente Lopez, Argentina (Presenter) Nothing to Disclose
Flavia B. Sarquis, MD, Vicente Lopez, Argentina (Abstract Co-Author) Nothing to Disclose
Silvia Giusti, Vicente Lopez, Argentina (Abstract Co-Author) Nothing to Disclose
Carlos M. Lamattina, MD, Vicente Lopez, Argentina (Abstract Co-Author) Nothing to Disclose
Bernardo O. Blejman, MD, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Julio A. San Martino, Vicente Lopez, Argentina (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

To review the various appearances of breast microcalcificationsSuggestions and tips for management of calcificationsInteractive imaging case review

TABLE OF CONTENTS/OUTLINE

Introduction: Overview of Mammographic microcalcifications
Technique
Mammographic views to evaluate microcalcifications
Anatomy
BI-RADS® Lexicon for Calcifications
Causes of pseudocalcifications
Management of calcifications
Biopsy technique
Cases
Test cases
Conclusion

Evaluation of Response to Neoadjuvent Chemotherapy on Breast MRI: Illustrative Depiction of Enhancement Pattern Response with Pathologic Correlation Station #9

Awards
Certificate of Merit

Participants
Raman Verma, MD, Ottawa, ON (Presenter) Nothing to Disclose
Mukta D. Mahajan, MBBS, Vienna, Austria (Abstract Co-Author) Nothing to Disclose
Zuzana Kos, Ottawa, ON (Abstract Co-Author) Nothing to Disclose
Jean M. Seely, MD, Ottawa, ON (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Evaluating treatment response to neoadjuvant chemotherapy is important in determining optimal surgical management. This exhibit will:1) Contrast common patterns of disease presentation and their associated treatment response on breast MRI with final pathologic correlation.2) State and review factors which may contribute to the extent of response following treatment in the context of current literature 3) Provide a summary of imaging features post-treatment

TABLE OF CONTENTS/OUTLINE

MRI is the imaging study of choice when evaluating response to treatment after neoadjuvant chemotherapy (NAC). Pretreatment and post-treatment breast MRI studies will be contrasted, specifically illustrating examples of treatment response on MRI including: 1) No response 2) Concentric shrinkage without surrounding lesions 3) Concentric shrinkage with surrounding lesions 4) Shrinkage with residual multinodular lesions 5) Diffuse contrast enhancement in whole quadrants 6) Nonvisualization of enhancement 7) False positive MRI – suspected imaging complete response (cIR) without pathologic complete response (pCR) 8) False negative MRI – residual imaging disease with pCR 9) Overestimation of residual disease 10) Underestimation of residual disease
Breast Wednesday Poster Discussions
Wednesday, Nov. 30 12:45PM - 1:15PM Room: BR Community, Learning Center

BR
AMA PRA Category 1 Credit ™:.50

Participants
Roberta M. Strigel, MD, MS, Madison, WI (Moderator) Research support, General Electric Company

Sub-Events
BR259-SD-WEB1 Performance of Pre-operative Breast MRI in Newly Diagnosed Cancer: Comparison of Outcomes Based on Mammographic Modality, Breast Density and Breast Parenchymal Enhancement
Station #1

Awards
Student Travel Stipend Award

Participants
Azadeh Elmi, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Emily F. Conant, MD, Philadelphia, PA (Abstract Co-Author) Consultant, Hologic, Inc; Consultant, Siemens AG
Andrew Kozlov, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Elizabeth S. McDonald, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

PURPOSE
To determine the performance of pre-operative MRI in newly diagnosed breast cancer based on breast density, background parenchymal enhancement (BPE), and mammographic modality, e.g. digital mammography (DM) or digital breast tomosynthesis (DBT).

METHOD AND MATERIALS
Retrospective IRB approved review was conducted of 401 consecutive MRI exams from women who underwent pre-operative breast MRI at our institution (10/1/2013-7/31/2015) for newly diagnosed, untreated cancer prior to surgery with a prior DM or DBT mammogram within 12 weeks. 13 cases were excluded because the final disposition of pathology of the possible additional disease seen on MRI was unknown. 388 exams were evaluated with prior DM (201 cases) or DBT (187 cases) imaging. MRI performance for detection of mammographically occult additional sites of malignancy was stratified by modality, mammographic density, and BPE. Differences between the groups were compared using two-proportion z-test equal variance. A true positive finding was defined as malignancy (DCIS or invasive disease) in the ipsilateral breast >2cm away from the index lesion or in the contralateral breast.

RESULTS
50 additional occult malignancies were prospectively detected in 388 exams (50/388, 12.9%), 37 ipsilateral (37/388, 9.5%) and 13 contralateral (13/388, 3.4%). In patients with DBT exams, MRI detected significantly more cancers in dense than in non-dense breasts (p=0.016, 15/83 (18.1%) vs. 7/104 (6.7%)). In patients with DM exams, there was no significant difference between cancer detection in dense versus non-dense breasts (p=0.79, 16/110 (14.5%) vs. 12/91 (13.2%), respectively). There was no observed difference in cancer detection (p=0.54) or false positive exams (p=0.47) in women who underwent DM versus DBT. Overall, higher BPE was associated with higher false positive rate (p=0.040, 14/113 (12.4%) high BPE vs. 17/275 (6.2%) low BPE ), but no significant difference in true positive exams (p=0.25, 32/275 11.6% low BPE vs. 18/113 15.9% high BPE).

CONCLUSION
In patients with a prior DBT exam, those with dense breasts are more likely to have additional disease detected on pre-operative MRI. A prior DBT exam was not observed to decrease the likelihood of finding additional disease on MRI.

CLINICAL RELEVANCE/APPLICATION
Additional studies are needed to determine if there is a specific cohort of women who might benefit most from pre-operative MRI.

BR260-SD-WEB2 Synthesized Mammography (SM) versus Full Field Digital Mammography (FFDM): A Comparison of Lesion Detection by Radiologists
Station #2

Participants
Deanna L. Lane, MD, Houston, TX (Presenter) Nothing to Disclose
Lumarie Santiago, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Rosalind P. Candelaria, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Marion E. Scoggins, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Gaiane M. Rauch, MD, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Beatriz E. Adrada, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Monica L. Huang, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
William R. Geiser, MS, Houston, TX (Abstract Co-Author) Nothing to Disclose
Kenneth Hess, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose

PURPOSE
To compare lesions detected on synthesized mammography (SM) to lesions detected on FFDM
METHOD AND MATERIALS

An IRB-approved retrospective review was performed of patients who underwent both FFDM and SM. Patients were seen over a 6 week period, from the time of SM implementation at our institution 12/15-1/26/16. Screening and diagnostic mammograms were included. Our mammography database identified all patients who underwent FFDM and tomosynthesis. All patients with mammogram BI-RADS 0, 3, 4, or 5 reports were included, as well as an equal number of consecutive patients with mammograms read as BI-RADS 1 or 2. Patients were excluded if they did not have both FFDM and SM available for review. Six fellowship-trained breast radiologists participated as readers; images were reviewed on a Hologic SecurView workstation. Standardized hanging protocols displayed only FFDM or only SM. Each radiologist performed two reading sessions - one for FFDM and one for SM. FFDM images were reviewed at least one week prior to SM images. Prior films were not utilized for comparison. Radiologists recorded mammographic findings and assigned a BI-RADS category to each finding. Mammographic findings and assigned BI-RADS category were compared between FFDM and SM.

RESULTS

FFDM and SM images were available for review in 147 patients. Radiologists detected significantly more noncalcified masses on FFDM than on SM (71 vs 55 masses, p=0.0015). Eight noncalcified masses were seen on FFDM without correlate on SM; most were small (0.5-1 cm), equal density oval-shaped masses with obscured margins. All were appropriately downgraded at BI-RADS assessment from either BI-RADS 4/5 or BI-RADS 0 (FFDM) to BI-RADS 1/2 (SM). We did not find a significantly greater number of calcifications on SM than on FFDM (p=0.68). 76% of radiologists' readings had concordant BI-RADS between FFDM and SM; the weighted kappa coefficient was 0.66 with 95% confidence interval (0.59,0.73). SM downgraded BI-RADS classification compared to FFDM in 16% of radiologists' readings and upgraded BI-RADS classification in 8%.

CONCLUSION

Significantly more masses were detected by radiologists on FFDM compared to SM. We did not detect significantly more calcifications on SM than on FFDM.

CLINICAL RELEVANCE/APPLICATION

Some mammographic findings may be better seen on FFDM than on SM, or vice versa. As we implement SM into clinical practice, it is valuable to know which, if any, lesions are visualized more easily on SM versus FFDM.

BR261-SD-WEBS

Inter-observer Agreement between the 4th and 5th Edition BI-RADS Density Scales

Station #3

Participants
Sian E. Iles, MD, Halifax, NS (Abstract Co-Author) Nothing to Disclose
Kaitlyn Tsuruda, MSc, Halifax, NS (Abstract Co-Author) Employee, Densitas Inc
Peter Brown, MD, Halifax, NS (Abstract Co-Author) Nothing to Disclose
Christopher B. Lightfoot, MD, Halifax, NS (Abstract Co-Author) Nothing to Disclose
Gerald H. Schaller, MD, Sydney, NS (Abstract Co-Author) Nothing to Disclose
Judy S. Caines, MD, Halifax, NS (Abstract Co-Author) Nothing to Disclose
Syed Arsalan Raza, MBBS, FRCP, Toronto, ON (Abstract Co-Author) Nothing to Disclose
Mohamed Abdolell, MSc, Halifax, NS (Presenter) Founder and CEO, Densitas Inc

PURPOSE

The emphasis on the masking effect in the 5th edition of the BI-RADS mammographic density scale versus percent density in the 4th edition has the potential to affect which women are notified through breast density notification legislation. This study evaluates the agreement between these two classification scales.

METHOD AND MATERIALS

Six radiologists assessed mammographic breast density on a set of 375 cases using the 4th and 5th editions of the BI-RADS density scale (labeled 1/2/3/4 and A/B/C/D, respectively). Classifications were subsequently categorized into “low” (1/2 or A/B) and “high” (3/4 or A/B) density categories. A consensus assessment was calculated based on the majority assessment and was used to calculate the proportions of each density category for each scale. Between-scale agreement was evaluated based on the consensus assessment using the kappa statistic.

RESULTS

The observed proportions of low/high density categories were virtually identical for both the 4th and 5th edition scale (63% vs 62% for the low density categories, p = 0.2). Additionally, 96% of the studies classified as 1/2 were also classified as A/B and 90% of studies classified as 3/4 were also classified as C/D. Agreement between the low-high consensus classifications using the two scales was almost perfect (Kappa = 0.86). 7% of women had a change in density status between the 4th and 5th editions of the density scale.

CONCLUSION

When considered on a two-category scale, as is often done for risk assessment, there was not a significant difference in the distribution of density categories across the 4th and 5th editions of the BI-RADS density scales. This, taken into consideration with the high agreement observed between the two scales, suggests that the two scales are nearly interchangeable. However there may be a small group of women living in states with enacted notification legislation for which there could be a change in density notification status as radiologists adopt the 5th edition BI-RADS lexicon.

CLINICAL RELEVANCE/APPLICATION

There is almost perfect agreement between the BI-RADS 4th and 5th edition density scales; the impact on patient pathways due to a change in scale is likely small. For a subset of women a change in scale may alter their density classification and notification status.

BR262-SD-WEBS

The Impact of the Introduction of a Breast Cancer Screening Programme on a Tertiary Symptomatic Breast Cancer Unit
In our study, the calcification-specific recall rate, PPV1, and PPV2 were similar to published results of FFDM, meaning that DBT with synthesized view were not present at diagnostic mammography. The calcification-specific PPV1 was 42/121 (34.7%). The calcification-specific cancer detection rate, therefore, for calcifications was calculated. The recall rate for calcifications was 121/10,006 (1.2%). There were 16 cases in which the calcifications identified on the DBT exams were characterizations. Prior research demonstrated the comparable performance of full field digital mammography (FFDM) to that of digital breast tomosynthesis (DBT) with synthesized “2D” mammograms. However, the characterization of calcifications remains challenging, with some studies demonstrating comparable results between FFDM and DBT, while others have demonstrated the superiority of FFDM. The purpose of our study is to describe the screening performance of DBT with synthesized “2D” mammograms in routine clinical practice.

METHOD AND MATERIALS

We retrospectively analyzed consecutive screening mammograms performed on 10,006 women between Feb and Oct 2015, during a period in which all DBT exams were performed with synthesized “2D” mammograms (Hologic C-View). We extracted 121 cases recalled for calcifications alone in 118 patients where a complete work up was completed including biopsy if indicated. All calcifications were characterized using BI-RADS descriptors and were given a final assessment. We calculated recall rate, the positive predictive value for screening (PPV1), the positive predictive value recommended for biopsy (PPV2) for calcifications specifically. Finally, we calculated the calcification-specific cancer detection rate (CDR).

RESULTS

The recall rate for calcifications was 121/10,006 (1.2%). There were 16 cases in which the calcifications identified on the DBT exams were not present at diagnostic mammography. The calcification-specific PPV1 was 42/121 (34.7%). The calcification-specific PPV2 was 14/42 (33.3%). The calcification-specific cancer detection rate, therefore, for calcifications was 14/10,006 (1.4/1000). Among the diagnosed cancers, 8 were DCIS only, and 6 were invasive.

CONCLUSION

In our study, the calcification-specific recall rate, PPV1 and PPV2, were similar to published results of FFDM, meaning that DBT with synthesized view were not present at diagnostic mammography.
synthesized "2D" mammograms adequately detect calcifications. One area in which the performance of DBT with synthesized "2D" mammograms might be improved is to decrease the rate of recall of artifactual "calcifications" identified on the synthesized view.

CLINICAL RELEVANCE/APPLICATION

Digital breast tomosynthesis with synthesized "2D" mammograms can be safely used to identify all abnormalities at screening mammography, including calcifications.

BR257-SD- WEB6  Neoplastic Seeding in the Setting of Percutaneous Image Guided Breast Biopsies

Station #6

Participants
Lumarie Santiago, MD, Houston, TX (Presenter) Nothing to Disclose
Beatriz E. Adrada, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Monica L. Huang, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Rosalind P. Candelaria, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

PURPOSE

To describe imaging features, primary tumor features, and biopsy technique in neoplastic seeding (NS) following percutaneous breast biopsies (BX).

METHOD AND MATERIALS

An IRB-approved retrospective review of patients presenting from January 1, 2009 - January 30, 2016 with new diagnosis of breast cancer, abnormal mammogram or palpable abnormality and subsequent diagnosis of NS along the BX needle tract. All patients underwent diagnostic mammography (FFDM) and whole breast ultrasound (US). Tumor histology, grade, receptor status, size, and TNM staging as well as BX guidance, needle gauge, and number of passes were recorded. The time from BX to NS diagnosis was measured. The imaging features of the primary breast malignancy (PBM) and NS were reviewed.

RESULTS

Eight (0.2%) NS cases were identified in 4,010 patients. Mean PBM cancer size was 2.7 cm (range: 1.6-5.7). US guidance was used in 6 cases (75%). Multiple insertion core needle BX was done in 6 (75%) cases. Single insertion vacuum assisted needle BX was done in 1 case. Sampling information was absent in 1 case. The mean number of passes was 4.25 (range: 1-11). The mean time from BX to NS diagnosis was 60.8 days (range: 34-165). In 7 (87.5%) cases tumor histology was IDC. A single case of papillary carcinoma was noted. In 6 (75%) cases tumor grade was high (2/3). All (100%) PBM were Her2 negative, 6 (75%) were PR negative and 5 (62.5%) were ER negative. In 7 (87.5%) cases tumors were unifocal. All PBM presented with a mass by FFDM. Associated calcifications were noted in 2 (25%) cases. Corresponding US masses were most frequently irregular (87.5%), not circumscribed (87.5%) and heterogeneous (50%). Most frequent NS FFDM presentation was focal asymmetry (37.5%) and occult (25%). Most frequent NS US presentation was mass (87.5%) often irregular (62.5%), not circumscribed (75%) and hypoechoic (87.5%). NS was most frequently subdermal in location (75%).

CONCLUSION

Multiple insertion BX, Her2 negative and high grade tumors may be risk factors for NS after percutaneous BX. PBM and NS have variable FFDM and US features. NS most frequently presented as a mass on US while having variable presentation at FFDM.

CLINICAL RELEVANCE/APPLICATION

Although rare, NS should be suspected based on its temporal and geographic relationship to the initial biopsy when there is apparent disease progression in HER2 negative and high-grade cancers.

BR265-SD- WEB7  Communication of Breast Biopsy Results to Patients: A Survey of Providers’ Preferences from an Academic Center with Large Community Network

Station #7

Participants
Suma Chandra, MD, Boston, MA (Presenter) Nothing to Disclose
Jordana Phillips, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Tejas S. Mehta, MD, MPH, Boston, MA (Abstract Co-Author) Nothing to Disclose
Vandana M. Dialani, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Valerie J. Fein-Zachary, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE

In our practice, after breast biopsies are performed, radiologists communicate pathology and management recommendations to the referring clinicians who then notify patients. Our purpose is to assess referring providers’ preferences regarding communication of breast biopsy results to inform potential practice change.

METHOD AND MATERIALS

An online survey using RedCap was circulated to providers who order breast imaging studies in our practice. Questions on demographics, perceptions of the current state, and preferences moving forward were included. Responses were analyzed using the Fisher exact test.

RESULTS

A total of 154/340 (45%) responded, of which 13/154 (8%) were breast specialists and 141/154 (92%) were not. 81/154 (53%) order greater than 100 mammograms per year. Delivering biopsy results is the responsibility of 142/154 (91%) of the respondents. 115/142 (81%) reported being very or somewhat comfortable with discussing pathologies with their patients. However, when given the option, 72/153 (47%) preferred the Breast Radiology department notify the patient while 81/153 (53%) preferred the current system of personally notifying patients of biopsy results. A majority reported giving benign 108/142 (76%) and malignant 95/142 (67%) results by telephone. The reported strengths and challenges of the current system are listed in Figure.
1. Regardless of who communicated the results, a majority 125/153 (82%) prefer the Breast Radiology department to contact the patient and provide management recommendations and, if needed, referral to the Breast Care Center, with non-specialists having a greater preference for this (p < .01). No difference was found in respondents based on number of exams ordered. A majority 88/125 (70%) preferred to be notified of patient-radiologist communication via documentation in the medical record and email or telephone.

CONCLUSION
There was near equal preference for referring clinician or radiologist to communicate breast biopsy results to patients, with most preferring radiologists be responsible for follow-up recommendations and management. Implementation of such changes may help streamline care. These results support the role of radiologists beyond consultants, as part of the clinical team.

CLINICAL RELEVANCE/APPLICATION
Many referring providers are interested in radiologists playing a larger role in the clinical team through communication of biopsy results and management recommendations to patients.

TEACHING POINTS
To know the essentials of appropriate assessment of breast calcifications
To understand the reasons of common misinterpretations in the evaluation of breast calcifications
To show a pathway to avoid mistakes

TABLE OF CONTENTS/OUTLINE
Classification of breast calcifications according to ACR BI-RADS 5th edition Essentials of the appropriate assessment of breast calcifications:
- Complete imaging work-up
- Knowledge of interpretation criteria
- Comparison to previous examinations when appropriate
- Limitations of sonography and MRI in the assessment of breast calcifications
- Case based review showing misinterpretations in the evaluation of breast calcifications and discussing their reasons
- Pathway to avoid mistakes
- Conclusions

TEACHING POINTS
According to the BI-RADS Atlas, BI-RADS 5 assessment should be reserved for lesions which are highly suggestive of malignancy, with a positive predictive value (PPV) of >95%. However, literature shows PPVs ranging between 74% to 92%, suggesting that the 95% PPV for BI-RADS 5 lesions is not commonly achieved or adhered to in clinical practice. This study was performed to see whether the long-term PPV of BI-RADS 5 lesions at an academic breast center falls within the ACR guideline of >95%. Out of the 22,564 patients who underwent diagnostic breast evaluations between January 2010 and September 2015, 239 patients (1.1%) received a BI-RADS 5 assessment. Only 5 (2.1%) of the BI-RADS 5 lesions were false positive, with benign pathology, giving a PPV of 97.9%. Our results demonstrate that a PPV of >95% for BI-RADS 5 category assessment is achievable in clinical practice. This presentation reviews the imaging features of these benign BI-RADS 5 lesions, as well as lessons learned from our experience.

TABLE OF CONTENTS/OUTLINE
Definition and clinical significance of BI-RADS 5 lesions, both true and false positive Non-standard use of BI-RADS 5 assessment in the literatureImaging review of 5 false positive cases• Fat necrosis• Phyllodes tumor (2 cases)• Radial sclerosing lesion• FibromatosisLessons learned
Participants

PARTICIPANTS

Bruce F. Schroeder, MD

PROGRAM INFORMATION

This one-hour workshop led by a Peer Educator will introduce GE's SenoClaire™ breast tomosynthesis including an overview of design elements, and a review of clinical case study presentations covering masses, calcifications, superposition and associated findings to increase clinical confidence. Attendees will: Learn the unique features of GE's Tomosynthesis design | See how accurate DBT exams are acquired on the SenoClaire system | Review clinical cases on the Seno Iris Workstation software during physician guided hands-on exam interpretation.

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop/event-summary-b904d22132614dc2b7633ee3b34f22de.aspx
Participants
Michael N. Linver, MD, Albuquerque, NM, (mammomike@aol.com) (Presenter) Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, Real Imaging Ltd; Scientific Advisory Board, Seno Medical Instruments, Inc

LEARNING OBJECTIVES
1) Discriminate between the subjective negative conclusions of the USPSTF and the true objective data supporting annual screening mammography beginning at 40. 2) Argue successfully in favor of screening mammography when confronted by mammography nihilists. 3) Create useful information for patients regarding the life-saving value of yearly mammography beginning at 40.

ABSTRACT
Early in 2016, the USPSTF reaffirmed their recommendations against screening mammography in women 40-49 and over 73, and recommended screening every 2 years for women 50-73. If fully implemented, as many as 100,000 more women would die prematurely from breast cancer over the next 10 years. The true facts the Task Force twisted or ignored about the real value of yearly screening beginning at 40 will be elucidated. The mythical "harms" of mammography purported by the Task Force will be revealed as overly exaggerated or nonexistent. Talking points radiologists can use in discussing screening guidelines with their patients and clinicians will be reviewed.
Participants

PARTICIPANTS

Christopher Henley, Chicago, Illinois, USA

PROGRAM INFORMATION

Under the guidance of a breast imaging expert you will develop your skills in the interpretation of 3D breast ultrasound acquired with the ACUSON S2000™ Automated Breast Volume Scanner (ABVS), HELX Evolution with Touch Control and displayed on workstations equipped with syngo.Ultrasound Breast Analysis (sUSBA) Software. Active participation in real clinical cases will enable you to become familiar with the coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Participants

Clemens Kaiser, Mannheim, Germany

PROGRAM INFORMATION

Throughout this interactive hands-on session, participants will develop their interpretive skills through extensive case reviews at workstations equipped with syngo.MR Brevis and under the guidance of an expert tutor. By actively practicing on real cases using different imaging techniques, participants will also learn to avoid pitfalls in interpreting breast MRI.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Participants

PARTICIPANTS

Jordana Phillips, MD

PROGRAM INFORMATION

This one-hour workshop led by a Peer Educator will introduce GE’s SenoBright™ contrast-enhanced spectral mammography (CESM) technology that helps answer cases with inconclusive mammogram and ultrasound findings. Attendees will: Learn the unique features of GE’s dual-energy acquisition | Understand how CESM exams are acquired on the SenoClaire™ system | Review clinical cases on the Seno Iris™ Workstation software during physician guided hands-on exam interpretation.

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop/event-summary-b904d22132614dc2b7633ee3b34f22de.aspx
SSM01

Breast Imaging (Tomosynthesis Screening)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: E451A

Participants
Margarita L. Zuley, MD, Pittsburgh, PA (Moderator) Research Grant, Hologic, Inc;
Liane E. Philpotts, MD, New Haven, CT (Moderator) Nothing to Disclose

Sub-Events

SSM01-01 3D Breast Tomosynthesis with Digital Mammography versus Digital Mammography Alone: Comparison of Performance Metrics at Prevalence versus Incidence Screens

Wednesday, Nov. 30 3:00PM - 3:10PM Room: E451A

Participants
Kathryn Lowry, MD, Boston, MA (Presenter) Nothing to Disclose
Pragya A. Dang, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Natasha K. Stout, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Elkan F. Halpern, PhD, Boston, MA (Abstract Co-Author) Research Consultant, Hologic, Inc; Research Consultant, Real Imaging Ltd; Research Consultant, Gamma Medica, Inc; Research Consultant, K2M Group Holdings, Inc
G. Scott Gazelle, MD, PhD, Boston, MA (Abstract Co-Author) Consultant, General Electric Company Consultant, Marval Biosciences Inc
Constance D. Lehman, MD, PhD, Boston, MA (Abstract Co-Author) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company
Anne Marie McCarthy, Boston, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE
Prior screening trials with digital breast tomosynthesis (DBT) have suggested reduced recall rates and increased cancer detection rates compared with digital mammography (DM) alone. However, most trials have only examined test performance after the first (prevalence) DBT exam, and it is not clear whether these effects are sustained on subsequent exams. The purpose of this study was to compare the performance of DBT at initial and subsequent screens to performance with DM.

METHOD AND MATERIALS
After IRB approval, electronic medical records review identified screening mammograms performed 1/2009-2/2011 before DBT integration (DM), and performed 1/2013-2/2015 after DBT integration. DBT examinations were grouped into initial DBT examinations (DBT1) and DBT examinations with one or two prior DBT exams (DBT2+). Women without documentation of any prior screening mammography were excluded from analysis. Differences in recall rates, cancer detection rates, and biopsy rates were examined using chi square statistics.

RESULTS
A total of 69,049 screening DM examinations were compared with 12,153 DBT1 screens and 43,267 DBT2+ screens. Recall rates significantly decreased with DBT1 relative to DM (53 versus 62 recalls per 1,000; p<0.001), and DBT2+ remained significantly lower than DM (56 per 1000; p=0.003) but decreased at DBT2+ exams and was no longer significantly different than DM (4.4 per 1,000; p=0.97). Invasive cancer detection rate similarly increased at DBT1 exam compared to DM (4.4 versus 2.8 per 1,000, p=0.003) but decreased at DBT2+ (3.0 per 1,000; p=0.53). A similar trend was observed with biopsy rates, which increased with DBT1 compared with DM (12.1 versus 9.2 per 1,000; p=0.002) and decreased with DBT2+ exams (10.3 per 1,000; p=0.07).

CONCLUSION
Cancer detection rates increase with initial DBT examinations relative to DM but return to similar rates as DM at subsequent examinations, suggesting an underlying prevalence screen effect. The benefit of recall reductions observed with initial DBT screening persists on subsequent screens.

CLINICAL RELEVANCE/APPLICATION
The added value of DBT over time appears to be the benefit of improvements in recall rather than sustained increased cancer detection rates that are found with initial DBT prevalence screens.

SSM01-02 Detection of High Risk Breast Lesions Following the Addition of Tomosynthesis to Conventional Digital Screening Mammography

Wednesday, Nov. 30 3:10PM - 3:20PM Room: E451A

Awards
Student Travel Stipend Award

Participants
Arielle A. Bauer, MD, Aurora, CO (Presenter) Spouse, Employee, Medtronic plc; Spouse, Stockholder, Medtronic plc
Alexandra Colvin, BS, Aurora, CO (Abstract Co-Author) Nothing to Disclose
Wei-Shin Wang, MD, Aurora, CO (Abstract Co-Author) Nothing to Disclose
New image processing for DBT+FFDM improved diagnostic sensitivity, while reducing patient dose dramatically. Above that of conventional FFDM alone, even at the same total AGD.

CONCLUSION

DBT+FFDM was 1.04–3.50 mGy (mean, 1.78 mGy) and 1.03–2.57 mGy (mean, 1.62 mGy) respectively. Sensitivity of DBT+FFDM with new processing and reduced dose increased significantly to the level of conventional FFDM (79.2 % vs. 62.5 %, 79.2 % vs. 75.0 %, 83.3 % vs. 75.0 %, and 79.2 % vs. 70.8 %). The AGD per view of the conventional FFDM and the improved DBT+FFDM were upstaged, while 15% of lesions identified with digital mammography plus tomosynthesis were upstaged (p = 0.2).

RESULTS

Seventy-four high risk lesions were identified with conventional digital screening mammography, corresponding to a detection rate of 1.38%, while eighty high risk lesions were identified after the institution of tomosynthesis, corresponding to a detection rate of 0.3% (p < 0.001). Of those that underwent surgical excision, 20.3% of the lesions identified with conventional mammography were upstaged, while 15% of lesions identified with digital mammography plus tomosynthesis were upstaged (p = 0.2).

CLINICAL RELEVANCE/APPLICATION

The addition of tomosynthesis to conventional digital mammography decreases the detection of high risk breast lesions while increasing breast cancer detection and is recommended for women undergoing breast cancer screening.

SSM01-03 New Image Processing for Digital Breast Tomosynthesis and Mammography Improved for Feature Enhancement and Dose Reduction

Wednesday, Nov. 30 3:20PM - 3:30PM Room: E451A

Participants
Tokiko Endo, MD, Nagoya, Japan (Presenter) Institutional Grant support, FUJIFILM Holdings Corporation
Takako Morita, MD, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose
Mikana Ooiwa, Nagaya, Japan (Abstract Co-Author) Nothing to Disclose
Namiko Suda, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose
Misaki Shiraiwa, MD, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose
Kazuki Yoshikawa, MD, Hamada, Japan (Abstract Co-Author) Nothing to Disclose
Yukie Hayashi, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose
Hiroshi Ogawa, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose
Takao Horiba, Kagamihara, Japan (Abstract Co-Author) Nothing to Disclose
Shu Ichihara, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose
Yasuyuki Satoh, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE

Digital breast tomosynthesis (DBT) used in combination with digital mammography (FFDM) has been reported as lacking in its ability to demonstrate and allow characterization of microcalcifications, while the main improvement required for DBT+FFDM is dose reduction. In this study, we applied newly developed image processing to DBT and FFD, and evaluated diagnostic performance at a combined dose the same as that of conventional FFDM alone.

METHOD AND MATERIALS

An institutional review board approved this study and written informed consent was provided by all patients. Mediolateral oblique and craniocaudal images of 200 breasts were obtained from 100 subjects aged 27–85 years (mean, 51 years). An improved reconstruction algorithm for DBT was developed to enhancing microcalcification shape and mass margins. New image processing for FFDM was developed to enhancing fine breast structure while suppressing noise. Images were acquired with the average glandular dose (AGD) for the improved DBT and FFDM processing at approximately 40 % and 70 % that of conventional FFDM respectively. The diagnostic accuracy of FFDM with new processing and reduced dose was the same as conventional FFDM in a comparison of two cohorts with almost the same number of findings. Four radiologists qualified in breast imaging interpreted the images independently. Diagnostic accuracy was assessed by comparing sensitivity, specificity and area under the receiver operating characteristic curve (AUC).

RESULTS

Sensitivity of DBT+FFDM with new processing and reduced dose increased significantly to the level of conventional FFDM (79.2 % vs. 70.8 %, \( P = 0.033 \)) while maintaining specificity and AUC. All of four radiologists showed increased sensitivity (75.0 % vs. 62.5 %, 79.2 % vs. 75.0 %, 83.3 % vs. 75.0 %, and 79.2 % vs. 70.8 %). The AGD per view of the conventional FFD and the improved DBT+FFDM was 1.04–3.50 mGy (mean, 1.78 mGy) and 1.03–2.57 mGy (mean, 1.62 mGy) respectively.

CONCLUSION

New image processing for DBT+FFDM for mammographic feature enhancement and dose reduction provided sensitivity improved above that of conventional FFDM alone, even at the same total AGD.

CLINICAL RELEVANCE/APPLICATION

New image processing for DBT+FFDM improved diagnostic sensitivity, while reducing patient dose dramatically.
**Conventional Digital Mammography: Are the Initial Reported Benefits Sustained?**

*Wednesday, Nov. 30 3:30PM - 3:40PM Room: E451A*

**Participants**
- Pragya A. Dang, MD, Boston, MA (Presenter) Nothing to Disclose
- Kathryn Lowry, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
- Anne Marie McCarthy, Boston, MA (Abstract Co-Author) Nothing to Disclose
- Elkan F. Halpern, PhD, Boston, MA (Abstract Co-Author) Research Consultant, Hologic, Inc; Research Consultant, Real Imaging Ltd; Research Consultant, Gamma Medica, Inc; Research Consultant, K2M Group Holdings, Inc
- Constance D. Lehman, MD, PhD, Boston, MA (Abstract Co-Author) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company

**PURPOSE**

Current evidence suggests decreased abnormal interpretation rates (AIR) and increased cancer detection rates (CDR) with Digital Breast Tomosynthesis (DBT) when compared to conventional digital mammography (DM). However, most of the reported performance metrics are from early experience with this technology. It remains unknown if these benefits are sustained over time. The purpose of our study is to compare screening performance of a large established DBT practice two years after initial implementation of DBT with DM alone, adjusting for patient variables and radiologist experience known to impact performance.

**METHOD AND MATERIALS**

In this IRB approved, HIPAA compliant study, we reviewed medical records to identify consecutive screening DBT exams from 1/2013-3/2015, and consecutive screening DM exams from 1/2009-3/2011. Performance statistics were calculated according to American College of Radiology BI-RADS 5th edition. AIR, CDR, positive predictive values (PPV), and Recommendations for Biopsy (RecBX) were compared for the two time periods. Logistic regression analysis was performed to assess for differences in performance, adjusting for patient demographics (age, density, race, presence of prior mammograms) and radiologist years of experience.

**RESULTS**

The study included 155,285 exams (78,298 DM and 76,987 DBT exams) (mean age: 57.7 years, range 28-98). After adjusting for patient demographics (age, density, race, presence of prior exam) and radiologist experience, the AIR of the DBT group (6.26, 4822/76987) was significantly lower than the DM group (6.89, 5397/78298), (p<0.0001); [adjusted OR: 0.72, 95% Confidence Interval [CI] (0.70-0.76)]; adjusted CDR for DBT (4.9/1000 screens) was not significantly different from DM (4.7/1000), (p=0.74); and the adjusted RecBX for 2D (1.26%) was slightly higher than DBT (1.25%) (p<0.001). The PPVs (1,2,3) for DM and DBT were 6.6%, 34.8%, 40.7%, and 7.8%, 36.4%, and 41.1%, respectively.

**CONCLUSION**

Reduction in AIRs with DBT reported in smaller studies from early implementation of this technology are sustained over time. CDRs, however, are unchanged from the DM group in a mature tomosynthesis practice over time.

**CLINICAL RELEVANCE/APPLICATION**

The benefit of reduced false positives with implementation of tomosynthesis is sustained over time; however, increased cancer detection rates as noted in earlier studies may not persist in established tomosynthesis practices.

**SSM01-05 Clinical Screening Performance of Tomosynthesis with Synthesized 2D Mammograms Compared to Tomosynthesis with Full Field Digital Mammography**

*Wednesday, Nov. 30 3:40PM - 3:50PM Room: E451A*

**Awards**
- Student Travel Stipend Award

**Participants**
- Emily Ambinder, MD, MSc, Baltimore, MD (Presenter) Nothing to Disclose
- Susan C. Harvey, MD, Lutherville, MD (Abstract Co-Author) Nothing to Disclose
- Babita Panigrahi, MD, BS, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
- Ryan W. Woods, MD, MPH, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Digital breast tomosynthesis (DBT) in screening mammography decreases recall rate and increases cancer detection rate. Most practices combine DBT with a 2D full field digital mammogram (FFDM) in order to facilitate comparison to prior FFDM exams. However, the combination of FFDM and DBT has a two-fold higher radiation dose. In order to mitigate the increased radiation dose, we began using synthesized 2D mammograms (SM) in place of FFDM for patients undergoing screening mammography with DBT following FDA approval of this method. The purpose of this study was to evaluate the screening performance of DBT with SM compared to the combination of DBT and FFDM for screening mammography.

**METHOD AND MATERIALS**

We retrospectively reviewed all screening studies utilizing DBT between 2014 and 2016. We divided the studies into two groups: DBT+FFDM (studies performed on or before 2/15/2015) and DBT+SM (studies performed after 2/15/2015). Overall recall rate, recall rate for specific findings, positive predictive value 1 (PPV1), and cancer detection rate (CDR) were compared between the two groups using the Chi-square test.

**RESULTS**

There were 5342 screening exams in the DBT+FFDM group and 14980 screening exams in the DBT+SM group. The total recall rate was 7% for the DBT+FFDM group and 7.2% for the DBT+SM group (p=0.66). There was no effect on positive predictive value 1 (7.08 versus 7.61, p=0.87) or cancer detection rate (4.87 versus 5.27, p=0.81). The number of technical callbacks between these groups was similar (0.37% versus 0.40%, p=0.89). Indications for recall were also compared between the two groups. No differences were found between recall rates for masses (2.68% versus 2.97%, p=0.29), calcifications (1.37% versus 1.46%,
When DBT is performed for screening, the use of a synthesized 2D mammogram rather than an additional FFDM has no significant effect on recall rate, positive predictive value 1, or cancer detection rate, and spares unnecessary radiation dose.

**CLINICAL RELEVANCE/APPLICATION**

Synthesized 2D mammogram can replace the traditional 2D digital mammogram for patients undergoing screening with digital breast tomosynthesis, decreasing radiation dose.

**SSM01-06  Lesion Conspicuity on Synthetic Mammography Images Compared to Full Field Digital Mammography Images in the Screening Setting**

**Wednesday, Nov. 30 3:50PM - 4:00PM Room: E451A**

Participants
Catherine S. Giess, MD, Wellesley, MA (Presenter) Nothing to Disclose
Eren D. Yeh, MD, Boston, MA (Abstract Co-Author) Consultant, Hologic, Inc; Consultant, Statlife
Eva C. Gombos, MD, Boston, MA (Abstract Co-Author) Royalties, Reed Elsevier
Elisabeth P. Frost, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Christine M. Denison, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Sona A. Chikarmane, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Reza Pakdaman, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Sughra Raza, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To compare the conspicuity of imaging findings evaluated at screening mammography on synthetic mammography (SM) + digital breast tomosynthesis (DBT) images to conspicuity on full field digital mammography (FFDM) + DBT images.

**METHOD AND MATERIALS**
Seven breast imagers each prospectively evaluated approximately 100-200 screening mammograms (FFDM, DBT, and SM; total 1206 examinations) over a 12 week period in sets of 10-50 consecutive examinations per screening session. Radiologists alternated viewing SM + DBT first, followed by FFDM views at one interpretation session, and subsequently viewed FFDM views + DBT followed by SM at the next interpretation session. Presence / absence of evaluable findings, and finding conspicuity [masses (M), calcifications (C), asymmetries (A), focal asymmetries (FA), and architectural distortion (AD)] on SM compared to FFDM were evaluated and BIRADS 0 or 1 / 2 assigned. DBT-only findings were excluded from analysis.

**RESULTS**
Results: Mammograms in 1206 patients were reviewed, with 119 patients recalled (9.9%). There were 409 evaluated findings (after 11 DBT-only findings excluded) considered BIRADS 0, 1, or 2, including 72 A, 35 FA, 49 AD, 119 C, and 134 M. Mass conspicuity on SM compared to FFDM included 72 equal, 5 more conspicuous, 54 less conspicuous, and 3 not seen on SM. FA/A conspicuity on SM compared to FFDM included 45 equal, 16 more, and 46 less. AD conspicuity on SM compared to FFDM included 1 only on SM, 18 equal, 27 more, and 3 less. C conspicuity on SM compared to FFDM included 7 only on SM, 13 equal, 95 more and 4 less. FFDM had significantly better conspicuity than SM for masses and asymmetries (p< 0.001); SM had significantly better conspicuity for calcifications and architectural distortion than FFDM (p<0.001).

**CONCLUSION**
Most findings are seen on both SM and FFDM during screening mammography. A strength of SM compared to FFDM is conspicuity of calcifications and architectural distortions, while a relative weakness is conspicuity of masses and asymmetries. Radiology practices replacing FFDM with SM should be aware that masses and asymmetries may be less conspicuous, potentially increasing emphasis on DBT data for detecting these findings.

**CLINICAL RELEVANCE/APPLICATION**
SM can be used to replace FFDM and lower radiation dose. However, radiologists utilizing SM should be aware of its relative strengths and weaknesses compared to FFDM in depicting different lesion types.

**Honored Educators**
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Catherine S. Giess, MD - 2015 Honored Educator
Eren D. Yeh, MD - 2015 Honored Educator
Sughra Raza, MD - 2015 Honored Educator
Breast Imaging (Practice Issues)
Wednesday, Nov. 30 3:00PM - 4:00PM Room: E451B

Trends in Breast Imaging: An Analysis of 21 Years of RSNA Abstracts

Wednesday, Nov. 30 3:00PM - 3:10PM Room: E451B

Participants
Susan Weinstein, MD, Philadelphia, PA (Moderator) Consultant, Siemens AG
Stamatia V. Destounis, MD, Scottsville, NY (Moderator) Nothing to Disclose

Sub-Events
SSM02-01  Trends in Breast Imaging: An Analysis of 21 Years of RSNA Abstracts

Participants
Samantha L. Heller, MD, PhD, New York, NY (Presenter) Nothing to Disclose
Linda Moy, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Yiming Gao, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE
The purpose of this study is to delineate trends and shifts in breast imaging as represented through the RSNA scientific program.

METHOD AND MATERIALS
Twenty-one years (1995-2015) of available RSNA program catalogues from the annual meeting were searched for the following criteria: session topic/modality, gender and degree of presenting author, national or international origin of abstract, study design. Stated grant or society funding and industry ties or support were also recorded.

RESULTS
Over the study period, we identified 1703 breast scientific program abstracts. Although we note increasing variety of investigated modalities, studies invoking MRI were consistently represented in the highest proportion per year, even from early years (27/87 (31%) in 1995; 20/96 (21%) in 2000; 16/75 (21%) in 2005; 28/72 (39%) in 2010; 30/116 (26%) in 2015. Tomosynthesis (DBT) abstracts have recently increased rapidly in number, representing 0% in 1995, and 2000, 5/75 (6.6%) in 2005, 5/72 (6.9%) in 2010 and 24/116 (24%) in 2015. Women were more frequently presenting authors than men, consistent over the study period (43/71 [61%] women in 1995 and 70/96 [73%] women in 2015). The majority of presenters held MD degrees (range 79.3-87.4% per year) while PhDs represented a minority (12.6%-20.7% per year). Prospective studies were consistently in the minority of abstract study design. Proportion of international representation has increased over time (24.1% of abstracts in 1995 compared to 54.3% in 2015). Although majority of studies do not report external sources of funding, industry ties and support were consistently more common than grant funding (up to 3x as much in some years).

CONCLUSION
Even as new radiologic modalities are explored, there is consistent and long-standing interest in core breast modalities, in particular MRI. International representation has steadily increased over 21 years. Majority of studies are unfunded; however, industry support permeates radiology research to a greater degree than government grants.

CLINICAL RELEVANCE/APPLICATION
A long-range overview and analysis of trends and patterns in breast imaging research allows for reflection on and discussion of current and future directions in the breast imaging field.

SSM02-02  State Mandated Breast Density Reporting Language: The Patient Experience

Participants
Lucy B. Spalluto, MD, Nashville, TN (Presenter) Nothing to Disclose
Consuelo Wilkins, MD,MSc, Nashville, TN (Abstract Co-Author) Nothing to Disclose

PURPOSE
To survey women who have received screening mammography reports containing state mandated breast density language regarding their understanding of exam results, preference for exam results, and understanding of the role of the radiologist.

METHOD AND MATERIALS
Study participants were identified through an institutional participant repository recruitment tool of patients confirming interest in research studies and through ResearchMatch.org. Inclusion criteria included women within the targeted state greater than age 40. Email invitations containing a link to the anonymous, electronic based survey were sent to potential participants. The survey was composed of 4 sections: Demographics, Understanding for examination results, Preference for result reporting, and Understanding of the role of the radiologist. The survey was administered via a mature, secure web application.

RESULTS
920 responses were elicited from the 1924 invited participants for a 47.8% response rate. While most women (95%, 832 of 870) felt that the state mandated language adequately informed patients that they have dense breast tissue and informed them that dense breast tissue can affect the interpretation of a mammogram (96%, 835 of 870), patients were uncertain what to do with this...
information. 41% (358 of 865) did not think the statement adequately informed patients what to do if they have dense breast tissue and 83% (716 of 868) did not think the statement adequately informed patients of what additional screening options are available to patients with dense breast tissue. While most of the surveyed women (83%, 717 of 860) knew a radiologist is a doctor, only 41% (349 of 848) knew that radiologists perform minimally invasive procedures.

CONCLUSION
The importance of breast density and patient awareness of breast density has led to legislation in many states mandating radiologists to directly notify patients of their breast density. In some of these states, standard legal language is issued for reporting. The results of this study demonstrate that the current mandated language may not meet the informational needs of patients. Further needs assessment for breast density reporting should be considered.

CLINICAL RELEVANCE/APPLICATION
The informational needs of patients receiving breast density results should be established in order to optimize breast density reporting methods.

SSM02-03  Impact of Second-Opinion Review of Breast Imaging at a Cancer Center: Is It Worthwhile?
Wednesday, Nov. 30 3:20PM - 3:30PM Room: E451B

Awards
Student Travel Stipend Award

Participants
Kristen Coffey, MD, New York, NY (Presenter) Nothing to Disclose
Donna D. D'Alessio, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Delia M. Keating, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Elizabeth A. Morris, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE
Second-opinion review of breast imaging studies can be a time consuming and labor-intensive process. The purpose of our investigation is to determine if reinterpretation of outside studies impacts clinical management, specifically by detecting additional cancer and preventing unnecessary biopsy.

METHOD AND MATERIALS
Retrospective IRB-approved review of submitted outside breast imaging studies for 200 patients seeking second opinions between January and April 2014 was performed. Each case was evaluated for concordance between the original report and second-opinion interpretation. Second-opinion review resulting in the recommendation and performance of new biopsies was further subdivided into benign, high-risk, and malignant categories based on histopathology obtained at our institution.

RESULTS
Second-opinion review of 200 patients found a change in interpretation in 55 cases (28%; 95% CI: 21-34). Overall, 26 recommendations led to a major change in management (13%; 95% CI: 9-18). Twenty new biopsies were performed, yielding 10 malignancies (5%; 95% CI: 2-9) and 4 high-risk lesions (2%; 95% CI: 1-5). Surgical management was changed to mastectomy in 60% patients with new sites of biopsy-proven malignancy. Eight biopsies were spared (4%; 95% CI: 2-8) due to benign interpretation of the imaging findings, with no disease at 1-year follow up.

CONCLUSION
Reinterpretation of outside studies at our cancer center resulted in a change in interpretation in more than a quarter of submitted studies, detecting additional cancer in 5% and averting biopsies in 4%. The practice of second opinion review is therefore a worthwhile utilization of resources and valuable for patient care.

CLINICAL RELEVANCE/APPLICATION
Subspecialty second-opinion review of outside breast imaging has a significant impact on surgical management.

SSM02-04  Management of Two or More Sites of Indeterminate Calcifications in Women without a Concurrent Breast Cancer Diagnosis
Wednesday, Nov. 30 3:30PM - 3:40PM Room: E451B

Participants
Lauren Q. Chang Sen, MD, Houston, TX (Presenter) Nothing to Disclose
Monica L. Huang, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Jessica W. Leung, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Wei Wei, Houston, TX (Abstract Co-Author) Nothing to Disclose
Beatriz E. Adrada, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

PURPOSE
To Investigate the malignancy rate of simultaneous stereotactic biopsies of two or more distinct sites of indeterminate calcifications in women without a concurrent breast cancer diagnosis

METHOD AND MATERIALS
This is a retrospective observational IRB-approved study. Stereotactic biopsy patients with concurrent breast cancer or single site biopsy of calcifications were excluded from the study. During a 39-month period at our institution, 264 patients with two or more distinct sites of calcifications (in either the same or opposite breast) underwent 557 stereotactic core biopsies, constituting the study cohort. Fisher’s exact test was used to compare cancer rates.

RESULTS
Of 264 patients = 2 separate calcifications in ipsilateral or bilateral breasts who underwent stereotactic biopsies. 71 (26.9%)
purposes of the practices of breast imaging were described. Although the distinction between screening and diagnostic mammography has blurred, other imaging modalities have advanced. Digital breast tomosynthesis (DBT) is changing the practice of breast imaging with decreased screening recalls and abbreviated diagnostic studies. The purpose of this study is to examine trends in the volume of screening and diagnostic mammograms in the last three years, and to assess alterations in how they are performed which may blur distinction between the two, specifically the use of breast tomosynthesis in cancer detection.

PURPOSE

Liane E. Philpotts, MD, New Haven, CT (Presenter) Nothing to Disclose
Laura S. Sheiman, MD, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Anees Chagpar, MD, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Madhavi Raghu, MD, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Reni S. Butler, MD, Madison, CT (Abstract Co-Author) Nothing to Disclose
Puciato, RT,BS, New Haven, CT (Abstract Co-Author) Nothing to Disclose

METHOD AND MATERIALS

An IRB-approved retrospective review of patients presenting from January 1, 2009 - January 30, 2016 with new diagnosis of breast cancer, abnormal mammogram or palpable abnormality and subsequent diagnosis of NS along the BX needle tract. All patients underwent diagnostic mammography (FFDM) and whole breast ultrasound (US). Tumor histology, grade, receptor status, size, and TNM staging as well as BX guidance, needle gauge, and number of passes were recorded. The time from BX to NS diagnosis was measured. The imaging features of the primary breast malignancy (PBM) and NS were reviewed. The imaging features of the primary breast malignancy (PBM) and NS were reviewed.

RESULTS

Eight (0.2%) NS cases were identified in 4,010 patients. Mean PBM cancer size was 2.7 cm (range1.6-5.7). US guidance was used in 6 cases (75%). Multiple insertion core needle BX was done in 6 (75%) cases. Single insertion vacuum assisted needle BX was done in 1 case. Sampling information was absent in 1 case. The mean number of passes was 4.25 (range 1-11). The mean time from BX to NS diagnosis was 60.8 days (range 34-165). In 7 (87.5%) cases tumor histology was IDC. A single case of papillary carcinoma was noted. In 6 (75%) cases tumor grade was high (2/3). All (100%) PBM were Her2 negative, 6 (75%) were PR negative and 5 (62.5%) were ER negative. In 7 (87.5%) cases tumors were unifocal. All PBM presented with a mass by FFDM. Associated calcifications were noted in 2 (25%) cases. Corresponding US masses were most frequently irregular (75%), not circumscribed (87.5%) and heterogeneous (50%). Most frequent NS FFDM presentation was focal asymmetry (37.5%) and occult (25%). Most frequent NS US presentation was mass (87.5%) often irregular (62.5%), not circumscribed (75%) and hypoechoic (87.5%). NS was most frequently subdermal in location (75%).

CONCLUSION

There is a substantial cancer rate in patients with stereotactic biopsies of multiple separate calcifications in the same or both breasts. When there are multiple similar appearing distinct sites of calcifications, the same histopathology is detected in 80.8% of patients.

CLINICAL RELEVANCE/APPLICATION

Although 80.8% of calcifications with the same morphology had the same histopathology, near 20% had different histopathology. Therefore, biopsy of each site is still required for surgical management.

SSM02-05 Neoplastic Seeding in the Setting of Percutaneous Image Guided Breast Biopsies

Participants
Lumarie Santiago, MD, Houston, TX (Presenter) Nothing to Disclose
Beatriz E. Adrada, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Monica L. Huang, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Rosalind P. Candelaria, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

METHOD AND MATERIALS

An IRB-approved retrospective review of patients presenting from January 1, 2009 - January 30, 2016 with new diagnosis of breast cancer, abnormal mammogram or palpable abnormality and subsequent diagnosis of NS along the BX needle tract. All patients underwent diagnostic mammography (FFDM) and whole breast ultrasound (US). Tumor histology, grade, receptor status, size, and TNM staging as well as BX guidance, needle gauge, and number of passes were recorded. The time from BX to NS diagnosis was measured. The imaging features of the primary breast malignancy (PBM) and NS were reviewed.

RESULTS

Eight (0.2%) NS cases were identified in 4,010 patients. Mean PBM cancer size was 2.7 cm (range1.6-5.7). US guidance was used in 6 cases (75%). Multiple insertion core needle BX was done in 6 (75%) cases. Single insertion vacuum assisted needle BX was done in 1 case. Sampling information was absent in 1 case. The mean number of passes was 4.25 (range 1-11). The mean time from BX to NS diagnosis was 60.8 days (range 34-165). In 7 (87.5%) cases tumor histology was IDC. A single case of papillary carcinoma was noted. In 6 (75%) cases tumor grade was high (2/3). All (100%) PBM were Her2 negative, 6 (75%) were PR negative and 5 (62.5%) were ER negative. In 7 (87.5%) cases tumors were unifocal. All PBM presented with a mass by FFDM. Associated calcifications were noted in 2 (25%) cases. Corresponding US masses were most frequently irregular (75%), not circumscribed (87.5%) and heterogeneous (50%). Most frequent NS FFDM presentation was focal asymmetry (37.5%) and occult (25%). Most frequent NS US presentation was mass (87.5%) often irregular (62.5%), not circumscribed (75%) and hypoechoic (87.5%). NS was most frequently subdermal in location (75%).

CONCLUSION

Multiple insertion BX, Her2 negative and high grade tumors may be risk factors for NS after percutaneous BX. PBM and NS have variable FFDM and US features. NS most frequently presented as a mass on US while having variable presentation at FFDM. Associated calcifications were noted in 2 (25%) cases. Corresponding US masses were most frequently irregular (75%), not circumscribed (87.5%) and heterogeneous (50%). Most frequent NS FFDM presentation was focal asymmetry (37.5%) and occult (25%). Most frequent NS US presentation was mass (87.5%) often irregular (62.5%), not circumscribed (75%) and hypoechoic (87.5%). NS was most frequently subdermal in location (75%).

CLINICAL RELEVANCE/APPLICATION

Although rare, NS should be suspected based on its temporal and geographic relationship to the initial biopsy when there is apparent disease progression in HER2 negative and high-grade cancers.

SSM02-06 Practice Changing Outcomes of Tomosynthesis: Shifting Volumes and Diminishing Distinctions between Screening and Diagnostic Patients

Participants
Reni S. Butler, MD, Madison, CT (Abstract Co-Author) Nothing to Disclose
Christine Puciato, RT,BS, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Maria Gumkowski, RT, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Jacquelyn Crenshaw, RT, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Anees Chagpar, MD, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Laura S. Sheiman, MD, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Madhavi Raghu, MD, New Haven, CT (Presenter) Nothing to Disclose
Liane E. Philpotts, MD, New Haven, CT (Abstract Co-Author) Nothing to Disclose

PURPOSE

Digital breast tomosynthesis (DBT) is changing the practice of breast imaging with decreased screening recalls and abbreviated diagnostic studies. The purpose of this study is to examine trends in the volume of screening and diagnostic mammograms in the last three years, and to assess alterations in how they are performed which may blur distinction between the two, specifically the practice of breast imaging with decreased screening recalls and abbreviated diagnostic studies. The purpose of this study is to examine trends in the volume of screening and diagnostic mammograms in the last three years, and to assess alterations in how they are performed which may blur distinction between the two, specifically the
proportion of screening patients receiving immediate results and the proportion of diagnostic patients imaged with only four views.

**METHOD AND MATERIALS**

A HIPAA compliant audit of the breast imaging electronic database (PenRad, MN) at a dedicated breast center offering DBT to all patients was performed to identify screening and diagnostic mammograms performed over 3 one-year intervals: A:10/1/12–9/30/13, B:10/1/13–9/30/14, C:10/1/14–9/30/15. The volume of each type of exam performed during this time was recorded along with the volume of patient visits to the clinical breast center (a surrogate for diagnostic referrals). In addition, the percentage of screening patients receiving immediate results was assessed, and the number of diagnostic patients imaged with only four routine views was determined.

**RESULTS**

The total number of exams performed during the three periods was similar A: 16,906, B: 16,813, C: 16,415. The number of clinical patient visits increased slightly over the three years. Screening mammograms increased (A: 5,726, B: 5,764, C: 6,710) by 17% while diagnostic mammograms decreased (A: 5,387, B: 5,048, C: 3,805) by 29%. The percentage of screening patients receiving immediate results increased by a factor of 2.5: from 18% in year 1 to 46% in year 3. The percentage of diagnostic patients imaged with only four routine views increased by a factor of 3: from 24% in year 1 to 73% in year 3.

**CONCLUSION**

Continued utilization of DBT in the screening and diagnostic environment over time allows for both a reduction in volume and number of views for diagnostic mammograms and an increase in volume of screening mammograms.

**CLINICAL RELEVANCE/APPLICATION**

DBT is changing current paradigms of breast imaging practice, including the way screening and diagnostic mammograms are defined and performed, with implications for patient scheduling, breast center staffing, and the option to give more patients immediate results.
Participants

PARTICIPANTS

Christopher Henley, Chicago, Illinois, USA

Program Information

Under the guidance of a breast imaging expert you will develop your skills in the interpretation of 3D breast ultrasound acquired with the ACUSON S2000™ Automated Breast Volume Scanner (ABVS), HELX Evolution with Touch Control and displayed on workstations equipped with syngo.Ultrasound Breast Analysis (sUSBA) Software. Active participation in real clinical cases will enable you to become familiar with the coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Controversy Session: Screening Mammography: Ending the Confusion

Wednesday, Nov. 30 4:30PM - 6:00PM Room: E451A

Participants
Cherie M. Kuzmiak, DO, Chapel Hill, NC, (Cherie_kuzmiak@med.unc.edu) (Moderator) Research Grant, FUJIFILM Holdings Corporation;

LEARNING OBJECTIVES
1) Understand the pros & cons between the different screening guidelines. 2) Discuss the importance of patient informed decision of the facts. 3) Be able to explain the different types of supplemental screening and when to use them appropriately.

ABSTRACT

URL

Sub-Events

SPSC44A  Screening Mammography Guidelines

Participants
Debra L. Monticciolo, MD, Temple, TX (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To understand the basic data on breast cancer screening with mammography. 2) To review the basis for the current screening recommendations. 3) To understand the pros and cons of recommendations from different sources.

ABSTRACT

URL

SPSC44B  Personalized Screening

Participants
Wendie A. Berg, MD, PhD, Pittsburgh, PA, (wendieberg@gmail.com) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify populations in which mammography screening has been less effective. 2) Describe indications for supplemental screening with MRI. 3) Discuss use of screening ultrasound and tomosynthesis in women with dense breasts.

URL
www.DenseBreast-info.org/Technology.aspx

SPSC44C  Ask the Experts

Participants
Debra L. Monticciolo, MD, Temple, TX (Presenter) Nothing to Disclose
Wendie A. Berg, MD, PhD, Pittsburgh, PA (Presenter) Nothing to Disclose
Cherie M. Kuzmiak, DO, Chapel Hill, NC, (Cherie_kuzmiak@med.unc.edu) (Presenter) Research Grant, FUJIFILM Holdings Corporation;

LEARNING OBJECTIVES
View learning objectives under the main course title.

ABSTRACT

URL
Breast Thursday Case of the Day

Thursday, Dec. 1 7:00AM - 11:59PM Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Phoebe E. Freer, MD, Salt Lake City, UT (Presenter) Nothing to Disclose
Matthew Stein, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Nicole S. Winkler, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Matthew B. Morgan, MD, Sandy, UT (Abstract Co-Author) Consultant, Reed Elsevier
Anna K. McGow, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Laurie L. Fajardo, MD, MBA, Park City, UT (Abstract Co-Author) Consultant, Hologic, Inc; Scientific Advisory Board, Hologic, Inc; Consultant, Koninklijke Philips NV; Advisory Board, Koninklijke Philips NV; Consultant, Siemens AG; Consultant, FUJIFILM Holdings Corporation; Advisory Board, Galena Biopharma, Inc
Maryam Rezvani, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Scott Harada, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose

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

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Maryam Rezvani, MD - 2015 Honored Educator
BI-RADS (An Interactive Session)
Thursday, Dec. 1 8:30AM - 10:00AM Room: E450A

Participants
Cherie M. Kuzmiak, DO, Chapel Hill, NC, (Cherie_kuzmiak@med.unc.edu) (Moderator) Research Grant, FUJIFILM Holdings Corporation;

LEARNING OBJECTIVES
1) Improve basic knowledge of the descriptive terms in the updated BI-RADS mammography lexicon. 2) Develop an understanding of the BI-RADS management terminology and explanations for each assessment category. 3) Apply the mammography lexicon descriptors appropriately and assign the most appropriate BI-RADS assessment category to various mammographic breast lesions. 4) Review updated BI-RADS ultrasound lexicon terms and assessment categories. 5) Provide a case-based illustration of BI-RADS ultrasound lexicon descriptors and assessment categories. 6) Test knowledge of concepts with challenging unknown cases. 7) Be able to apply a systematic approach to using MRI BI-RADS. 8) Recognize the similarities between BI-RADS for MRI and mammography. 9) Recognize situations where a BI-RADS assessment is not used for MRI.

ABSTRACT

Sub-Events

RC615A Mammography

Participants
Cecilia L. Mercado, MD, New York, NY, (cecilia.mercado@nyumc.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Improve basic knowledge of the descriptive terms in the updated BI-RADS mammography lexicon. 2) Develop an understanding of the BI-RADS management terminology and explanations for each assessment category. 3) Apply the mammography lexicon descriptors appropriately and assign the most appropriate BI-RADS assessment category to various mammographic breast lesions.

ABSTRACT

RC615B Ultrasound

Participants
Eun L. Langman, MD, Chapel Hill, NC, (EJL@med.unc.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Review updated BI-RADS ultrasound lexicon terms and assessment categories. 2) Provide a case-based illustration of BI-RADS ultrasound lexicon descriptors and assessment categories. 3) Test knowledge of concepts with challenging unknown cases.

ABSTRACT

RC615C Breast MRI

Participants
Bonnie N. Joe, MD, PhD, San Francisco, CA, (bonnie.joe@ucsf.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Be able to apply a systematic approach to using MRI BI-RADS. 2) Recognize the similarities between BI-RADS for MRI and mammography. 3) Recognize situations where a BI-RADS assessment is not used for MRI.

ABSTRACT

Breast MRI BI-RADS follows a systematic approach analogous to mammography BI-RADS. BI-RADS includes three important components: (a) a lexicon of descriptors, (b) a reporting structure to include final assessment categories and management recommendations, and (c) a framework for data collection and auditing. This session will use an interactive format (audience response system) to review appropriate use of BI-RADS for breast MRI interpretation including scenarios where BI-RADS assessments are not appropriate.
Breast Tomosynthesis Self-guided Reading Sessions: Siemens Healthineers Vendor Workshop
Thursday, Dec. 1 10:30AM - 2:00PM Room: Booth 5534

Participants

PARTICIPANTS
N.A.

PROGRAM INFORMATION

You are invited to our self-guided reading sessions. With syngo Breast Care workstations configured especially to allow you to work at your own place at a time that suits you! A series of breast tomosynthesis cases presented as problem cases with a solution enables you to develop and test your tomosynthesis reading skills.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Automated Breast Volume Scanner (ABVS) Self-guided Reading Sessions: Siemens Healthineers Vendor Workshop

Thursday, Dec. 1 10:30AM - 2:00PM Room: Booth 5534

Participants

PARTICIPANTS
N.A.

PROGRAM INFORMATION

With syngo.Ultrasound Breast Analysis (sUSBA) Software, self guided reading sessions with real clinical cases will enable you to become familiar with the coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

Registration

http://www.fairorg.de/siemens-healthcare/portal/workshop.cfm/RSNA16/
Breast Imaging (MR Diagnostics)

Thursday, Dec. 1 10:30AM - 12:00PM Room: E450A

Participants
Janice S. Sung, MD, New York, NY (Moderator) Nothing to Disclose
Christopher E. Comstock, MD, New York, NY (Moderator) Nothing to Disclose
Colleen H. Neal, MD, Ann Arbor, MI (Moderator) Nothing to Disclose

Sub-Events

SSQ01-01  A Multicenter Randomized Trial on Breast Cancer (BC) Screening in Women at Intermediate Risk Comparing Contrast-Enhanced MRI Alone Versus Mammography and Ultrasonography (Mam/US): Feasibility and Short-Term Results

Thursday, Dec. 1 10:30AM - 10:40AM Room: E450A

Participants
Rubina Manuela Trimboli, San Donato Milanese, Italy (Presenter) Nothing to Disclose
Luigina A. Bonelli, GENOVA, Italy (Abstract Co-Author) Nothing to Disclose
Massimo Calabrese, MD, Genova, Italy (Abstract Co-Author) Nothing to Disclose
Alberto S. Tagliafico, MD, Genova, Italy (Abstract Co-Author) Nothing to Disclose
Francesca Valdora, GENOVA, Italy (Abstract Co-Author) Nothing to Disclose
Stefano Corcione, MD, Ferrara, Italy (Abstract Co-Author) Nothing to Disclose
Stefania Montemazzi, MD, Verona, Italy (Abstract Co-Author) Nothing to Disclose
Lucia Camera, Verona, Italy (Abstract Co-Author) Nothing to Disclose
Luca A. Carbonaro, MD, San Donato Milanese, Italy (Abstract Co-Author) Nothing to Disclose
Claudio Losio, MD, Milan, Italy (Abstract Co-Author) Nothing to Disclose
Chiara Zuiani, MD, Udine, Italy (Abstract Co-Author) Nothing to Disclose
Sara Vigano, MD, San Donato Milanese, Italy (Abstract Co-Author) Nothing to Disclose
Antonella Petritto, MD, Naples, Italy (Abstract Co-Author) Nothing to Disclose
Ilaria Poire, GENOVA, Italy (Abstract Co-Author) Nothing to Disclose
Paolo Buzzi, Genova, Italy (Abstract Co-Author) Nothing to Disclose
Francesco Sardanelli, MD, San Donato Milanese, Italy (Abstract Co-Author) Speakers Bureau, Bracco Group Research Grant, Bracco Group Speakers Bureau, Bayer AG Research Grant, Bayer AG Research Grant, IMS International Medical Scientific
Federica Pediconi, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Daniele De Falco Alfano, MD, Ferrara, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess the performance of contrast-enhanced MRI imaging versus Mam/US for screening women at intermediate BC risk (study funded by the Italian Ministry of Health, Ricerca Finalizzata 2009-1539582).

METHOD AND MATERIALS
IRB approval at 10 centers and informed written consent by each enrolled woman were obtained. Asymptomatic women aged 40-59 were enrolled for a 15%-29% cumulative lifetime BC risk (Tyrer-Cuzick model, IBIS risk/evaluator), and/or a ≥ 75% density at mammography. Patients were randomly assigned to receive annual Mam/US or contrast-enhanced MRI (gadobenate dimeglumine, 0.1 mmol/kg). Two rounds per woman were planned.

RESULTS
A total of 1,302 women (median age 46, range 40-59) were enrolled from 07/2013 to 11/2015. Of them, 624 (48%) were assigned to Mam/US and 630 (48%) to MRI, while 48 (4%) were eligible but refused randomization. At 1st round, BC was found in 3 of 610 women (0.49%) for Mam/US (2 invasive ductal carcinoma [IDC], 1 invasive lobular carcinoma) and in 6 of 529 (1.13%) for MRI (4 IDC, 1 cribriform, 1 mucinous, 1 ductal carcinoma in situ; one bilateral BC); at 2nd round, in 0 of 346 (0.0%) and in 2 of 217 (0.92%) (1 IDC, 1 tubular), respectively. At 1st round, the recall rate was 29/610 (4.8%) for Mam/US and 105/529 (19.8%) for MRI; at 2nd round, 10/346 (2.9%) and 33/217 (15.2%), respectively. Notably, the rate of invasive assessment for MRI was 41/529 (7.8%) at 1st round and 11/217 (5.1%) at 2nd round. The cumulative rate (1st and 2nd round) of invasive assessment was 7.6% for Mam/US and 12.2% for MRI. At 1st round, positive predictive value was 10.3% (2.2%-27.0%) for Mam/US and 14.6% (5%-29%) for MRI; at 2nd round, 18% (2%-51%) for MRI (no detection for Mam/US).

CONCLUSION
Randomized controlled trials exploring the value of screening MRI versus Mam/US are feasible. More invasive BCs were detected with MRI than with Mam/US. PPV of MRI resulted to be competitive with that of Mam/US; cumulative invasive assessment rate slightly increased for MRI but was balanced by a higher BC detection.

CLINICAL RELEVANCE/APPLICATION
If our results will be confirmed by other studies, women at intermediate risk of BC could benefit from screening with MRI as a stand-alone screening tool.

SSQ01-02  Revisiting Non-Mass Enhancement (NME) in Breast MRI: Analysis of Outcomes and Follow-up using the Updated BI-RADS Atlas

Thursday, Dec. 1 10:40AM - 10:50AM Room: E450A
Are Mammographically Occult Additional Tumors Identified More Than 2cm Away From the Primary Breast Cancer on MRI Clinically Significant?

Thursday, Dec. 1 10:50AM - 11:00AM Room: E450A

Participants
Sona A. Chikarmane, MD, Boston, MA (Presenter) Nothing to Disclose
Aya Michaels, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Catherine S. Giess, MD, Wellesley, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE
To (1) determine positive predictive values (PPV) of non-mass enhancement (NME) descriptors using the revised BI-RADS atlas and (2) assess the frequency of re-classification of NME as background parenchymal enhancement (BPE)

METHOD AND MATERIALS
IRB-approved retrospective review of the MRI database from 1/1/2009-3/30/2012 identified 7332 contrast-enhanced breast MRIs. All findings prospectively assessed as NME and given BI-RADS 3, 4 and 5 (n=386) were re-reviewed by 2 radiologists in consensus, blinded to pathology. Findings considered post-surgical, associated with known cancers, BI-RADS 3 cases with initial assessments prior to study period, previously biopsied, and findings re-classified as BPE, focus or mass were excluded (n=181). The 1st finding reported was used (1 finding per patient). Fibroglandular tissue, BPE, distribution, internal enhancement patterns (IEP), and T2 signal were recorded. The medical record was reviewed for demographics and outcomes of imaging surveillance and biopsy.

RESULTS
205 cases (205 women) were included (ave 48.8, range 21-84 yrs). Of excluded cases, 77/386 (20%) were re-classified as BPE (ave 43.9, range 31-62 yrs), significantly younger than patients with NME (p=0.003). Pathology was available in 145/205 (70.7%) cases (50 malignant, 10 high risk [no upgrades], 85 benign). PPVs of distributions: segmental (10/29, 34.5%); linear (12/53, 22.6%); focal (22/102, 21.5%); regional (3/18, 16.6%); and diffuse (3/3, 100%). PPVs for IEP: clustered ring (10/30, 33.3%); clumped (11/40, 27.5%); heterogeneous (15/69, 21.7%) and homogenous (14/66, 21.2%). No difference for NME malignancy rate was noted by BPE (10/52 [19.2%] in marked/moderate; 40/113 [26.1%] in mild/minimal, p=0.35). 32% (16/50) of malignant NME had T2 signal.

CONCLUSION
Careful assessment of findings as BPE vs NME can improve PPVs, particularly in younger women, as 20% of prospectively assigned NME cases were re-classified BPE. Although clustered ring enhancement had one of the study’s highest PPVs (33.3%), this number falls much below previously published rates. Reliance on T2 signal as a benign feature may be misleading, as slightly over 1/3 of malignancies had T2 signal.

CLINICAL RELEVANCE/APPLICATION
To improve PPVs of NME, assessment of findings as BPE vs NME must be carefully evaluated before recommending biopsy, particularly in younger women. The significance of high T2 signal in differentiating benign vs malignant lesions should be re-visited.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Catherine S. Giess, MD - 2015 Honored Educator

Are Mammographically Occult Additional Tumors Identified More Than 2cm Away From the Primary Breast Cancer on MRI Clinically Significant?

SSQ01-03

Awards
Student Travel Stipend Award

Participants
Sarah Goodman, MD, New York, NY (Presenter) Nothing to Disclose
Victoria Mango, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Lauren C. Friedlander, MD, White Plains, NY (Abstract Co-Author) Nothing to Disclose
Elise Desperito, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Alexandra Pass, New York, NY (Abstract Co-Author) Nothing to Disclose
Ralph T. Wynn, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Richard S. Ha, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the clinical significance of mammographically occult additional tumors identified more than 2 cm away from the primary breast cancer on pre-operative MRI.

METHOD AND MATERIALS
An IRB approved, HIPAA compliant review of breast MRIs from 1/1/08 to 12/31/14, yielded 256 mammographically occult breast tumors in 207 patients. Of these patients, 150 tumors were more than 2 cm away from the edge of the primary tumor in 129 patients. These patients underwent further assessment including MRI feature characterization and pathology review. Statistical analysis was performed.

RESULTS
112/129 (86.8%) patients had 1 additional tumor and 17/129 (13.2%) had 2 or more additional tumors. In 71/129(55.0%), additional tumors were located in a different quadrant and in 58/129 (45.0%) additional tumors were in the same quadrant but ≥2 cm away. Overall, primary tumor size was significantly larger (mean 1.87 cm, 95% CI: 1.48-2.26) than the additional tumors (mean 0.79 cm,
95% CI: 0.46-1.12, p=0.0023). However, in 20/129 (15.5%) the additional tumor was larger and in 26/129 (20.2%) the additional tumor was > 1 cm. The primary tumor was significantly more likely to be invasive (81.4%, 105/129) compared to additional tumors (70%, 105/150, p = 0.037). No significant difference in ERBB2/hormone receptor status or tumor grade was present between the two groups. In 9/129 (6.9%) patients, additional tumors yielded unsuspected invasive cancer or higher tumor grade. The primary tumors were more likely to be masses (75.2%, 97/129) than the additional tumors (56.2%, 79/150, p=0.0003). The additional tumor was more likely to be nonmass lesion type (37.3%, 56/150 vs 24%, 31/129, p=0.026) and focus lesion type (10%, 15/150 vs 0.8%, 1/129, p=0.0005). No statistical differences were present regarding initial and delayed enhancement pattern (p>0.05).

CONCLUSION

Mammographically occult additional tumors identified more than 2 cm away from the primary breast tumor are unlikely to be surgically treated if undiagnosed and may be clinically significant with 15.5% of additional tumors larger than the primary tumor, 20.2% greater than 1 cm in size and 6.9% more biologically significant.

CLINICAL RELEVANCE/APPLICATION

MRI detected additional breast tumors that are unlikely treated by surgery (>2cm away) may represent larger and biologically significant tumors with clinical management implications.

SSQ01-04  Effect of Background Parenchymal Enhancement on Diagnostic Performance of Breast MRI

Participants
Kimberly M. Ray, MD, San Francisco, CA (Presenter) Nothing to Disclose
Iryna Lobach, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Vignesh Arasu, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Michael Hofman, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate the effect of background parenchymal enhancement (BPE) on the diagnostic performance of breast MRI.

METHOD AND MATERIALS

This study is an IRB-approved, HIPAA-compliant prospective review of 3,602 contrast enhanced breast MRI exams recorded in a mammography registry among 6 breast imaging facilities in the San Francisco Bay Area, from 1/2010-10/2012. Data was collected on patient demographics, breast cancer risk factors and menopausal status. All breast MRI indications for examination were included that had a BPE classification. BI-RADS final assessment was used to calculate performance measures. Biopsies performed within 180 days of MRI and pathology results were used to calculate PPV3. Breast cancers obtained by linkage to the state tumor registry within 12 months of MRI examinations were used to calculate cancer detection rate (CDR), sensitivity, and specificity. Performance measures were calculated and compared for exams with low BPE (mild or minimal) versus high BPE (moderate or marked) using binomial tests of proportions.

RESULTS

There were 2,656 (73.7%) exams classified as low BPE and 946 exams (26.3%) classified as high BPE. The abnormal interpretation rate was 350/2,656 (13.2%) vs. 223/946 (23.6%) for the low vs. high BPE groups, respectively (p<0.001). The biopsy rate was 276/2,656 (10.4%) vs. 169/946 (17.9%) for the low vs. high BPE groups, respectively (p<0.001). PPV3 was 0.49 (95% CI 0.43, 0.55) vs. 0.34 (95% CI 0.27, 0.42) for the low vs. high BPE groups, respectively (p=0.004). Cancer detection rates for the low vs. high BPE groups were 50 vs. 61 per 1000 examinations (p=0.23). Specificity was significantly lower for the high vs. low BPE groups for screening and diagnostic indications (p<0.001), but there was no significant difference in sensitivity.

CONCLUSION

Relative to MRI examinations with minimal or mild BPE, those with moderate or marked BPE were associated with higher abnormal interpretation and biopsy rates, lower PPV3, and lower specificity, but there was no significant difference in sensitivity for cancer detection between the cohorts.

CLINICAL RELEVANCE/APPLICATION

Moderate to marked BPE at breast MRI is associated with higher abnormal interpretation and false positive biopsy rates, with no additional cancer detection.

SSQ01-05  Is Background Parenchymal Enhancement Better Assessed on Axial or Sagittal Acquisition on Breast MRI?

Participants
Alana A. Lewin, MD, New York, NY (Presenter) Nothing to Disclose
Laura Heacock, MD, MS, New York, NY (Abstract Co-Author) Nothing to Disclose
Amy N. Melsaether, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Yiming Gao, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Samantha L. Heller, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
James S. Babb, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
Hildegard B. Toth, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Linda Moy, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE
BPE may confound accurate interpretation of MR images. Since atypical patterns of BPE usually present as asymmetric enhancement, the ability to simultaneously visualize both breasts may improve interpretive accuracy. We sought to determine if axial acquisition led to fewer follow-up exams and biopsies of enhancing lesions that were felt to represent BPE.

METHOD AND MATERIALS
An IRB-approved, retrospective review of 3468 consecutive breast MRI exams was performed from Jan 2013 – March 2016. Our practice routinely performed BPE and amount of fibroglandular tissue since 2010. MRI exams were acquired in the sagittal plane from Jan 2013 – June 2015 in 2653 (76.5%) exams. Since July 2015 – March 2016, the axial acquisition was utilized in 815 (23.5%) MRI exams. The final BI-RADS assessments, category of BPE, rate of follow-up and biopsy recommendations were recorded to determine the outcomes of NME and foci (single and multiple foci). Statistics included Fisher’s exact tests.

RESULTS
Of 3468 exams, 2254 (65%) were assessed as BI-RADS 1 or 2, 104 (3%) as BI-RADS 0, 243 (7%) as BI-RADS 3, 659 (19%) as BI-RADS 4 or 5. The remaining 227 NME and foci comprised our BI-RADS 3 lesions and 557 NME and foci comprised our BI-RADS 4 or 5 group. NME and foci were more likely to be categorized as BI-RADS 3 on sagittal acquisition 183/2653 (6.9%) than on axial imaging 34/815 (4%) (p=0.0048). Also, NME and foci were more likely to be categorized as BI-RADS 4 on sagittal acquisition 459/2653 (17.3%) than on axial imaging 98/815 (12%) on axial imaging (p=0.003). The PPV3 was 95/459 (20.7%) on sagittal imaging and 30/98 (30.6%) on axial imaging. Further findings that were classified as asymmetric BPE and, either biopsied and proven benign or being followed, trended toward significance of being more often detected on sagittal imaging (94/642 (14.6%) than on axial imaging 11/132 (8.3%) (p=0.0685).

CONCLUSION
Axial acquisition of breast MRI allows for direct comparison of asymmetric BPE in both breasts, with fewer BI-RADS 3 lesions, decreased follow-up of biopsies findings and higher positive predictive value of NME/foci compared to sagittal MRI.

CLINICAL RELEVANCE/APPLICATION
Axial breast MRI has increased positive predictive value and decreased follow-up of NME compared to a sagittal acquisition.

SSQ01-06 Pre-operative MRI Predicts Recurrence after Primary Invasive Breast Cancer Diagnosis Indepedently of Histopathology: Results from 10 Years of Follow-up of a Multi-modality Imaging Trial Cohort

Awards
Trainee Research Prize - Fellow

Participants
Jennifer Rowland, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Elizabeth S. McDonald, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Lauren Pantalone, BS, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Andrew Oustimov, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Rebecca Batiste, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Kathleen M. Thomas, BS, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Michael D. Feldman, MD, PhD, Philadelphia, PA (Abstract Co-Author) Advisory Board, Inspirata Inc Advisory Board, Koninklijke Philips NV Advisory Board, XIFIN, Inc
Mitchell D. Schnall, MD, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Emily F. Conant, MD, Philadelphia, PA (Abstract Co-Author) Consultant, Hologic, Inc; Consultant, Siemens AG
Despina Kontos, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

METHOD AND MATERIALS
We retrospectively analyzed data from a trial completed at our institution during 2002-2006, designed to determine the value of multi-modality imaging for breast cancer screening, detection, and staging. A total of 901 women were recruited and 231 were diagnosed with primary invasive breast cancer. All women received digital mammography, breast MRI, and whole-breast ultrasound at primary diagnosis and lesion features were interpreted using BI-RADS. Prognostic markers were assessed, including tumor histopathology, TNM stage, grade, lymph node status and IHC including ER, PR, and Her2. Women received standard “first-line” therapy and 10-year follow-up was tracked. Imaging and histopathology features were tested for univariate associations with recurrence free survival (RFS) using Kaplan-Meier analysis, and features with p-value below 0.20 were considered for multivariate analysis in Cox proportional hazards models. Imaging features were added one at a time to a baseline model with the histopathology markers, and were deemed significant at the α=0.05 level using the likelihood ratio test. Effect sizes were assessed via hazard ratios (HR) and model discriminatory capacity was evaluated with the C-statistic, adjusted for time-to-event data.

RESULTS
A total of 36 (16%) recurrences were observed. MRI lesion enhancement pattern (diffuse vs. non-diffuse) was significantly associated with RFS in both univariate (p=0.001, HR=4.20 (1.66-10.61)) and multivariate analysis (p=0.001, HR=5.90 (2.00-17.42)), with significant independent contribution of the MRI feature (p=0.004). The discriminatory capacity of the models with and without the MRI feature were 0.81 (0.69-0.92) and 0.77 (0.65-0.88), respectively, suggesting improved prognostic ability with the MRI feature.

CONCLUSION
Presence of diffuse MRI lesion enhancement has independent prognostic value and could be used to augment the assessment of a woman’s risk of recurrence when incorporated with clinical and histopathologic markers.
CLINICAL RELEVANCE/APPLICATION
Pre-operative MRI imaging of invasive breast cancer may improve the prediction of 10-year recurrence free survival, therefore enabling more personalized treatment planning.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Mitchell D. Schnall, MD, PhD - 2013 Honored Educator

SSQ01-07  Management of High-Risk Breast Lesions Found on Mammogram or US: Can MRI Identify Patients Who Do Not Need Excision?

Participants
Jill Hammersley, MD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose
Grace Blitzer, BS, Milwaukee, WI (Presenter) Nothing to Disclose
Savannah C. Partridge, PhD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Stephen A. Quinet, MD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose
Habib Rahbar, MD, Seattle, WA (Abstract Co-Author) Research Grant, General Electric Company

PURPOSE
The purpose of this study is to evaluate the diagnostic performance of MRI to predict malignant upgrade of high-risk lesions prior to excisional biopsy.

METHOD AND MATERIALS
For this IRB-approved study, we retrospectively searched our database of all 4846 breast MRI reports performed at our institution between 1995-2016 for terms indicating the presence of a high-risk lesion, defined as ADH, LCIS, ALH, radial scar, papilloma, or FEA. Patients confirmed by medical record review to have a high-risk lesion first identified on mammogram and/or ultrasound and who had an MRI performed ≤6 months after the biopsy yielding high-risk pathology but prior to excision were included in this study. We retrospectively evaluated these MRIs for presence or absence of enhancement at the biopsy site. Final outcomes were determined by surgical excision or ≥24 months of negative imaging follow-up. The diagnostic performance of MRI for the detection of malignancy based on presence of enhancement was calculated. The number and results of additional biopsies prompted by suspicious MRI findings were also recorded.

RESULTS
Forty-eight lesions (18 ADH, 8 ALH, 12 LCIS, 9 papillomas, and 1 FEA) in 44 patients were included in the study. Forty lesions underwent definitive excision while 8 had negative follow-up imaging. Of the 48 high-risk lesions, 28 (58%) showed contrast enhancement on MRI and 20 (42%) did not. Eight of the 48 lesions (17%) upgraded to cancer on excision, all of which demonstrated enhancement on MRI. The sensitivity, specificity, negative predictive value, positive predictive value and accuracy of MRI based on presence of enhancement were 100%, 50%, 100%, 29% and 58%, respectively. MRI detected additional suspicious lesions prompting biopsy in 24/44 (55%) patients; 7/24 lesions (29%) were malignant and 17/24 (71%) were high risk or benign.

CONCLUSION
The absence of enhancement on MRI at the site of a known high-risk lesion predicted lack of upgrade to malignancy in this cohort. Although MRI prompted additional biopsies in a slight majority of patients, these biopsies confirmed the presence of malignancy in 17% of patients prior to surgery.

CLINICAL RELEVANCE/APPLICATION
Our study suggests that patients with a high-risk lesion that does not enhance on MRI may not require surgical excision and instead may be safely followed with imaging.

SSQ01-08  Impact of Background Parenchymal Enhancement on Cancer Risk Across a Diversity of High Risk Patient Populations Undergoing Screening Breast MRI

Participants
Geoffrey M. Rutledge, MD, Boston, MA (Presenter) Nothing to Disclose
Dorothy A. Sippo, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Pragya A. Dang, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Ashley A. Roark, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Elkan F. Halpern, PhD, Boston, MA (Abstract Co-Author) Research Consultant, Hologic, Inc; Research Consultant, Real Imaging Ltd; Research Consultant, Gamma Medica, Inc; Research Consultant, K2M Group Holdings, Inc
Constance D. Lehman, MD, PhD, Boston, MA (Abstract Co-Author) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company

PURPOSE
To evaluate the impact of background parenchymal enhancement (BPE) on cancer risk across a diversity of high risk patient populations undergoing screening breast magnetic resonance imaging (MRI).

METHOD AND MATERIALS
To evaluate the impact of background parenchymal enhancement (BPE) on cancer risk across a diversity of high risk patient populations undergoing screening breast magnetic resonance imaging (MRI).
Consecutive screening breast MRIs performed between February 7, 2011 and February 7, 2015 were reviewed with IRB approval. Multivariate logistic regression was used to assess the association of the following variables with cancer risk: age, clinical indication [grouped and prioritized as BRCA carrier > personal history (PH) of breast cancer > family history (FH) of breast cancer], qualitative BPE assessment (grouped into minimal, mild, or moderate/marked), and mammographic breast density [grouped into dense (heterogeneous or extreme) or non-dense (fatty or scattered)]. Cancer diagnosis was defined as a tissue diagnosis of invasive or in situ carcinoma within twelve months of the MRI or before the next screening MRI, whichever occurred first.

RESULTS

The study cohort included 4535 screening MRIs performed in 2338 women, grouped by BPE into minimal (1752/4535, 38.6%), mild (2122/4535, 46.8%), or moderate/marked (661/4535, 14.6%) and by clinical indication into BRCA (550/4535, 12.1%), PH (2664/4535, 58.7%), or FH (1321/4535, 29.1%). Seventy-three cancers were diagnosed overall (rate of 16.1 per 1000); BPE was assessed in these cases as minimal (17/73, 23.3%), mild (38/73, 52.1%), or moderate/marked (18/73, 24.7%), and clinical indication was BRCA (16/73, 21.9%), PH (44/73, 60.3%), or FH (13/73, 17.8%). BPE and clinical indication were independent predictors of cancer development (p=0.0004 and p=0.002, respectively), but age and mammographic breast density were not (p=0.21 and p=0.57, respectively). In comparison to minimal BPE, the odds ratios of mild and moderate/marked BPE were 2.1 (confidence interval 1.2-3.8, p=0.09) and 4.5 (2.1-9.4, p=0.0003), respectively. In comparison to FH, the odds ratios of PH and BRCA were 2.1 (1.4-4.0, p=0.94) and 4.1 (1.9-8.9, p=0.001), respectively. The effect of BPE was similar across all indications (p=0.66).

CONCLUSION

Increased BPE is an independent predictor of breast cancer in high risk patients undergoing screening MRI and its effect is similar across diverse high risk populations.

CLINICAL RELEVANCE/APPLICATION

BPE could be used as an imaging biomarker to improve risk assessment and inform decision-making in a diversity of high-risk patient populations undergoing screening MRI.

SSQ01-09 Preoperative Breast MRI for Patient Management: Preliminary Results from the MIPA Study

Thursday, Dec. 1 11:50AM - 12:00PM Room: E450A

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METHOD AND MATERIALS

In 2012, after an international call, 96 centers applied to the study and 34 were selected from 14 countries. Up to March 2016, 1st, 4,295 patients were enrolled, 1,926 (45%) having a complete case report form and suited for analysis. Indications and reasons for MRI as well as the ordering physician was recorded.

RESULTS

Of the 34 centers, 19 (56%) were academic. Up to now, 28 centers started the enrollment. Of 1,926 patients, 972 (50.5%) underwent MRI before surgery, 954 (49.5%) did not. Of 972 patients, 816 (84%) were studied adding diffusion weighted imaging (DWI) to the standard protocol. Gadobutrol at a dose of 0.1 mmol/kg bodyweight was used in 680/972 (70%) patients. In 155/972...
patients (16%) the index cancer was diagnosed with MRI performed for screening (n=39, 4%) or problem solving (n=116, 12%).
Considering the remaining 817 patients, preoperative MRI was performed as usual practice in 415 (51%) cases or for a specified indication in 402 (49%) cases, mainly ductal carcinoma in situ or invasive lobular carcinoma at needle biopsy, suspected multiple/bilateral cancer at conventional imaging, or dense breasts. Preoperative MRI was ordered by a radiologist in 477/817 (58%), by a surgeon in 259/817 (32%), by a radiologist and a surgeon in 50/817 (6%), by an oncologist alone or in combination with other physicians in 31/817 (4%).

CONCLUSION
On the large scale of almost 2,000 patients in 34 centers, 50.5% of patients underwent MRI before surgery. In 12% of them, MRI was already performed for screening or problem solving. DWI was included in the protocol of 84% of MRI examinations. Preoperative MRI was mainly ordered by radiologists (64%). However, a surgeon was involved in 38% of the ordered MRI examinations.

CLINICAL RELEVANCE/APPLICATION
Screening or problem solving MRI is also “preoperative” in 10% of cases. Notwithstanding the opinions against the use of preoperative MRI, about one third of preoperative MRI are ordered by surgeons.
SSQ13-01  Positron Emission Tomography (PET) Imaging of Chemokine Receptor CXCR4 in Patients with Breast Carcinoma: Initial Experience

Participants
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Sub-Events

PURPOSE
CXCR4 is a chemokine receptor that is overexpressed in several types of human cancers including breast cancer and seems to play crucial role in the mechanism of metastasis. The aim of this proof of concept study was to evaluate the novel CXCR4 targeted Positron Emission Tomography (PET) probe 68Ga-Pentixafor for Imaging of breast carcinoma.

METHOD AND MATERIALS
10 patients suffering from breast cancer (9 patients with primary breast cancer, one patient with local recurrent breast cancer) underwent either PET/CT or PET/MR imaging using 68Ga-Pentixafor. The lesions included 9 invasive ductal carcinomas (IDC) and one invasive lobular cancer (ILC). Maximum standardized uptake values (SUVmax) and tumor-to-background ratios (T/B ratio) were determined in the breast cancer lesions and correlated with immunohistochemistry.

RESULTS
8 of 10 breast cancers were visually detectable with a mean SUVmax of 3.1 (range 1.7 to 4.5) and a mean T/B ratio of 2.8. The visually undetectable lesions included the case of ILC and one IDC (T2 Grade 2). Immunohistochemistry revealed highest CXCR4 staining intensity in the patient with local recurrent breast cancer which also showed highest T/B ratio of all examined lesions. Lowest CXCR4 staining intensity was observed in the visually undetectable case of ILC. Interestingly, the CXCR4 positive cells in immunohistochemical workup not only comprised tumor cells but also surrounding lymphocytes.

CONCLUSION
CXCR4 directed PET imaging of breast cancer is feasible. Moreover, based on these first observations in this small patient cohort, histopathological CXCR4 expression profile on the tumor cell surface seems to correlate with signal intensity in PET imaging.

CLINICAL RELEVANCE/APPLICATION
CXCR4 directed PET imaging might be a promising new tool in oncology. Further studies are necessary to evaluate, if signal intensity of the primary cancer in PET is associated with prognostic factors, e.g. with metastatic potential of the tumor.

SSQ13-02  Impact of High Definition Reconstruction in FLT PET/CT

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PURPOSE
18F-fluorothymidine (FLT) is a promising non-invasive PET/CT imaging biomarker taken up in proliferative tissues such cancer lesions, bone marrow and liver that is also used for therapy response assessments which necessitates precise delineation and accurate SUV measurements. We therefore proposed and assessed the benefits of reducing the image reconstruction voxel volume 64mm3 (SD)⇒8mm3 (HD) and thus increasing the effective imaging matrix size.

METHOD AND MATERIALS
Using the list mode raw data from a FLT PET/CT therapy assessment trial, 10 breast cancer patients studies that were imaged...
using a dose of 10 mCi on a conventional TOF PET/CT system, were reconstructed using a newly implemented high definition (HD) reconstruction approach. The previous FLT datasets were used as comparator and had been reconstructed using a standard definition (SD) default approach using 4 mm voxel length and 33 subsets with 3 iterations. For the HD approach using the 2mm voxel length which leads to 1/8 of the referenced voxel volume, 4 reconstructions with 3 iterations and 33, 21, 15 and 9 subsets were performed on Baseline and follow-up FLT scans. Quantitative assessments were performed by placing 3D ROIs on lesions as well as healthy liver and bone marrow (L1, L3 & L5 vertebrae). Image review was done by three blinded readers.

RESULTS

Initially we compared the different subset approaches for the HD reconstruction and found the 3i9s rated as clinically preferable and was subsequently used. Image quality, lesion detectability and lesion delineation was rated preferable by blinded review and was found to be significantly (p<.01) improved on the high definition recon. Our quantitative assessment included 72 lesions across the 24 PET exams, the SUV_Max of lesions increased on average by 18%, while the liver background SUV_Mean varied by only 2-3% between HD and SD recon. Substantial increases in SUV_Mean were also noted in the bone marrow (13%).

CONCLUSION

High definition image reconstruction was found to be feasible and highly beneficial for FLT PET leading to substantially improved image quality and lesion delineation as well as more accurate quantification.

CLINICAL RELEVANCE/APPLICATION

FLT PET imaging benefits from high definition reconstruction leading to improved image quality, lesion delineation and quantitative accuracy.

SSQ13-03 Quantification Accuracy in Detection of Primary Breast Cancer and Axillary Lymph Node Metastasis by Whole-body (WB) and Prone Breast PET/MR Compared with PET/CT

Thursday, Dec. 1 10:50AM - 11:00AM Room: S504CD

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PURPOSE

In this prospective study, we focus on evaluating PET quantification accuracy in primary breast carcinoma (CA) and axillary lymph node (LN) metastasis using WB PET/MR and regional prone PET/MR acquired with breast coil, as compared with PET/CT.

METHOD AND MATERIALS

From April to June 2015, 13 breast CA patients (age=53.4±10.5y) were enrolled for clinically indicated PET/CT and subsequent PET/MR (Biograph mCT & mMR). PET/CT acquired with 2min/bed at ~70min post 18F-FDG injection. WB PET/MR started at ~120min with 3min/bed PET acquisition and axial T2 HASTE, DWI & coronal T2. Regional prone PET/MR with breast coil began at ~160min with 5min PET acquisition and routine breast sequences. PET/CT and PET/MR for primary and axillary LN disease were interpreted individually, with SUVmax and ADC measured.

RESULTS

A total of 20 breast CA lesions (size=2.6±2.0cm) and 11 axillary LN metastases were confirmed by histopathology and follow-up. PET/CT identified 18/20 primary lesions and 9/11 metastatic axillary LN. For primary breast CA, WB PET/MR detected 15/20 lesions and SUVmax was underestimated compared to PET/CT (5.5±4.5 vs 6.9±4.3; median %change=20%, range=-31~0%). Prone breast PET/MR detected 18/20 lesions with SUVmax comparable to that of PET/CT (6.8±6.2 vs 6.9±4.3; median %change=3%, range=-10~9%), while inversely correlated with ADC (range=0.59~1.03, mean=0.85±0.12 ×10-3mm2/s, r=-0.627, p<0.05). For axillary LN metastasis, WB PET/MR was similar to PET/CT for identifying 9/11 nodes with comparable SUVmax (%change=80~41% compared with PET/CT), which was due to various segmentation misclassification errors of the adjacent non-breast soft tissue as seen on the attenuation coefficient maps, including the axillae.

CONCLUSION

Regional prone PET/MR with breast coil was comparable to PET/CT in quantitative assessment of primary breast CA but was not suitable for evaluation of the axillary nodes, whereas results were opposite for WB PET/MR. Combined prone breast and WB PET/MR is the recommended procedure, particularly if monitoring treatment response is needed for these 2 locations.

CLINICAL RELEVANCE/APPLICATION

Regional prone PET/MR with dedicated breast coil has higher PET quantification and diagnostic accuracy for primary breast tumors than WB PET/MR but should not be used for non-breast tissue assessment.


Thursday, Dec. 1 11:00AM - 11:10AM Room: S504CD

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PURPOSE
To evaluate the diagnostic value of different MR sequences and PET data, acquired with an integrated PET/MR scanner, for whole-body restaging of breast cancer patients.

METHOD AND MATERIALS
A total of 32 consecutive patients with a suspected recurrence of breast cancer were prospectively enrolled for a whole-body 18F-FDG PET/MR examination. The whole-body MR protocol comprised: 1) T2w HASTE ax., 2) DWI ax. and 3) post-contrast T1w VIBE ax. Two readers evaluated the following datasets: 1. MRI alone, 2. PET/MR-HASTE/DWI, 3. PET/MR-HASTE/VIBE, PET/MR-HASTE/DWI/VIBE and were instructed to identify the total number of tumor lesions in each reading session. The diagnostic confidence for each detected lesion (3 point ordinal scale) and the lesion conspicuity (4 point ordinal scale) for the three different MR sequences were additionally rated.

RESULTS
Tumor recurrence was present in 21/32 (66%) patients and a total of 141 lesions (malignant, n = 101; benign, n = 40) were described. On a lesion based analysis, MRI revealed a sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of 81%, 85%, 93%, 64% and 82%, respectively, and a confidence level (CL) of 2.24 ± 0.71 for the identification of tumor recurrence. All three PET/MR readings were rated higher than MRI alone (PET/MR-HASTE/DWI: 92%, 93%, 97%, 82% and 92%, CL: 2.44 ± 0.66; PET/MR-HASTE/VIBE: 93%, 93%, 97%, 84% and 93%; CL: 2.65 ± 0.53; PET/MR-HASTE/DWI/VIBE: 94%, 95%, 98%, 86% and 94%, CL: 2.72 ± 0.49). Furthermore, mean values for lesion conspicuity were 3.30 ± 0.82 (VIBE), 3.02 ± 0.84 (HASTE) and 2.82 ± 1.15 (DWI), respectively and differed significantly from each other.

CONCLUSION
Our results demonstrate the usefulness of 18F-FDG PET data as a valuable additive to MR imaging for more accurate restaging of breast cancer patients. Furthermore, the presented data underline the benefit of contrast-enhanced MR sequences and questions the use of DWI.

CLINICAL RELEVANCE/APPLICATION
Well-considered MR protocols are required for an accurate and effective oncological work-up of breast cancer patients using integrated PET/MRI. The omission of DWI does not result in a significant impairment of the staging performance but enables a distinctive reduction in scan-duration accompanied by improved patient comfort.

SSQ13-05 Integrative and Comparative Analysis of 18F-FDG PET/CT and DWIFASE, DWIEPI, STIR on 3T and 1.5T MR Imaging: Strategy to Converge More the Trajectory for Diagnosis and Prognostication of Lung Cancer

Thursday, Dec. 1 11:10AM - 11:20AM Room: S504CD

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PURPOSE
To quantitatively compare the potential of FDG PET/CT and diffusion-weighted imaging obtained with fast advantage spin-echo sequence (DWIFASE), echo planar imaging sequence (DWIEPI), and short inversion time inversion recovery (STIR) imaging on 3T as well as 1.5T MR imaging in the diagnosis and prognostic prediction of lung cancer.

METHOD AND MATERIALS
3T and 1.5T MRI and PET/CT were prospectively performed in 75 consecutive patients with suspicious lung cancer, followed by surgical treatment. ADCs from DWI and tumor-to-muscle ratio from STIR was calculated in terms of primary lesions as ADCFASE, ADCPEI, 1.5T and STIR3T or STIR1.5T. Spearman correlation coefficient was analyzed between ADCs or STIR values. Multivariate logistic regression analysis was performed to investigate the discriminating factors of malignancy from benign lesions in terms of 1.5T MRI & PET or 3T MRI & PET. Also, all ADC and STIR values and SUVmax as well as clinical characteristics such as staging, histologic subtype, age, sex, and smoking history were investigated with univariate and multivariate Cox regression analysis to evaluate the prognostic potential, where ROC analysis was used to estimate the discriminating performance of prediction model built.

RESULTS
All 83 lung lesions (72 malignant, 11 benign) were analyzed. STIR3T were higher than STIR1.5T (2.401 ± 0.757 and 1.401 ± 0.507, R = 0.533, P < 0.001). ADCFASE and ADCPEI, 1.5T were correlated better than correlations with ADCEPI, 3T (R = 0.876, 0.821, and 0.659, all Ps < 0.001). Multivariate logistic regression analysis helped identify STIR1.5T (OR, 1.006), ADCEPI, 1.5T, (0.027) and SUVmax (1.862) in 1.5T as well as ADCFASE (0.752) and SUVmax (1.664) in 3T as significant differentiators of malignancy, with 96.9% sensitivity & 75% specificity, 98.5% & 78.6%. Multivariate analysis revealed sex (HR, 0.042), pathologic subtype (0.007), and STIR3T (17.418) are independent predictors for clinical outcome, with Az of ROC curve of 0.891.
CONCLUSION

We found the potential of DWI and STIR on 3T MRI and 1.5T MRI as well as PET/CT regarding the diagnostic and prognostic prediction of lung cancer, for which the capability was improved when sequences were combined efficiently.

CLINICAL RELEVANCE/APPLICATION

Quantitative image variables from DWI and STIR on 3T and 1.5T MRI can allow more accurate diagnosis and prognostication of lung cancer, thus may contribute to more robust predictive and prognostic biomarkers.

SSQ13-06  Do Staging Differences Between Thoracic 18F-FDG PET/CT and 18F-FDG PET/MR Lead to Different Therapeutic Decisions in Patients Suffering from Non-Small Cell Lung Cancer?

Thursday, Dec. 1 11:20AM - 11:30AM Room: S504CD

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PURPOSE

To investigate whether differences in thoracic tumor staging between 18F-fluorodeoxyglucose positron emission tomography / computed tomography (18F-FDG PET/CT) and 18F-FDG PET / magnetic resonance (18F-FDG PET/MR) imaging change therapeutic decisions in Non-Small Cell Lung Cancer (NSCLC) patients.

METHOD AND MATERIALS

Seventy-seven NSCLC patients (34 female, 43 male, mean age 61 ± 10y) that underwent whole-body 18F-FDG PET/CT from the base of skull to the upper thighs and subsequent thoracic 18F-FDG PET/MR were enrolled in this retrospective study. Thoracic 18F-FDG PET/CT and 18F-FDG PET/MR images were staged by two independent radiologists according to the 7th edition of the AJCC staging manual. Treatment strategies based on staging results of either thoracic 18F-FDG PET/CT or 18F-FDG PET/MR were discussed separately in a simulated interdisciplinary tumor board consisting of an oncologist, a radiation oncologist, a thoracic surgeon and a radiologist under consideration of the histopathological subtype and all available clinical data at the timepoint of imaging. Therapeutic decisions based on both imaging modalities were recorded. Descriptive statistics were used for comparison of the results and reasons for changes in the therapeutic decision were investigated.

RESULTS

Differences in thoracic tumor staging were observed in 35% of patients (27 patients) between thoracic 18F-FDG PET/CT and 18F-FDG PET/MR. Differences between both hybrid imaging modalities were detected when assessing the T-stage in 18% (n = 14), the N-stage in 23% (n = 18), and the M-stage in 1% (n = 1). However, these differences in thoracic tumor staging changed patient therapy management in only six patients (8%).

CONCLUSION

Thoracic 18F-FDG PET/CT and PET/MR lead to comparable therapeutic decisions in patients suffering from NSCLC. 18F-FDG PET/MR can be considered a true alternative to 18F-FDG PET/CT for clinical NSCLC staging.

CLINICAL RELEVANCE/APPLICATION

Comparable therapeutic decisions in PETCT and PET/MR in NSCLC patients allow prospective randomized studies on PET/MR in NSCLC imaging and will speed up its introduction in clinical practice.

SSQ13-07  Clinical Utility of PET/CT’s Triggered by ACR LungRads Category 4A or 4B Lung Cancer Screening CT Result

Thursday, Dec. 1 11:30AM - 11:40AM Room: S504CD

Participants
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PURPOSE

F-18 FDG PET/CT (PCT) is invaluable in pulmonary nodule workup, and uptake correlates with malignancy and, in early stage lung cancers, survival. The National Lung Cancer Screening Trial demonstrated mortality benefit of low-dose screening CT (LDCT) for high risk persons. In ACR LungRads, Category 4 is "suspicious" for malignancy: For 4A, PCT is triggered for an 8-15 mm solid nodule on baseline and for 4B, for a new solid nodule/ solid component of part-solid nodule measuring >= 8 mm. Previous literature rates PCT performance as poor for nodules < 10 mm, however. Given FWHM of PCT scanners is ~8 mm, the lower limit trigger of 8 mm in LungRads will include small nodules which may be underestimated by partial volume effect (3D PET, 3*FWHM = 24 mm). PCT may be insensitive when used in this manner and regular screening may be equivalent. Our study goal is to report the diagnostic utility of PCT performed for workup of Category 4 findings on LDCT.

METHOD AND MATERIALS

This IRB-approved, HIPAA-compliant study retrospectively reviewed PCT from Feb 2015- March 2016, prompted by positive screening LDCT (Category 4A/4B or read as positive= greater than mediastinum). Standardized uptake value (SUVmax) of nodules was measured. LDCT nodule size and morphology were recorded. Results were correlated with pathology and change in clinical management.

RESULTS
16 patients underwent 16 PCT with 21 nodules yielding mean CT size of 14 (range 8-30) mm and CT features of solid, part solid, cavitary, spiculated. 6 were PET-positive and of these, 4 malignant on histology; 2 were inflammatory on histology. 15 nodules were PET-negative; 3 of these were classified as benign with no further followup recommended; 12 were scheduled for CT follow up per LungRads. PET-positive rate was 29.5 ± SE 0.10% overall, and PPV as judged by histology or stable behavior on subsequent CT was 0.66 (95% CI 0.29-1.0).

CONCLUSION
38% of nodules on PCT performed for Category 4 LDCT were positive, and 67% of these were malignant. Average nodule size in our population was >8 mm trigger, but <24 mm limit for full PET recovery. PET-negative nodules were not sampled, but many of these nodules were stable in size. Further study is needed in a larger patient cohort with longer followup.

CLINICAL RELEVANCE/APPLICATION
Although PCT redemonstrates utility in workup of indeterminate nodules, optimal triggers for PCT in the setting of CT lung cancer screening need further study.

SSQ13-08 Whole-Body FDG-PET/MRI: Comparison of the Capability for the IASLC/ ITMIG Thymic Epithelial Tumor Staging with Whole-Body MRI, Integrated FDG-PET/CT and Conventional Radiological Examination

Thursday, Dec. 1 11:40AM - 11:50AM Room: SS04CD

Participants
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PURPOSE
To compare the diagnostic capability for the IASLC/ ITMIG thymic epithelial tumor staging among whole-body FDG-PET/MRI, whole-body MRI including diffusion weighted imaging (DWI), integrated FDG-PET/CT with contrast-enhanced (CE-) brain MRI and conventional radiological examination including whole-body CE-CT and CE-brain MRI.

METHOD AND MATERIALS
64 consecutive thymic epithelial tumor patients (30 men, 34 women; mean age 56 years) prospectively underwent whole-body MRI including DWI, integrated FDG-PET/CT with contrast-enhanced (CE-) brain MRI and conventional radiological examination including whole-body CE-CT and CE-brain MRI.

RESULTS
Inter-observer agreements of each factor on all methods were determined as substantial or almost perfect (0.67)

CONCLUSION
Whole-body PET/MRI and MRI have better potential for the IASLC/ ITMIG thymic epithelial tumor staging than conventional radiological examination, and are considered at least as valuable as PET/CT with CE-brain MRI in this setting.

CLINICAL RELEVANCE/APPLICATION
Whole-body PET/MRI and MRI have better potential for the IASLC/ ITMIG thymic epithelial tumor staging than conventional radiological examination.

SSQ13-09 Sensitivity of PET/MR for Detecting Pulmonary Nodules in Pediatric Cancer Patients

Thursday, Dec. 1 11:50AM - 12:00PM Room: SS04CD

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Samantha Holdsworth, PhD, Palo Alto, CA (Abstract Co-Author) Nothing to Disclose
PURPOSE

To determine the sensitivity of MR, integrated PET+MR and PET+CT for the detection of pulmonary nodules in pediatric cancer patients compared to clinical CT as a standard of reference.

METHOD AND MATERIALS

In this prospective IRB-approved, HIPAA-compliant study we performed 15 "one stop" whole body PET/MR scans of 11 pediatric and young adult patients with lymphoma (n=6), bone sarcoma (n=2) and other cancers (n=3). Scans were performed on a GE Signa 3T hybrid PET/MR scanner 60 minutes after 18F-FDG (2-3MBq/kg), using free-breathing axial T2-FSE (TR 5048ms/TE 116ms) and PROPELLER (TR 5669ms/TE 101ms) sequences with simultaneous PET-data acquisition. Two experienced reviewers assessed the number, location and size of pulmonary nodules on CT, MR, PET+MR (i.e. positive on PET and MR) and PET+CT (i.e. positive on PET and CT) scans. Sensitivities of MR, PET+MR and PET+CT were compared with CT as standard of reference.

RESULTS

CT revealed 151 total nodules with 59 ≥ 10mm, 48 between 5-9mm, 34 between 3-4mm and 10 < 3mm in size respectively. MR detected 116 total nodules with 59 ≥ 10mm, 44 between 5-9mm, 12 between 3-4mm and 1 < 3mm in size respectively. Considering clinically significant nodules ≥ 3mm, sensitivity was 81.5% for MR, 56% for PET+MR and 49% for PET+CT. PET+MR and PET+CT detected 59 and 57 nodules > 1 cm, 22 and 14 nodules 5-9 mm, and 4 and 3 nodules 3-4 mm, respectively. The mean effective dose of PET/MR (2.5 mSv) was significantly lower compared to PET/CT (11.4 mSv).

CONCLUSION

MR provided comparable sensitivity compared to CT for the detection of pulmonary nodules ≥ 5 mm, but inferior sensitivity for the detection of 3-4 mm nodules. The PET part of the PET/MRI outperformed the PET part of the PET/CT in the detection of FDG-avid nodules. PET/MR reduced the radiation exposure of the patient by 75% compared to PET/CT.

CLINICAL RELEVANCE/APPLICATION

Solving the limited sensitivity of MRI for the detection of pulmonary nodules will enable "one stop" staging of pediatric cancer patients with substantially reduced radiation exposure compared to PET/CT. Our ongoing studies address further improvement of MRI technologies for detection of clinically relevant pulmonary nodules with a size of 3-4mm.
Patterns of Eye Movements in Breast Tomosynthesis and Full Field Digital Mammography: An Eye Tracking Study

Station #1

Participants
Jessica W. Leung, MD, San Francisco, CA (Moderator) Nothing to Disclose

Sub-Events

BR266-SD-THA1 Patterns of Eye Movements in Breast Tomosynthesis and Full Field Digital Mammography: An Eye Tracking Study

Station #1

Participants
Avi M. Aizenman, Cambridge, MA (Abstract Co-Author) Nothing to Disclose
Trafton Drew, PhD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Dianne Georgian-Smith, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Jeremy M. Wolfe, PhD, Cambridge, MA (Presenter) Research collaboration, IBM Corporation;

PURPOSE
Digital breast tomosynthesis (DBT) is a promising yet relatively new imaging modality. Understanding how eye movements differ from reading DBT to full-field digital mammography (FFDM) can inform best practices for reading DBT. We use eye tracking to quantify and compare the basic pattern of eye movements adopted by radiologists searching DBT to FFDM.

METHOD AND MATERIALS
11 radiologists (Os) read 9 DBT and 8 FFDM images in one projection (either DBT or FFDM). 4 cases in each modality contained positive findings that had led to further testing in clinic. Os had on average 6 years of experience reading FFDM and .62 years reading DBT. Os in the study were asked to mark any asymmetries that were possibly a clinically significant mass or questionable areas of architectural distortion warranting further diagnostic work-up. XY eye position was tracked at 1000 Hz, and was co-registered with slice/depth plane as radiologists scrolled through the DBT images producing a 3D scanpath. Os were given 2 minutes to localize any suspicious findings.

RESULTS
DBT was overall associated with significantly fewer false positives per case compared to FFDM (t(10)=2.65, p<.05), and significantly longer search durations (75s) than for FFDM (43s) (t(10) = 5.661, p<.001). No significant differences were found for detection. DBT also led to significantly longer fixations (the eye focusing at a particular XY location) than FFDM t(10) = 7.1, p<.0001. In DBT, Os viewed on average 3.8 image slices during fixation, which may explain the longer fixation duration. For DBT, 10/11 of the Os described using a purposeful strategy in which their eyes remain relatively stationary in XY while they “drilled” through depth. Eyetracking revealed that Os often made large scanning movements while drilling, deviating from their described search strategy.

CONCLUSION
Improvement in performance for DBT comes at a cost in time per case. Eye tracking data shows how radiologists are spending that time, as well as suggesting radiologists are deviating from introspected search strategies. Techniques for increasing speed without sacrificing accuracy can be tested against these baseline data.

CLINICAL RELEVANCE/APPLICATION
Best clinical practices for reading DBT are currently unclear. The current study provides baseline metrics for assessing the effectiveness of different search strategies in DBT.

BR268-SD-THA3 Quantification of Breast Cancer Heterogeneity for Identifying Molecular Subtypes on MRI: Preliminary Study

Station #3

Participants
Haeji Rue, Iksan, Korea, Republic Of (Presenter) Nothing to Disclose
Hye-Won Kim, MD, Iksan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jong Hyun Ryu, Iksan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Kwon-Ha Yoon, MD, PhD, Iksan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
Molecular subtype in breast cancer is important for planning further treatment and predicting prognosis. Correlation between molecular subtype of breast cancer and heterogeneity of breast cancer on T1WI, T2WI, diffusion-weighted image, post-contrast subtraction image was evaluated.

METHOD AND MATERIALS
A total of 88 breast cancer lesions (28- luminal A, 27- luminal B, 17- triple negative, 16 - human epidermal growth factor receptor 2(HER-2)) in 88 patients who had biopsy proven invasive carcinoma between July 2014 and December 2015 were enrolled in this study. We measured degree of cancer heterogeneity on T1WI, T2WI, fat suppressed T2, diffusion-weighted image and 1minute subtraction image by using MATLAB(matrix laboratory)-based software which calculate a coefficient of variation (CV) map of each
The purpose of this exhibit is: To review the radiological features of cancers only detected by US and/or DBT. To review the

TEACHING POINTS

The purpose of this exhibit is: To review the radiological features of cancers only detected by US and/or DBT. To review the

RESULTS

Decreased CV values on DWI (b value-300) were observed in luminal A compared with luminal B and increased CV values on DWI (b value-300) were observed in luminal B compared with triple negative (p<.05). There were also significant differences in CV value on subtraction image between luminal A and each of luminal B, Triple negative, HER-2. With Bonferroni correction, CV values on subtraction image between luminal A and triple negative, luminal A and HER-2 were only significantly different. ROC curves of CV value on each sequences of MRI were not significantly different for identifying each molecular subtype of breast cancer.

CONCLUSION

The quantification of intratumoral heterogeneity values on MRI was different between molecular subtypes.

CLINICAL RELEVANCE/APPLICATION

Intratumoral heterogeneity values on MRI with CV map can help to identify molecular subtype of breast cancer.

BR270-SD-
THAS  HER2-positive Breast Cancer: Correlation between DCE-MRI Spatial Features, Temporal Kinetics, and Predictors of Tumor Progression and Recurrence

Station #5

Participants
Laura Heacock, MD, MS, New York, NY (Presenter) Nothing to Disclose
Yiming Gao, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Alana A. Lewin, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Neeti Bagadiya, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Samantha L. Heller, MD, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
James S. Babb, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
Amy N. Melsaether, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Linda Moy, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate the magnetic resonance imaging features of human epidermal growth factor receptor 2-positive (HER2+) tumors compared with those of estrogen receptor/progesterone receptor-positive (ER/PR+) and triple negative breast cancers (TNBC), with an emphasis on early temporal kinetic features of use in an abbreviated breast MRI protocol (AB-MRI).

METHOD AND MATERIALS

An institutional review board-approved study evaluated the DCE-MRI imaging findings in 135 women with pathology-proven HER2+ (22%, 31/135), ER/PR+/HER2- (57%, 77/135) and TNBC (21%, 28/135) invasive cancers imaged at 3.0T with a 7-channel breast coil. MR spatial features evaluated included shape, margins, internal enhancement and size. Initial enhancement ratio (% enhancement over baseline on the first post-contrast images), background parenchymal enhancement (BPE) and peritumoral BPE were assessed. If PET/CT was performed, pre-treatment SUVmax was recorded. Final pathology, tumor markers, ki-67, and positive axillary nodes were examined. Statistics included Fisher's exact tests, Mann-Whitney U tests and Spearman's rho.

RESULTS

HER2+ cancers were more likely to be irregular (83.8%, 26/31) masses (100%, 31/31) with washout kinetic curves (80.6%, 25/31) and positive nodes (47%, 14/31), but were not statistically different from other tumor types (p=0.417). HER2 tumors were larger (mean=4.4 cm [1.2-9.1 cm]) than ER/PR+ tumors (p=0.001) but not TNBC (p=0.957). For all cancers, IER and ki-67 positively correlated (r=0.28, p=0.002). SUVmax also positively correlated with ki-67 (r=0.454, p=0.026) but was not different between tumor types. Mean IER was higher for HER2+ than ER/PR+ tumors (p=0.026) but not significantly different from TNBC (p=0.34). For HER2+ tumors alone, IER positively correlated with BPE (r=0.532, p=0.003) and peritumoral BPE (0.539, p=0.003), but there was no correlation between IER, grade, SUVmax, or axillary node status.

CONCLUSION

HER2+ tumors cannot be reliably distinguished from TNBC based on spatial morphology alone. IER, a measure of tumor wash-in, correlated with ki-67, a marker of tumor aggression, as did SUVmax. IER could be easily incorporated into AB-MRI using conventional DCE-MRI.

CLINICAL RELEVANCE/APPLICATION

DCE-MRI lesion morphology alone is not predictive of HER-2+ tumors. IER, an early kinetic marker easily measured in an abbreviated breast MRI (AB-MRI) screening protocol, may predict HER2+ aggressiveness.

BR165-ED-
THA6  Additional Tumors in Breast Cancer: What Have We Learnt?

Station #6

Participants
Maylin Caballeros, MD, Pamplona, Spain (Presenter) Nothing to Disclose
Jose Miguel Madrid, MD, Pamplona, Spain (Abstract Co-Author) Nothing to Disclose
Arlette Elizaide, Pamplona, Spain (Abstract Co-Author) Nothing to Disclose
Natalia Rodriguez-Spiteri, Pamplona, Spain (Abstract Co-Author) Nothing to Disclose
Paula Martinez-Miravete, MD, Pamplona, Spain (Abstract Co-Author) Nothing to Disclose
Luis Pina, MD, PhD, San Sebastian, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: To review the radiological features of cancers only detected by US and/or DBT. To review the
pathological features of cancers only detected by US and/or DBT.

TABLE OF CONTENTS/OUTLINE

Introduction: How do we do: Additional US+DBT in all dense breasts Technical principles of DBT and US: why do they detect not suspected cancers in mammography? Features of tumors detected by additional DBTa) Radiological features: DBT was more sensitive to detect spiculated masses and distortions DBT did not detect as many BI-RADS 3 lesions as US DBT needed at least a small amount of peritumoral fat tissueb) Pathological features: All additional tumors were invasive DBT detected less Her2 and Triple Negative tumors than US 4. Features of tumors detected by USa) Radiological features: US was more sensitive to detect masses One of the main problems of US was the high detection rate of BI-RADS 3 lesions US sensitivity was independent to the amount of peritumoral fatb) Pathological features: Most of the additional cancers were invasive with only a few pure DCIS US detected both Luminal as well as Her2/TN cancers 5. Conclusion The highest diagnostic accuracy was achieved by using additional DBT+US Almost all the additional cancers were invasive
Breast Thursday Poster Discussions
Thursday, Dec. 1 12:45PM - 1:15PM Room: BR Community, Learning Center

BR
AMA PRA Category 1 Credit ™: .50

Participants
Jessica W. Leung, MD, San Francisco, CA (Moderator) Nothing to Disclose

Sub-Events
BR271-SD-THB1 Negative Predictive Value of Mammography and Sonography in the Evaluation of a Focal Area of Clinical Concern in the Fatty Breast
Station #1

Awards
Student Travel Stipend Award

Participants
Eric M. Blaschke, MD, Boston, MA (Presenter) Nothing to Disclose
Michelle C. Specht, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Sophie M. Cowan, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Barbara L. Smith, MD, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Kevin S. Hughes, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Constance D. Lehman, MD, PhD, Boston, MA (Abstract Co-Author) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company
Michele Gadd, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE
The American College of Radiology (ACR) Appropriateness Criteria support the option of mammography alone in women with only fatty breast tissue at the site of clinical concern, although there is scarce literature to support this recommendation. We assess the performance of mammography and ultrasound in patients with fatty breasts presenting with an area of clinical concern.

METHOD AND MATERIALS
This IRB approved study included 1,028 consecutive cases in 876 women with fatty breast density who presented with an area of clinical concern and underwent combined mammography and sonography between 3/2006 and 3/2015. Outcomes were determined by imaging, biopsy, or any pathology in our hospital tumor registry within a minimum of 12 months follow up. Performance measures were defined according to the ACR BI-RADS Atlas, Fifth Edition.

RESULTS
Of the 876 women (mean age 56.2, range 24-92), 775 (88.5%) were assessed as BI-RADS 1 or 2, 61 (7.0%) as BI-RADS 3, and 40 (4.6%) as BI-RADS 4 or 5 by mammography and ultrasound combined. 20 cancers were diagnosed, for a cancer detection rate of 22.8 per 1000 women. Performance metrics of mammography were: sensitivity 90%, specificity 98.8%, negative predictive value 99.8%. Of the two breast cancers not seen with mammography, one case was a parasternal mass in a patient with prior mastectomy and reconstruction for DCIS and the second was an infiltrating lobular carcinoma in a focal region of density in an otherwise fatty breast found by ultrasound in a 73 year old BRCA positive patient. Performance metrics of combined mammography and ultrasound were: sensitivity 100%, specificity 98.0%, NPV 100%.

CONCLUSION
No breast cancers were missed by mammography in patients with fatty breast tissue at the site of clinical concern. These findings support the current ACR Appropriateness Criteria allowing the option of mammography alone in this specific clinical setting.

CLINICAL RELEVANCE/APPLICATION
The high negative predictive value of mammography supports the judicious, rather than routine, use of ultrasound in patients with fatty breast density presenting with areas of clinical concerns.

BR273-SD-THB3 Perfusion Parameters at Dynamic Contrast-enhanced Breast MR Imaging are Associated with Disease-Specific Survival in Patients with Triple-Negative Breast Cancer
Station #3

Participants
Vivian Y. Park, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Eun-Kyung Kim, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Min Jung Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jung Hyun Yoon, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hee Jung Moon, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
The aim of this study is to investigate the association between perfusion parameters in pretreatment MR imaging and survival outcome (disease-free survival [DFS], disease-specific survival [DSS]) in patients with triple negative breast cancer (TNBC).

METHOD AND MATERIALS
Sixty-one patients (median age, 50 years; range, 27-77 years) with TNBC (median size on imaging, 255 mm; range, 11-142 mm)
who underwent pretreatment MR imaging between November 2010 and August 2012 were included. We analyzed clinical-pathologic variables and MR imaging parameters (including SER, peak enhancement, Ktrans, kep, ve). Calculation of perfusion parameters was performed with dedicated post-processing software, using a semi-automated segmentation method. Cox proportional hazards models were used to determine associations between survival outcome and 1) variables obtainable before treatment (age, menopausal status, MR imaging features, preoperative diagnosis of lymph node metastasis,) and 2) post-treatment clinical-pathologic variables.

**RESULTS**

The median follow-up time was 46.1 months (range, 6.3-58.4 months). Eleven of 61 (18.0%) patients had events and seven (11.4%) died from breast cancer. Among pretreatment variables, a larger tumor size on MR images (hazard ratio [HR]=1.024, P=.003) was associated with worse DFS at univariate analysis. In multivariate pretreatment models for DFS, a higher ve value (HR=1.658, P=.038), higher peak enhancement (HR=1.843, P=.018) and a larger tumor size on MR images (HR=1.060, P=.001) were associated with worse DFS. In multivariate post-treatment models, a larger pathologic tumor size (HR for DFS, 1.074 [P=.005]; HR for DSS, 1.050 [P=.024]) and metastasis in surgically resected axillary lymph nodes (HR for DFS, 5.789 [P=.017]; HR for DSS, 23.717 [P=.002]) were associated with worse survival outcome.

**CONCLUSION**

A higher ve value, peak enhancement and larger tumor size of the primary tumor at pretreatment MR imaging were independent predictors of worse DSS in TNBC patients.

**CLINICAL RELEVANCE/APPLICATION**

For patients with triple-negative breast cancer, a ve value, peak enhancement, and tumor size on pretreatment MR imaging may be incorporated into pretreatment prediction models that can aid in tailoring clinical trial populations and treatment.

**BR274-SD-THB4**  
**Contrast Enhanced Mammography as a Promising Method of Differentiating Breast Lesions**

**Participants**
Shayandokht Taleb, Minneapolis, MN (Presenter) Nothing to Disclose  
Bryan Donald, MD, St Paul, MN (Abstract Co-Author) Nothing to Disclose  
Noelle E. Hoven, MD, Minneapolis, MN (Abstract Co-Author) Nothing to Disclose  
Tim H. Emory, MD, Saint Paul, MN (Abstract Co-Author) Nothing to Disclose  
Jessica E. Kuehn-Hajder, MD, Minneapolis, MN (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To determine the accuracy of contrast-enhanced digital mammography (CEDM) in differentiating malignant versus benign breast lesions.

**METHOD AND MATERIALS**

We retrospectively reviewed the medical and imaging records of all patients who had CEDM at our center from Dec 2012 to Sep 2015 and subsequently underwent imaging guided core needle biopsy. During this time, CEDM was used both for high-risk screening and for staging and characterization pre-biopsy for BI-RADS 4b, 4c and 5 lesions. A single reader reviewed all images and compared the interpretation with final clinical report. In case of discrepancy in interpretation of images, a second reader reviewed all images to reach consensus. The data on calcifications and enhancement were recorded. Histopathology of specimen biopsy was also reviewed and considered as gold standard to classify the lesions as malignant or nonmalignant.

**RESULTS**

In a 3-year period, 164 women with mean age of 52 (range: 25-79) underwent CEDM at our center and had imaging guided core needle biopsies performed. Biopsy was recommended based on diagnostic mammography/ultrasound workup of symptoms, abnormal physical exam or screening callback. The results demonstrated that enhancement on CEDM was significantly associated with malignancy (P<0.001). Enhancement on CEDM had 95.3% sensitivity, 50.0% specificity, 85.3 % negative predictive value, and 77.7% positive predictive value for detection of malignant lesions. The receiver operating characteristic (ROC) analysis showed an area under the curve of 0.726 (P<0.001). When cases with suspicious calcifications and/or abnormal enhancement were combined, sensitivity was 100%, specificity was 29.3%, negative predictive value was 100% and positive predictive value was 72.1% for detection of malignant lesions. Thus, all cases that did not have either suspicious calcifications or abnormal enhancement were found to be benign.

**CONCLUSION**

In a population with highly suspicious lesions, enhancement on CEDM is sensitive for malignancy/atrophy. And, when combined with suspicious calcifications, a negative predictive value of 100% suggests that it is possible to downgrade a lesion to probably benign. We hope that as we increase the study population size this finding will be confirmed.

**CLINICAL RELEVANCE/APPLICATION**

Contrast enhanced mammography appears to add significant sensitivity to other suspicious mammographic findings in differentiation of malignancy/atrophy versus benign lesions.

**BR275-SD-THB5**  
**MRI to Predict Nipple-areola Complex (NAC) Involvement: An Automatic Method to Compute the 3D Distance between the NAC and Tumor**

**Participants**
Valentina Giannini, PhD, Candiolo, Italy (Presenter) Nothing to Disclose  
Emanuele Tabone, Candiolo, Italy (Abstract Co-Author) Nothing to Disclose  
Valeria Doronzi, Candiolo, Italy (Abstract Co-Author) Nothing to Disclose  
Francesca Maria Sambataro, Candiolo, Italy (Abstract Co-Author) Nothing to Disclose  
Daniele Regge, MD, Torino, Italy (Abstract Co-Author) Speakers Bureau, General Electric Company
PURPOSE
To describe and test an innovative and automatic method able to compute the 3D tumor-NAC distance, by automatically segmenting both the tumor and the NAC, and to assess its role in predicting NAC involvement.

METHOD AND MATERIALS
99 patients scheduled to NAC sparing mastectomy underwent MR examination at 1.5T, including at least the sagittal T2w and DCE MR imaging. The method developed to compute the 3D tumor-NAC distance consists of different steps. First, the NAC is segmented on the T2w sagittal image, by using a region growing algorithm in which the seeds and the thresholds are automatically found and set based on patients characteristics. Then, the tumor is segmented on the Maximum Intensity Projection over Time image, by extracting contrast-enhanced regions using a normalization technique based on the contrast-uptake of mammary vessels. Finally, the 3D distance is computed between the base of the NAC and the nearest margin of the lesion. Manually axial and sagittal 2D measurements were also evaluated and compared with the 3D distance. NAC involvement was defined by the presence of invasive ductal/lobular carcinoma and/or ductal carcinoma in situ/ductal intraepithelial neoplasia.

RESULTS
Overall, the tumor-NAC distance was computed on a dataset of 95/99 patients, since 3 patients were discarded because their lesions were not segmented (sensitivity=97%), and one was removed because its inverted nipple was not detected by the system (sensitivity=99%). Among them, 25 had NAC involvement (26.3%). Area under the ROC curve (AUC) was equal to 0.830 (95% CI: 0.749-0.911 ) for the automatic distance, 0.676 (95% CI: 0.557-0.796 ) for the manual axial distance, 0.664 (95%v CI: 0.542-0.786) for the manual sagittal distance, and 0.664 (95%CI: 0.542-0.783) for the minimum manual distance. The best performances were obtained by the automatic distance at the cut-off point of 21 mm, where sensitivity, specificity, positive predictive value and negative predictive value were 72%, 80%, 56% and 89%, respectively.

CONCLUSION
The proposed automatic method outperformed the results obtained with the manual 2D measurements in assessing the NAC involvement.

CLINICAL RELEVANCE/APPLICATION
This method could be integrated in the clinical practice to reduce the reading time, the inter-observer variability and to provide reliable information for surgical planning and intraoperative management of candidate patients to the NAC sparing mastectomy.

TEACHING POINTS
(1) Review the basic acquisition protocol of conventional dynamic contrast enhanced MRI (DCE-MRI)(2) Describe acquisition protocols for three novel breast MRI techniques: abbreviated MRI accelerated MRI true fast technique (ultrafast) view sharing technique (TWIST) (3) Illustrate the various differences between the techniques with regards to technical aspects, image acquisition and image interpretation

TABLE OF CONTENTS/OUTLINE
(1) Review of the basic acquisition protocol for three novel breast MRI techniques: abbreviated MRI accelerated MRI true fast technique (ultrafast) view sharing technique (TWIST) (2) Demonstration of exemplary cases illustrating each techniques’ unique acquisition(3) Discussion of the similarities and differences between the various techniques with regards to technical aspects, image acquisition and image interpretation
Case-based Review of Breast (An Interactive Session)

Thursday, Dec. 1 1:30PM - 3:00PM Room: S100AB

BR DM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Janie M. Lee, MD, Bellevue, WA, (jmlee58@uw.edu) (Director) Research Grant, General Electric Company

LEARNING OBJECTIVES
1) Identify the appropriate application of multimodality breast imaging for routine screening, supplemental screening, and diagnostic indications. 2) Select appropriate methods for imaging-guided percutaneous breast biopsy and perform post-biopsy radiologic-pathologic correlation. 3) Calculate performance measure values for a breast imaging audit and compare with appropriate performance benchmarks.

Sub-Events

MSCB51A Screening: Digital Mammography and Tomosynthesis

Participants
Sarah M. Friedewald, MD, Chicago, IL, (sarah.friedewald@nm.org) (Presenter) Consultant, Hologic, Inc; Research Grant, Hologic, Inc; Consultant, C. R. Bard, Inc

LEARNING OBJECTIVES
View learning objectives under main course title.

ABSTRACT
Screening: Digital Mammography and Tomosynthesis

The discussion will review the imaging modalities currently available for supplemental screening. The pros and cons of each modality will be discussed as well as the pertinent literature.

MSCB51B Supplemental Screening

Participants
Susan Weinstein, MD, Philadelphia, PA (Presenter) Consultant, Siemens AG

LEARNING OBJECTIVES
View learning objectives under main course title.

ABSTRACT
Supplemental Screening

The discussion will review the imaging modalities currently available for supplemental screening. The pros and cons of each modality will be discussed as well as the pertinent literature.

MSCB51C Evaluating the Symptomatic Patient

Participants
Sughra Raza, MD, Boston, MA, (sraza1@partners.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Sughra Raza, MD - 2015 Honored Educator
SPSH51
Hot Topic Session: Personalized Screening for Breast Cancer
Thursday, Dec. 1 3:00PM - 4:00PM Room: S406B
BR
AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants

Sub-Events

SPSH51A  Risk Assessment in Breast Imaging

Participants
Emily F. Conant, MD, Philadelphia, PA (Presenter) Consultant, Hologic, Inc; Consultant, Siemens AG

LEARNING OBJECTIVES
1) Describe the basics of breast cancer risk assessment. 2) Assess the potential impact of including imaging phenotypes to breast cancer risk assessment.

ABSTRACT

URL

SPSH51B  Personalized Screening Paradigms - How Do We Incorporate New Technologies?

Participants
Phoebe E. Freer, MD, Salt Lake City, UT, (phoebe.freer@hsc.utah.edu ) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Describe the medical evidence for supplementary screening techniques in high-risk patients. 2) Appraise and apply adjunctive screening paradigms including tomosynthesis, ultrasound, MRI, and emerging technologies to patients based on a patient’s breast cancer risk factors. 3) Review the current state of density notification and legislation in the United States.

ABSTRACT

URL

SPSH51C  Personalized Treatment of Breast Cancer

Participants
Fiona J. Gilbert, MD, Cambridge, United Kingdom, (fjg28@cam.ac.uk) (Presenter) Research Grant, GlaxoSmithKline plc; Research Grant, General Electric Company; Research Grant, Hologic, Inc

LEARNING OBJECTIVES
1. Describe the value of MRI and US in staging the breast and axilla 2. Understand monitoring response with morphological and functional MRI to predict and measure response (size, 2D and volume, DCE, DWI)3. Appreciate the contribution of FDG PET to predict and measure response4. Review the contribution of ER imaging and HER imaging in personalised treatment
Case-based Review of Breast (An Interactive Session)

Thursday, Dec. 1 3:30PM - 5:00PM Room: S100AB

Participants
Janie M. Lee, MD, Bellevue, WA, (jmlee58@uw.edu) (Director) Research Grant, General Electric Company

LEARNING OBJECTIVES
1) Identify the appropriate application of multimodality breast imaging for routine screening, supplemental screening, and diagnostic indications. 2) Select appropriate methods for imaging-guided percutaneous breast biopsy and perform post-biopsy radiologic-pathologic correlation. 3) Calculate performance measure values for a breast imaging audit and compare with appropriate performance benchmarks.

ABSTRACT

Sub-Events
MSCB52A  Breast Interventional Cases

Participants
Elissa R. Price, MD, San Francisco, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under the main course title.

MSCB52B  Radiologic - Pathologic Correlation

Participants
Heidi R. Umphrey, MD, Birmingham, AL (Presenter) Research Grant, General Electric Company; Research Grant, Koninklijke Philips NV

LEARNING OBJECTIVES
View learning objectives under the main course title.

MSCB52C  Performance Measures

Participants
Bethany L. Niell, MD, Tampa, FL, (Bethany.niell@moffitt.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under the main course title.


**Interventional Breast Procedures**

**Thursday, Dec. 1 4:30PM - 6:00PM Room: N228**

**Participants**
Cherie M. Kuzmiak, DO, Chapel Hill, NC, (Cherie_kuzmiak@med.unc.edu) (Moderator) Research Grant, FUJIFILM Holdings Corporation;

**LEARNING OBJECTIVES**

**ABSTRACT**

1) Differentiate breast lesions amenable to sonographic directed breast biopsy from those requiring stereotactic guidance or surgical excision. 2) Assess and communicate procedure- and patient-related factors that will optimally prepare patients for sonographically-guided breast biopsy procedures. 3) Identify and apply biopsy techniques that enhance competency and contribute to safe, efficient and accurate sonographically-guided breast biopsies. 4) Critique their skills in providing clear and compassionate communication during biopsy recommendation and delivery of results.

**RC715B Mammographic Directed Breast Biopsy: The Emerging Role of DBT Biopsy**

**Participants**
Jules H. Sumkin, DO, Pittsburgh, PA (Presenter) Institutional research agreement, Hologic, Inc; Advisory Board, General Electric Company

**LEARNING OBJECTIVES**

1) Apply the techniques learned to be able to perform an upright DBT directed breast biopsy from a technical perspective. 2) Contrast the advantages and disadvantages of performing DBT directed biopsy Vs Prone Stereotactic biopsy. 3) Identify the types and location of lesions which are best suited for DBT biopsy Vs Prone Stereotactic biopsy. 4) Describe the impact of using DBT directed biopsy on breast center operations.

**ABSTRACT**

Similar to the need for MRI biopsy capability in a practice that performs breast MRIs, the need for tomosynthesis guided breast biopsies in a practice using tomosynthesis is inevitable as there are certain lesions seen only on tomosynthesis that would be impossible to biopsy utilizing 2D stereotactic guidance. Since the introduction of DBT directed biopsy several years ago it has become apparent that there are certain types and locations of lesions which are most amenable to DBT directed biopsy Vs traditional prone stereotactic biopsy. This course will review the limited literature on this topic, describe how to perform a DBT directed biopsy, discuss which lesion types and locations are most amenable to using this technique, and consider what the operational impact the technology has on the breast center.

**RC715C The Pathology is Back: What Next?**

**Participants**
Amy S. Campbell, MD, Washington, DC, (amy.s.campbell@gunet.georgetown.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify key information in the pathology report needed to differentiate benign, malignant and high-risk lesions. 2) Examine the process of determining radiologic and pathologic concordance. 3) Describe what constitutes a discordant lesion and when to recommend repeat biopsy or surgical excision. 4) Define high-risk lesions and discuss management considerations. 5) Develop a strategy for critical evaluation of the pathology report in conjunction with imaging to render appropriate recommendations.
Participants
Ehsan Samei, PhD, Durham, NC (Coordinator) Research Grant, General Electric Company; Research Grant, Siemens AG
Norbert J. Pelc, ScD, Stanford, CA (Coordinator) Research support, General Electric Company; Research support, Koninklijke Philips NV; Consultant, Varian Medical Systems, Inc; Consultant, NanoX; Scientific Advisory Board, RefleXion Medical Inc; Scientific Advisory Board, Prismatic Sensors AB; Medical Advisory Board, OurCrowd, LP;

Sub-Events
RC721A Breast

Participants
John M. Boone, PhD, Sacramento, CA (Presenter) Research Grant, Siemens AG; Royalties, Wolters Kluwer nv;

RC721B MSK

Participants
Wojciech Zbijewski, PhD, Baltimore, MD, (wzbijewski@jhu.edu) (Presenter) Research Grant, Carestream Health, Inc

LEARNING OBJECTIVES
1) Describe the special purpose CT systems for musculoskeletal (MSK) imaging. 2) Compare the capabilities of special purpose MSK CT systems to conventional modalities. 3) Identify diagnostic applications enabled by special purpose MSK CT.

ABSTRACT
RC721C Interventional

Participants
Charles M. Strother, MD, Madison, WI (Presenter) Research Consultant, Siemens AG Research support, Siemens AG License agreement, Siemens AG
LEARNING OBJECTIVES

1) Establish criteria for MR Image-guided breast biopsy patient selection. 2) Cultivate a working understanding of MR Image-guided biopsy and needle localization instrumentation and implementation. 3) Basic MR Image-guided biopsy and needle localization parameters and requirements for coil, needle and approach selection. 4) Discuss practice integration issues. 5) Discuss pearls and pitfalls associated with successful MR Image-guided biopsy.

ABSTRACT

This course is intended to provide both basic didactic instruction and hands-on experience in the application of MRI guided breast biopsy. MRI provides greater sensitivity for detecting breast cancer compared with mammography and ultrasound, although with imperfect specificity. MRI guided biopsy is required to confirm or exclude malignancy for MRI only findings. This course will be devoted to the understanding and identification of the following pertaining to MRI guided biopsy: 1) appropriate patient selection 2) optimal positioning for biopsy 3) target selection and confirmation 4) various biopsy technologies and techniques 5) potential problems and pitfalls.
US-guided Interventional Breast Procedures (Hands-on)

Thursday, Dec. 1 4:30PM - 6:00PM Room: E264

Participants
Jocelyn A. Rapelyea, MD, Washington, DC (Presenter) Speakers Bureau, General Electric Healthcare Company; Research consultant, Q-view LLC.; Research consultant, QTUS
Margaret M. Szabunio, MD, Lexington, KY, (Margaret.szabunio@uky.edu) (Presenter) Nothing to Disclose
Shambhavi Venkataraman, MD, Boston, MA, (svenkata@bidmc.harvard.edu) (Presenter) Nothing to Disclose
Angelique C. Floerke, MD, Washington, DC (Presenter) Consultant, Becton, Dickinson and Company
Rachel F. Brem, MD, Washington, DC (Presenter) Board of Directors, iCAD, Inc; Board of Directors, Dilon Technologies LLC; Stock options, iCAD, Inc; Stockholder, Dilon Technologies LLC; Consultant, U-Systems, Inc; Consultant, Dilon Technologies LLC; Consultant, Dune Medical Devices Ltd
Karen S. Johnson, MD, Durham, NC (Presenter) Nothing to Disclose
Nicole S. Lewis, MD, Washington, DC (Presenter) Nothing to Disclose
Kathleen R. Gundry, MD, Atlanta, GA (Presenter) Nothing to Disclose
Michael N. Linver, MD, Albuquerque, NM (Presenter) Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, Real Imaging Ltd; Scientific Advisory Board, Seno Medical Instruments, Inc
Christina G. Marks, MD, Saint Louis, MO (Presenter) Nothing to Disclose
Caroline M. Ling, MD, Darby, PA (Presenter) Nothing to Disclose
Jessica Torrente, MD, Washington, DC (Presenter) Nothing to Disclose
Tilden L. Childs III, MD, Fort Worth, TX (Presenter) Stockholder, Pfizer Inc
Evguenia J. Karimova, MD, Boston, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

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

ABSTRACT

This course is intended to familiarize the participant with equipment and techniques in the application of US guided breast biopsy and needle localization. Participants will have both basic didactic instruction and hands-on opportunity to practice biopsy techniques on tissue models with sonographic guidance. The course will focus on the understanding and identification of: 1) optimal positioning for biopsy 2) imaging of adequate sampling confirmation 3) various biopsy technologies and techniques 4) potential problems and pitfalls.
RC815A  Breast Calcifications

Participants
Stephen A. Feig, MD, Orange, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Describe calcifications using BI-RADS descriptors for morphology and distribution. 2) Recommend diagnostic imaging workup for specific cases of screen-detected calcifications. 3) Estimate the likelihood of malignancy for these cases using BI-RADS Final Assessment Categories. 4) Debate the clinical significance of DCIS detected on basis of calcifications alone.

RC815B  Breast Masses

Participants
Gilda Cardenosa, MD, Richmond, VA (Presenter) Nothing to Disclose

RC815C  Asymmetries & Associated Findings

Participants
Paula B. Gordon, MD, Vancouver, BC (Presenter) Stockholder, OncoGenex Pharmaceuticals, Inc; Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, Real Imaging Ltd

LEARNING OBJECTIVES
1) Describe the types of asymmetries using BI-RADS descriptors. 2) Demonstrate options for diagnostic imaging workup for specific cases. 3) Discuss options for biopsy. 4) Estimate the likelihood of malignancy for these cases using BI-RADS Final Assessment Categories.

ABSTRACT
Up to March 2016, 1st, 4,295 patients were enrolled, 1,926 (45%) having a complete case report form and suited for analysis. Of 1,926 patients, 954 (49.5%) did not undergo MRI and 972 (50.5%) underwent MRI. Mastectomy rate planned at mammography/US and the actually performed one were recorded. For the MRI group, any change in the patients’ surgical management due to MRI was noted. Mastectomies and reoperations were the surgical patients' outcomes. Raw odds ratios (OR) were adjusted for patient age and breast density for MRI group over non-MRI group. McNemar and c2 tests were used for comparisons.

**METHOD AND MATERIALS**

A total of 34 centers from 14 countries were selected for participation. For each breast, the surgical treatment planned at mammography/US and the actually performed one were recorded. For the MRI group, any change in the patients’ surgical management due to MRI was noted. Mastectomies and reoperations were the surgical patients’ outcomes. Raw odds ratios (OR) were adjusted for patient age and breast density for MRI group over non-MRI group. McNemar and c2 tests were used for comparisons.

**RESULTS**

Up to March 2016, 1st, 4,295 patients were enrolled, 1,926 (45%) having a complete case report form and suited for analysis. Of 1,926 patients, 954 (49.5%) did not undergo MRI and 972 (50.5%) underwent MRI. Mastectomy rate planned at mammography/US was 134/954 (14.0%) for the non-MRI group and 195/972 (20.1%) for the MRI group (P<.001): adjusted OR 1.4 (95% confidence interval [CI] 1.2–1.6). In the MRI-group, planned mastectomies passed to 203/972 (20.9%) after MRI (P=.016). MRI-detected new contralateral cancers were 8/972 (0.8%). Actual mastectomy rate was 140/954 breasts (14.7%) in the non-MRI group and 203/972 (20.9%) in the MRI group (P<.001): adjusted OR 1.4 (95%CI 1.2–1.6). Of 769 breasts conservatively treated, MRI did not change...
the surgical treatment in 569 (74%), while prompted a wider or >1 excision in 100 (13%) and a less extensive surgical treatment in 100 (13%). Per-patient reoperation rate for close/positive margins was 124/954 (13.0%) in the non-MRI group and 68/972 (7%) in the MRI group (P<.001): adjusted OR 0.5 (95%CI 0.4–0.6).

CONCLUSION
These preliminary results showed that most mastectomies were already planned at mammography/US so that preoperative MRI was used mainly as a confirmation tool. This selection bias also contributed in determining a lower reoperation rate in women undergoing MRI. Conservative treatment was modified by MRI in relation to disease extent, with a balance between increased and decreased breast tissue removal.

CLINICAL RELEVANCE/APPLICATION
Preoperative MRI prompts a very low rate of additional mastectomies and allows for tailoring conservative treatment.

PURPOSE
To evaluate the role of breast contrast enhanced MR imaging (CE-MR) for detecting and characterizing papillary lesions and to compare the obtained results with conventional digital ductography, having the histological findings as the reference standard.

METHOD AND MATERIALS
49 consecutive patients with spontaneous, unilateral, single-pore nipple discharge underwent conventional digital ductography and CE-MRI (1.5 Tesla device) with morphological (T2-TSE, STIR) and dynamic sequences (THRIE). Sensitivity, specificity and diagnostic accuracy values for both ductography and CE-MRI were calculated having post-surgical histological examination (n=43) and 12 month MR follow up (n=6) as the reference standard. The obtained performance values were compared by using Mc Nemar test searching for any statistical significant difference between the two imaging tools.

RESULTS
CE-MRI detected papillary lesions in 41/49 (84%) patients (mass like enhancement, n=30 - papillomas; ductal enhancement, n=7 – papillomatosis; linear enhancement, n=4 – papillary carcinomas) with sensitivity, specificity and accuracy values of 95%, 100% and 96%, respectively. Conventional digital ductography detected papillary lesions in 33/49 (67%) patients (single filling defects, n=26 – papillomas; multiple filling defects, n=4 – papillomatosis; filling stops with ductal distortions, n=3; papillary carcinomas) with sensitivity, specificity and accuracy values of 77%, 100% and 80%, respectively. A significant difference between the two imaging tools was found in terms of sensitivity and diagnostic accuracy (p<0.05).

CONCLUSION
Breast CE-MRI represents an accurate and non-invasive tool for diagnosing and classifying papillary lesions with higher sensitivity and accuracy values as compared with conventional ductography.

CLINICAL RELEVANCE/APPLICATION
Breast CE-MRI allows to diagnose and classify papillary lesions with high accuracy and can replace conventional ductography in the management of patients.

PURPOSE
We explored whether quantitative parameters derived from dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) and diffusion-weighted imaging (DWI) correlated with the Ki-67 proliferation status in patients with estrogen receptor (ER)-positive invasive breast cancer.

METHOD AND MATERIALS
Between October 2014 and February 2015, 88 women with 88 ER-positive invasive breast cancers underwent preoperative DCE-MRI and DWI. The perfusion parameters (Ktrans, Kep, and Ve) and apparent diffusion coefficients (ADC) of each tumor were recorded. Correlations between these quantitative parameters and the Ki-67 proliferation status were sought using multivariate regression analysis and by construction of receiver operating characteristic (ROC) curves. The Ki-67 proliferation index was categorized as high (≥ 14%) or low (< 14%).
RESULTS

In the high-Ki-67 group, the mean Ktrans was significantly higher (P < 0.001) than that of the low-Ki-67 group, and the mean ADC significantly lower (P < 0.001). However, the mean Kep and Ve values did not differ between the two groups (P = 0.248 and P = 0.055, respectively). The ROC curve showed that cutoffs of 0.277 for Ktrans and 0.894×10^{-3} mm2/s for ADC, respectively, optimally predicted a high Ki-67 status (areas under the curve = 0.728 and 0.722; both P values < 0.001). Univariate analysis showed that a higher Ktrans (≥ 0.277), a lower ADC (≤ 0.894×10^{-3} mm2/s), a larger tumor size (≥ 2 cm), a higher histological grade (grade 3), and the presence of axillary metastasis were significantly associated with high-Ki-67 status (all P values < 0.05). Of these variables, a higher Ktrans (> 0.277; adjusted odds ratio (OR) = 8.893, 95% CI = 1.937-40.821; P = 0.005) and a higher histological grade (grade 3; adjusted OR = 8.353, 95% CI = 1.521-45.862; P = 0.015) independently predicted a high Ki-67 status.

CONCLUSION

MRI-derived quantitative parameters including Ktrans and the ADC were correlated significantly with the Ki-67 proliferation status in patients with ER-positive invasive breast cancer. Furthermore, upon multivariate analysis, a higher Ktrans was the strongest independent predictor of a high Ki-67 proliferation index.

CLINICAL RELEVANCE/APPLICATION

Quantitative parameters derived from DCE-MRI and DWI facilitate evaluation of proliferative tumor activity before surgery and may serve as useful imaging biomarkers predicting breast cancer prognosis.

SST01-04  Invasive Lobular Carcinoma: Detection and Multiplicity with Multimodalities

Friday, Dec. 2 11:00AM - 11:10AM Room: E450B

Participants

In Hye Chae, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Jin Chung, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Eun-Suk Cha, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jee Eun Lee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jeoung Hyun Kim, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE

To compare the diagnostic performances of mammography, sonography, breast specific gamma imaging (BSGI), PET, digital breast tomosynthesis (DBT) and magnetic resonance imaging (MRI) for the detection of invasive lobular carcinoma (ILC).

METHOD AND MATERIALS

This is a retrospective study of women with surgically proven ILC. All patients underwent surgery at our institution from October 2011 to November. All patients were performed various imaging modalities, prior to the surgery: mammography, sonography, BSGI, PET, DBT, and/or 3-T MRI. The imaging findings were classified as positive or negative for ILC, by experienced breast radiologists. The final surgical pathology made into the reference standard. The detection rate was evaluated for each index cancer per breast. The diagnostic performances were also evaluated for multiple suspicious lesions per breasts.

RESULTS

A total of 78 breasts in 76 women (mean age; 51 years, range; 33-85 years) had ILCs, two patients had bilateral invasive lobular carcinomas and 32 breasts had multiple ILCs per breast. Patients preoperatively underwent mammography (n=72), sonography (n=77), BSGI (n=50), PET (n=74), DBT (n=15), and MRI (n=76). For index cancer, the detection rate was 100% for sonography, MRI, and DBT, while the detection rate of BSGI, PET and mammography were; 96.0%, 93.2% and 87.5%, respectively. For multiple ILCs, DBT had a sensitivity of 100%, MRI had a sensitivity of 93.3%, sonography, PET, BSGI, and mammography as follows; 96.0%, 93.2% and 87.5%, respectively. The sensitivity of sonography for multiple ILCs (75.0%) was significantly higher than that of mammography (22.6%, P = .000) and BSGI (38.1%, P =.006). The diagnostic accuracy for multiple ILCs were 100% in DBT, 73.6% in PET, 71.4% in sonography, 67.1% in MRI, 60% in BSGI and 56.9% in mammography.

CONCLUSION

Sonography, DBT and MRI showed 100% detection rate of main ILCs. DBT was the most accurate imaging modality, whereas mammography and BSGI showed relatively low diagnostic performances, for the multiplicity of ILCs. DBT is an effective modality for patients with ILCs, and has a promising role in the diagnosis of multiple ILCs.

CLINICAL RELEVANCE/APPLICATION

Digital breast tomosynthesis can demonstrate multiple suspicious lesions of invasive lobular carcinoma and is recommended as part of preoperative evaluation in patients with invasive lobular carcinoma.

SST01-05  National Performance Benchmarks for Modern Diagnostic Digital Mammography: Update from the Breast Cancer Surveillance Consortium

Friday, Dec. 2 11:10AM - 11:20AM Room: E450B

Participants

Brian L. Sprague, PhD, Burlington, VT (Abstract Co-Author) Nothing to Disclose
Rob F. Arao, MPH, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Diana Miglioretti, PhD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Janie M. Lee, MD, Bellevue, WA (Abstract Co-Author) Research Grant, General Electric Company
Kara Kerlikowske, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Constance D. Lehman, MD, PhD, Boston, MA (Presenter) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company
Louise M. Henderson, Chapel Hill, NC (Abstract Co-Author) Nothing to Disclose
Tracy Onga, PhD,MS, Lebanon, NH (Abstract Co-Author) Nothing to Disclose
Anna N. Tosteson, Lebanon, NH (Abstract Co-Author) Nothing to Disclose
Garth H. Rauscher, PhD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Diana S. Buist, PhD,MPH, Seattle, WA (Abstract Co-Author) Nothing to Disclose
PURPOSE
To establish contemporary performance benchmarks for modern diagnostic digital mammography.

METHOD AND MATERIALS
This HIPAA compliant, IRB approved study included data from six Breast Cancer Surveillance Consortium registries (414 radiologists;90 radiology facilities). Women characteristics, mammogram indication and findings, linked with cancer diagnoses from state cancer registries were prospectively collected on women undergoing diagnostic digital mammography at participating facilities. We included 373,176 examinations conducted during 2007-2013 on 246,206 women. Performance statistics overall and stratified by diagnostic indication were calculated according to the American College of Radiology BI-RADS 5th edition. Benchmarks were derived from the distribution of performance metrics across radiologists.

RESULTS
Overall, diagnostic performance measures were: cancer detection rate (CDR), 32.9 per 1000; abnormal interpretation rate, 12.6%; positive predictive value-2, 26.2%; positive predictive value-3, 28.9%; false negative rate, 4.8 per 1000; sensitivity, 87.2%; specificity, 90.4%; cancers stage 0 or 1, 63.9%; minimal cancers, 46.9%; mean size of invasive cancers, 21.1 mm; invasive cancers node negative, 70.1%. Performance varied widely across specific diagnostic indications (e.g., additional evaluation of a recent mammogram, breast lump, short interval follow-up) and across radiologists. CDR ranged from 9.9/1000 for short interval follow-up exams to 61.4/1000 for evaluation of a breast lump. Cancers detected for exams evaluating a breast lump had poorer prognostic characteristics, including a high percentage of invasive cancers (93.3%), low percentage of minimal cancers (17.0%), larger mean tumor size (28.4 mm), and a high percent of node positive disease (41.0%). Comparison to prior studies reveals substantial changes in diagnostic mammography performance since the change from film to digital mammography, including increased cancer detection rates and declining specificity and positive predictive values.

CONCLUSION
These performance measures can serve as national benchmarks, which may help transform variation in radiologists’ diagnostic interpretive performance into targeted quality improvement efforts.

CLINICAL RELEVANCE/APPLICATION
Data from a large set of mammography facilities in the US linked to cancer registries provide contemporary performance benchmarks for diagnostic mammography in the era of modern digital mammography.

SST01-06 Dense or Not Dense: Implications of Visual and Quantitative Mammographic Density Assessment

Friday, Dec. 2 11:20AM - 11:30AM Room: E450B

Awards
Student Travel Stipend Award

Participants
Meaghan Mackesy, MD, Boston, MA (Presenter) Nothing to Disclose
Elisabeth P. Frost, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Eva C. Gombos, MD, Boston, MA (Abstract Co-Author) Royalties, Reed Elsevier
Catherine S. Giess, MD, Wellesley, MA (Abstract Co-Author) Nothing to Disclose
Sona A. Chikarmane, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
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Sughrta Raza, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE
Legislation requiring radiologists to inform women if they have mammographically dense tissues exists in numerous states and is expanding. The historically used visual assessment of density is known to suffer from intra- & inter-observer variability. Ideally, computer based quantitative tools should be objective & more robust. The purpose of this study was to assess the frequency of agreement between visual and quantitative density-based risk stratification in a screening mammography population.

METHOD AND MATERIALS
IRB approved review of 2566 screening mammograms performed between December 2015 & March 2016 was performed, noting radiologists’ visually assessed density (RD) & quantitative (Quantra ™) density (QD) assignment for each case, based on BIRADS density categories A-D. All cases with discrepant RD & QD categories were tabulated. Within discrepant cases, we identified those with the discrepancy between categories A/B and C/D, or non-dense versus dense (NDvD). NDvD cases were blindly reviewed by a consortium of experienced breast imagers who assigned a visual density category to each case by consensus. This categorization was then compared to the prospective RD and QD.

RESULTS
RD & QD assignments were discrepant in 590 out of 2566 cases (23%). Of the discrepant cases, 224/590 (38%) had NDvD discrepancy (accounting for 8.7% of all 2566 cases). Of the 224 NDvD discrepant cases, RD resulted in 128 heterogeneous or extremely dense cases, QD resulted in 96. Of the 224 NDvD cases, there were 13 RD category A, all assigned category C by QD; and 5 RD category D cases which were assigned QD category A (3) or B (2). Consortium review deemed QD assignments in these cases unquestionably incorrect. In 177/224 (79%) of NDvD discrepant cases, the consortium density assignment was in agreement with prospective RD.

CONCLUSION
Quantitative density assessment would ideally categorize density of all screening mammograms correctly, identifying women at higher cancer risk who may benefit from supplemental screening. However, at present, this method has limitations and concurrent visual inspection is necessary to avoid misclassification of screening mammograms.

CLINICAL RELEVANCE/APPLICATION
Given legislation requiring density reporting, variability of qualitative & quantitative density assessment has far-reaching implications, both for supplemental screening & overall risk assessment.
Dedicated Breast PET (dbPET): The Extraordinary Contribution of Molecular Imaging in the Management Breast Cancer

**PURPOSE**

To determine the value of this technology in the routine management of breast cancer patients. Different approaches are discussed, from the use in monitoring therapy, to correlation with magnetic resonance imaging and even the development of the first 3D PET guided biopsy system on the world.

**METHOD AND MATERIALS**

Five hundred women with known or suspected breast carcinoma were enrolled in this study. A prone position high-resolution dedicated breast PET and MRI examinations were performed. A joint reading of MRI and PET scans side-by-side by a nuclear medicine physician and a radiologist was performed. Sensitivity, specificity, positive and negative predictive value, functional quantification, volume characterization and heterogeneity were registered. Final consideration of MRI and dbPET scans were compared with post-surgical pathology reports.

**RESULTS**

A total of 537 lesions were assessed. Lesion size range was 0.2 to 7.6 cm. In lesion-by-lesion analysis, sensitivity and specificity of MRI alone were 91% and 54%, respectively; while lesion-based sensitivity of dbPET was 93% and breast-based specificity was 100%. The positive predictive value and the negative predictive value for MRI alone were 69% and 85%, respectively; and for dbPET were 100% and 89%, respectively. In a significant number of cases, dbPET helped to clarify or disprove positive findings by MRI, and helped to define new positives that had gone unnoticed at MRI. When treatment was successful, a significant difference was found between pre- and post-neoadjuvant Chemotherapy status and the SUVmax (p < 0.001) of breast tumors. An exquisite and unexpected millimeter correlation with post-surgical pathology at the end of neoadjuvant therapy has been found in dbPET images.

**CONCLUSION**

Dedicated breast PET scans increase the specificity of MRI. The results of the current study show that FDG-dbPET is more effective than MRI in detecting true breast cancer positives. dbPET MAMMI has proven to be an excellent tool for monitoring of neoadjuvant therapy, showing earlier and better precision and accuracy than conventional techniques. Such an association might be of relevant importance to treatment continuity or adjustment.

**CLINICAL RELEVANCE/APPLICATION**

DbPET MAMMI has proven to be an excellent tool for diagnosis and monitoring of neoadjuvant therapy, showing earlier and better precision and accuracy than conventional techniques.

89Zr-trastuzumab PET/CT for Detection of Unsuspected HER2-positive Metastases in Patients with HER2-negative Primary Breast Cancer

**PURPOSE**

To determine if imaging with 89Zr-trastuzumab, a HER2-targeting PET tracer, can detect HER2-positive metastases in patients with HER2-negative primary breast cancer.

**METHOD AND MATERIALS**

Patients with HER2-negative primary breast cancer and distant metastases evident on CT, MR, or FDG PET/CT were enrolled in an IRB-approved prospective clinical trial. Patients underwent PET/CT with 5 mCi of 89Zr-trastuzumab in a total of 50 mg trastuzumab to screen for 89Zr-DFO-trastuzumab-avid metastases. Metastases avid for 89Zr-trastuzumab were biopsied to define HER2 status. Patients with pathologically proven HER2-positive metastases went on to receive HER2 targeted therapy to evaluate treatment response.
RESULTS

Nineteen patients have been enrolled in this prospective clinical trial, all of whom had pathologic retesting that confirmed HER2-negative primary breast cancer, and 13 of whom have so far been imaged with 89Zr-trastuzumab PET/CT. Seven patients demonstrated suspicious foci on 89Zr-DFO-trastuzumab PET/CT. Three of these seven patients had 89Zr-DFO-trastuzumab directed biopsy that confirmed the presence of HER2-positive metastases on pathology (by ASCO criteria). Four of these seven patients with suspicious foci had HER2-negative disease on pathology, and were classified as false positives for HER2-imaging on 89Zr-trastuzumab PET/CT. Of the three patients with biopsy proven HER2-positive metastases, two have completed a course of HER2-targeted therapy, and both demonstrated treatment response.

CONCLUSION

89Zr-trastuzumab PET/CT imaging may detect unsuspected HER2-positive metastases in patients with HER2-negative primary breast cancer. 89Zr-trastuzumab PET/CT also demonstrated a number of foci which were HER2-negative on pathology, and may represent false positive HER2-imaging.

CLINICAL RELEVANCE/APPLICATION

This is a proof of concept that HER2-targeted imaging can identify unsuspected HER2-positive malignancy and identify additional candidates for HER2-targeted therapy.

SST01-09  Quantitative CAD for Mammograms: Reducing False Positive Biopsies

Friday, Dec. 2 11:50AM - 12:00PM Room: E450B

Participants
Alyssa T. Watanabe, MD, Los Angeles, CA (Presenter) Consultant , CureMetrix, Inc
Rebecca Rakow-Penner, MD, PhD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
William Daughton, PhD, La Jolla, CA (Abstract Co-Author) Employee, CureMetrix, Inc
Hoanh X. Vu, PhD, San Diego, CA (Abstract Co-Author) Employee, CureMetrix, Inc
Michele Rochelle, MD, Poway, CA (Abstract Co-Author) Nothing to Disclose
Haydee Ojeda-Fournier, MD, La Jolla, CA (Abstract Co-Author) Employee, CureMetrix, Inc
Mohammad Eghtedari, MD, La Jolla, CA (Abstract Co-Author) Nothing to Disclose
Noha Abdelgellil, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Eric Weise, San Diego, CA (Abstract Co-Author) Researcher, CureMetrix, Inc

PURPOSE

Almost 2% of screening mammograms result in biopsy, and approximately 70% of these biopsies are benign (Allison, Cancer, 2015). Decreasing the number of unnecessary biopsies would be cost effective and decrease patient anxiety about breast cancer screening. We evaluated a novel algorithm that differentiates benign and malignant calcifications and compared these results to those of experienced radiologists in selecting cases for biopsy. The algorithm is based on a quantitative learning algorithm that takes into account morphology and clustering formation of benign and malignant calcifications as well as stability over time.

METHOD AND MATERIALS

In this IRB approved study, we performed a comparative analysis on 391 patients’ screening and diagnostic mammograms where tissue was sent to biopsy based on suspicious calcifications detected by MQSA certified, fellowship-trained breast imaging radiologists. Cases from 2 different centers were reviewed. These images were evaluated with the qCAD and compared to the expert radiologists’ reads. The outcome of the algorithm is an analytical function determined by the training datasets that mathematically define both malignant and benign calcifications. The algorithm is self-learning, improving over time as it encounters more patient cases.

RESULTS

Out of the 391 cases sent to biopsy, 302 cases were benign and 89 malignant (including DCIS). In a preliminary study using 44 cases (30 cases benign and 14 malignant), the algorithm detected 100% of confirmed cancer cases and had 11 cases with false positives, substantially fewer than the 30 false positives by the radiologists. If biopsy recommendations were based on the algorithm up to 63% of biopsies could have been avoided. The PPV of 32% could have been increased to 56% with the benefit of the qCAD.

CONCLUSION

This novel algorithm demonstrates that it can reduce the number of false negative biopsies based on suspicious calcifications by up to 63%. Also, the algorithm can be used to evaluate both screening and diagnostic mammograms.

CLINICAL RELEVANCE/APPLICATION

The use of this quantitative CAD for mammography may be useful in reducing false positive breast biopsies and significantly increasing the positive predictive value (PPV) of biopsy. This may lead to health savings costs as well as eliminate pain and distress for many patients.