Breast Imaging and Interventional

104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

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BR001-EB-X

Male Breast Disease: Pictorial Review of Multimodality Images

All Day Room: NA Hardcopy Backboard

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TEACHING POINTS

1. Review of uncommon male breast disease that prone to many of the same pathological processes as female breasts. 2. Review of various male breast disease by multimodality breast images including mammography, ultrasonography, breast MRI or chest CT scan.

TABLE OF CONTENTS/OUTLINE

1. Characteristic imaging features of gynecomastia that the most common abnormality of male breast 2. Benign male breast diseases including lipoma, myofibroblastoma, fibroadenomatous change, fat necrosis, abscess, cellulitis, intramammary lymph nodes 3. Malignant male breast disease including infiltrative ductal carcinoma, liposarcoma, metastatic carcinoma of axilla

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BR002-EB-X

Synthetic Mammography: Advantages, Disadvantages, Artifacts, and Pitfalls

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Participants
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TEACHING POINTS

To discuss synthetic mammography (SM) in terms of its acquisition technique from digitial breast tomosynthesis (DBT) data set To discuss the differences and advantages of DBT/SM compared to DBT/ full field digital mammography (FFDM) To discuss the appearance of benign and pathologic findings on SM and how the technique is different from FFDM To highlight artifacts and potential pitfalls of DBT and SM

TABLE OF CONTENTS/OUTLINE

1. Introduction to DBT/SM a. Discuss DBT b. Discuss SM 2. Advantages/differences of DBT/SM compared to DBT/FFDM a. Decreased radiation dose b. Shorter acquisition time, decreasing motion c. SM algorithm enhances certain features, examples of the following will be provided i. calcifications ii. margins iii. distortion 3. Artifacts and potential pitfalls of DBT and SM a. High density artifacts i. Shadowing ii. Zipper or slinky artifact b. Motion i. Bounce ii. Zig-zag slinky artifact iii. Blur c. Pseudocalcifications i. Appearance of pseudocalcifications on SM ii. Discussion of looking at DBT data set and other synthetic image d. Pseudoasymmetry e. Decreased axillary contrast resolution i. Appearance of axilla on SM ii. Discussion of evaluating the axilla on DBT images

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Is It Really a Simple Intramammary Lymph Node?

All Day Room: NA Hardcopy Backboard

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TEACHING POINTS

The purpose of this exhibit is to discuss the evaluation of simple intramammary lymph nodes trough a multimodality pictorial essay, utilizing mammography, ultrasound and MRI. The increase of breast cancer screening exams nowadays led to the rising of masses findings. The differentiation of other breast masses with habitual lymph nodes have extremely important relevance, since the last are benign findings, so any conduct other than routine screening is not adequate, raising the cost to health system with additional exams, raising the x-ray dosage in the patient and could lead to unnecessary biopsies. They are usually less than 1 cm in greatest diameter. Being seen on mammography as a circumscribed oval or reniform non-calcified mass with a central or peripheral lucency that represents fat within the hilum. Without exception the nodes are smoothly circumscribed and well defined and have low density. If those features are not present it is not a simple lymph node. Thus, the radiologists have to be aware how to diagnostic simple intramammary lymph nodes to lead the patient in the proper assessment.

TABLE OF CONTENTS/OUTLINE

Introduction Typical characteristics Atypical characteristics. Conclusion

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Radiation Treatment Planning: What the Breast Imager Should Know

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TEACHING POINTS

-Know the indications and rationale for radiation therapy in lumpectomy and mastectomy patients -Understand how breast cancer stage affects treatment options -Appreciate how axillary and internal mammary lymph node involvement affects the radiotherapy treatment field -Become familiar with the radiation treatment process (treatment planning, number of visits, timing of radiation after surgery)

TABLE OF CONTENTS/OUTLINE

-Review the role of radiation therapy in breast cancer treatment -Discuss which patients require radiation therapy as part of treatment plan -Discuss margin status in breast conservation therapy and radiation field considerations as informed by the American Society for Radiation Oncology (ASTRO) Clinical Practice Statements -Discuss implications of lymph node involvement on the radiation therapy field and how this may contribute to late effects (e.g. lymphedema, coronary artery disease, etc.) -Illustrate experience of radiation therapy from patient perspective (timing, number of visits, duration of visits) -Present 2-4 multi-modality cases which highlight pertinent information provided by the breast radiologist that influences size and type of radiation field (e.g. axillary and/or internal mammary lymphadenopathy, multifocal/multicentric disease, inflammatory breast cancer, local recurrence)

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Complex Cystic and Solid Breast Masses - What Should I Know?

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TEACHING POINTS

The purpose of this exhibit was to evaluate complex cystic and solid breast lesions by mammography, ultrasonography (US) and advanced magnetic resonance (MR) techniques, correlating imaging with histologic findings. Complex cystic and solid masses have a substancial chances of being malignant (23 - 31%). For that reason, percutaneous or surgical biopsy is usually indicated and US is the modality of choice for characterizing and guiding biopsy. Common benign causes of complex cystic and solid masses include fibrocystic changes, intraductal or intracystic papilloma without atypia, fibroadenoma and phyloides tumor. Atypical findings include atypical ductal hyperplasia, lobular neoplasia, and atypical papilloma. Malignant findings include ductal carcinoma in situ (DCIS), intracystic papillary? carcinoma and invasive carcinomas. Advanced MR techniques like dynamic imaging provide a high level of diagnostic confidence in the characterization of complex cystic breast lesion, thus allowing early diagnosis and significantly reducing patient morbidity and mortality.

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Introduction Complex cystic and solid mass Enhancement breast lesions Benign lesions Malignant lesions Breast MRI Conclusion

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BR006-EB-X

Malignant Breast Lesions: Can We Predict the Tumor Subtype?

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Participants
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TEACHING POINTS

1- To recognize the morphological findings in oncological breast lesions according to tumor subtype. 2- To compare our imaging findings with the published bibliography. 3- To describe the importance correlating radiological and histopathological findings.

TABLE OF CONTENTS/OUTLINE

Introduction. Background. Radiological findings related to tumor subtype. Luminal A. Luminal B. Triple Negative. HER2/Neu positive. Discussion. Conclusion.

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BR012-EB-X

Incidental Extra-Mammary Findings on Breast MRI: A Pictorial Illustration

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TEACHING POINTS

-Utilize a systematic approach for interpreting extra-mammary findings seen on breast MRI. -Become familiar with the frequency of extra-mammary findings seen on breast MRI based on organ system. -Recognize the utility of pursuing additional imaging/diagnostic work-up of the findings identified.

TABLE OF CONTENTS/OUTLINE

-A pictorial illustration of the cases encountered at our institution will be presented with emphasis on pertinent findings and workup. -A total of 20 cases will be presented with findings grouped into the following categories: osseous, hepatic, biliary, cardiac/vascular, pulmonary, neurology, and endocrine. -A systematic approach will be discussed including the utility of additional workup of the pathology presented.

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BR100-ED-X

Imaging of Lesions of Uncertain Malignant Potential on Core Biopsy

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

To review the pathological classification of lesions, with emphasis on lesions of uncertain malignant potential (B3). To illustrate clinical presentation, imaging findings (mammogram, US, MR) of cases from our series of breast lesions with pathologic correlation. To emphasize pitfalls, diagnostic difficulties, differential diagnosis and management of these lesions.

TABLE OF CONTENTS/OUTLINE

We present: 1.Histopathological classification of breast lesions. 2. Definition of B3 lesions (uncertain malignant potential). 3. Imaging (Mammograms, US, MR) of the different entities included in this group: atypical epithelial proliferation of ductal type, lobular intraepithelial neoplasia, complex sclerosing lesions/radial scar, papillary lesions and columnar cell change. 4. Differential diagnosis and management.Tips- Discordant diagnoses must be reviewed, sometimes repeat core biopsy or surgery are mandatory. - Remember entities which may cause an underestimation on core biopsy to choose the best approach in patient management

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BR101-ED-X

BRCA Mash-Up: Pictorial Review of BRCA-Associated Breast Cancer Phenotypes

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

Women with BRCA1 or BRCA2 mutations face up to a 65% lifetime risk of developing breast cancer. BRCA1 and BRCA2-associated breast cancers have been shown to have distinct imaging features and radiologists must recognize the characteristics of these tumors in order to increase the likelihood of earlier detection. Additionally, BRCA1 cancers tend to be more aggressive than BRCA2 cancers, with more mammographically occult cancers in the BRCA1 population. After reviewing this exhibit, participants will understand key clinical differences resulting from BRCA1 and BRCA2 mutations and describe the associated characteristic imaging features.

TABLE OF CONTENTS/OUTLINE

• Epidemiology of BRCA mutations • Key clinical differences resulting from BRCA1 and BRCA2 mutations • Comprehensive imaging review highlighting the characteristic findings of BRCA1 and BRCA2-associated breast cancers on 2D and 3D mammography, ultrasound, and MRI

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BR102-ED-X

Technique and Benefits for Same Day Dual-Energy Contrast-Enhanced Mammography and Breast Biopsy

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS

Dual-energy contrast enhanced mammography (DECM) is a technique using intravenous contrast injection with dual energy radiography to detect any additional enhancing breast lesions. In our experience of over 500 cases, DECM has been more effective than standard mammography in identifying occult lesions in the breast tissue of patients presenting for biopsy for a known lesion. Contrast mammography has the potential to be complimentary in a center with access to gold standard contrast enhanced MRI, and a reasonable substitute when MRI is not possible for any number of reasons. Done on the biopsy day, any new lesion(s) can undergo workup at this time; bringing a more complete assessment while streamlining patient care. Describe the dual energy contrast enhanced mammography technique Detail the benefits and possible drawbacks in using this technique Provide a comparison of DECM with contrast enhanced MRI

TABLE OF CONTENTS/OUTLINE

Dual energy contrast enhanced mammography technique Our breast center protocol Advantages and disadvantages of DECM Comparison of contrast enhanced MRI and contrast mammography as reported in the literature Future directions - We are in the process of reviewing our 500+ DECM exams to quantify extent and pathology of occult enhancing breast lesions

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BR103-ED-X

Breast Cancer Recurrence in the Post-Operative Breast: Catch Me If You Can!

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS

1. Discuss common mammographic findings suggestive of breast cancer recurrence: in Post Lumpectomy Breast TRAM Flap Mastectomy 2. Discuss current recommendations for post-operative surveillance mammography

TABLE OF CONTENTS/OUTLINE

1. The following imaging findings will be reviewed: Features of recurrence in Post Lumpectomy Breast Features of recurrence in Tram Flap Features of recurrence in Mastectomy Available screening guidelines

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BR104-ED-X

A Radiologist's Practical Guide to use of DWI during Breast MRI

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS

1. Diffusion weighted imaging (DWI) can aid MRI interpretation by improving specificity, often the bane of this modality. 2. Apparent diffusion coefficient (ADC) values of fibroadenomas are typically in the range of 1.5 - 2.0 x 10-3 mm2/sec, quite different from invasive ductal cancer, which is typically below 1.2 x 10-3 mm2/sec. Actual ADC values associated with any tissue will depend on details of the diffusion sequence. One role for DWI may be in confirming fibroadenoma for lesions with some atypical BI-RAD features. 3. Fat in the breast, intermixed with glandular tissue imposes limitations on appropriate use of diffusion data 4. Breast MRI is often associated with image distortion and displacement, challenging interpretation of small lesions. Strategies for coping with this phenomenon will be discussed.

TABLE OF CONTENTS/OUTLINE

1. Need to know physics of DWI; meaning of ADC values. 2. Examples of displacement and distortion; how to compensate for these limitations 3. Examples of mass and non-mass benign and malignant lesions using conventional BI-RADS and application of diffusion data - when to use it, when not to use it. 4. ADC 'double threshold' so as not to confuse fibroadenoma and mucinous breast cancer. 5. Review of recent literature on advanced diffusion methods such as Kurtosis imaging

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BR105-ED-X

Multimodality Approach to the Nipple-Areolar Complex: A Pictorial Review and Diagnostic Algorithm

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
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TEACHING POINTS

* We describe and illustrate the normal anatomy and anatomic variants of the nipple-areolar complex (NAC). * We show the imaging techniques used to study the NAC. * We review benign and malignant conditions that can affect the NAC, and propose a diagnostic algorithm for the imaging workup.

TABLE OF CONTENTS/OUTLINE

Normal anatomy and anatomic variants of the NAC. Imaging techniques used to evaluate the NAC (mammography, ultrasound, MRI, galactography). Benign and malignant processes that involve the NAC and their appearance on imaging modalities, with clinical-pathological correlations. Diagnostic imaging algorithm.

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BR106-ED-X

Breast Asymmetry. What Does It Mean? What Should I Do?

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

To review the definition and classification of asymmetry in breast mammograms. To illustrate imaging features (mammogram, US, MR) of cases from our series with pathologic correlation. To analyze and discuss the specific management of those lesions, including diagnostic difficulties and imaging work-up (additional mammogram projections, US, tomosynthesis, MR) To emphasize pitfalls and clues to differential diagnosis.

TABLE OF CONTENTS/OUTLINE

- BIRADS Fifth edition classification and definition of asymmetries: asymmetry, global asymmetry, focal asymmetry , developing asymmetry. -Different possible etiologies of each type. -Difficulties in imaging and diagnostic work-up: additional mammogram projections, US, tomosynthesis, MR, comparison with previous studies and follow-up. - A case-based review with pathological correlates will illustrate imaging findings and pathological correlation of challenging cases including, ductal and lobar breast cancer, pseudoangiomatous stromal hyperplasia (PASH), hormonal changes.

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BR107-ED-X

Tumor Biology and Imaging Manifestations: Can You Match the Imaging Findings to the Correct Tumor Type?

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS

1. To discuss the genetic biomarkers and biologic behavior of breast cancers a. ER, PR, Her2/Neu or ERRB2 receptor, Ki-67 protein b. Luminal A, Luminal B, Basal, Triple Negative, Her-2 Enriched subtypes 2. To present a series of cases from our tertiary breast center in an interactive format to illustrate common radiologic manifestations of breast cancer subtypes a. Can we predict the subtype based on imaging? 3. To recognize the importance of these imaging findings and how they correlate with treatment and prognosis 4. Estimate future implications of tailored personalized treatment in breast cancer

TABLE OF CONTENTS/OUTLINE

1. Introduction to breast cancer biology 2. Compare and contrast breast cancer subtypes and their pathophysiology a. Luminal A, Luminal B, Basal, Triple Negative, Her-2 Enriched 3. Interactive case review of the imaging findings of each subtype a. Multiple pathology-proven cases from our institution 4. Treatment and prognosis of each subtype 5. Future directions in personalized treatment of breast cancer

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BR108-ED-X

Basic Concepts and Implications of Molecular Classification of Breast Cancer

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

Review the classification of subtypes in breast cancer. Analyse implications of breast cancer subtyping in clinical settings: different treatment , survival, follow-up. Discuss the imaging findings of each molecular subtype .

TABLE OF CONTENTS/OUTLINE

Introduction to molecular classification of breast cancer: intrinsic subtypes (gene expression), surrogate intrinsic subtypes (defined by routine histology and IHC data). Definitions of the major molecular subtypes of invasive breast cancer. Clinical implications: different molecular profiles with different degrees of treatment sensitivity , patterns of spread (lymph nodes, metastases) and different outcomes. Discussion of different imaging findings in the different subtypes. A case-based review with pathological correlates will illustrate imaging findings and limitations in diagnosis, posttreatment evaluation and follow-up of the different subtypes of breast cancer.

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BR109-ED-X

You Found What in My Breast?!

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

Review benign pathologies and findings that can simulate malignant disease in the breast, including infectious etiologies, foreign bodies, dermal, and iatrogenic processes. Identify these entities based on characteristic multi-modality imaging appearances. Review tips, tricks, potential pitfalls, mimics and the role of clinical history in the diagnosis of these entities.

TABLE OF CONTENTS/OUTLINE

We will present a case-based pictorial essay of our experience from our academic and community-based breast imaging network. Cases include: Foreign bodies/Iatrogenic Post-surgical gossypiboma including surgical mesh, towel, and staples Bullet fragments mimicking calcification Retained catheter fragments Post-laparotomy emphysema Sewing and acupuncture needles Infection The 'fillarial dance' (active, mobile parasite on US cine) Calcified chronic fillarial infection Calcified trichinosis Cysticercosis Dermal Tattoo pigment-nodal/cutaneous Neurofibromatosis Hidradenitis Fat necrosis following Methylene blue injection prior to sentinel node Other Amyloidosis from Sjogren Syndrome Poland Syndrome Peri-implant effusion Gold therapy sequelae

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BR110-ED-X

Radioactive Seed Localization-Speed Bumps of Early Adoption: How to Pave the Way to Successful Use of Non-Wire Localizations

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

Understand the advantages and disadvantages of using radioactive seed localization versus needle-wire localization. Identify potential pitfalls and unique situations which are specific to non-needle-wire localizations, specifically radioactive seeds. Describe strategies that can be used to overcome these pitfalls.

TABLE OF CONTENTS/OUTLINE

Overview: a brief history of radioactive seed and other non-needle-wire localization techniques Brief description of the implementation of a radioactive seed localization program Case examples of potential problems and unique situations involving radioactive seed localization Hematoma/seroma at/near localization site Flanking localization Localization of axillary lymph nodes More than one ipsilateral finding Malpositioned radioseed Summary Review when the use of radioseeds may be contraindicated Suggestions for new users

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BR111-ED-X

Optimizing Mammographic Positioning: One Technologist at a Time

All Day Room: NA Digital Education Exhibit

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Meaghan Mackesy, MD, Burlington, MA (*Abstract Co-Author*) Nothing to Disclose
Kristine Mallinson, Lexington, MA (*Abstract Co-Author*) Nothing to Disclose
Michelle R. McSweeney, DO, Burlington, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Describe the importance of breast positioning in mammography and the new MQSA requirements for ongoing assessment and improvement of image quality 2. Demonstrate how large batch analysis of positioning metrics can provide insight into trends of deficiencies by technologist and the opportunity for directed training 3. Exhibit how a one-time teaching intervention is not sufficient

TABLE OF CONTENTS/OUTLINE

1. Importance of positioning in mammography a. Cases b. Description of MQSA EQUIP Initiative c. Educational review of seven positioning quality metrics computed from images 2. A program for assessment & improvement of breast positioning a. Description of program Software for analysis of large batches of images for positioning Results analyzed by technologists for individualized improvement b. Intervention: Individualized training provided c. Results Initial analysis Results after re-education by trainer 3. Challenges and future goals a. Lessons learned from initial experience Initial re-training in one area led to increased deficiencies in other areas Improvements not sustained, need for continuous monitoring/interventions b. Future goals Potential for frequent/real-time feedback and ultimately improved patient care

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BR112-ED-X

Preparation of Digital Mammograms for the Application of Deep Learning Algorithms

All Day Room: NA Digital Education Exhibit

Participants
Alexandra (Ali) Silver, BSC, Kelowna, BC (*Presenter*) Nothing to Disclose
Yuhao Huang, Kelowna, BC (*Abstract Co-Author*) Nothing to Disclose
Carson McKay, BSC, Kelowna, BC (*Abstract Co-Author*) Nothing to Disclose
Rasika Rajapakshe, PhD, Kelowna, BC (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

This educational presentation will illustrate the following: 1. Annotation of Breast abnormalities recorded as DICOM Grayscale Softcopy Presentation State (GSPS) (DICOM PR Modality); 2. De-identification of DICOM files; 3. Description of DICOM PR Graphic Objects including Coordinates, Area, Mean, Standard Deviation and Shape of Object; 4. Utilization of PR Graphic Objects to create a Binary Mask image, referencing to the corresponding mammogram (Image Pair); 5. Generation and display of an Image Pair for each PR file and its referenced mammogram, and; 6. Generation of PNG files from Image Pairs for application in Machine Learning Algorithm.

TABLE OF CONTENTS/OUTLINE

1. Introduction and background on Machine learning. | 2. How Annotation of Breast abnormalities are saved as a DICOM Grayscale Softcopy Presentation State (GSPS) (DICOM PR Modality). | 3. Explanation of PR file format. | 4. Description of the creation of a "PR Viewer" program to create and display the Binary Mask image and its corresponding mammogram. | 5. Utilization of Image Pairs for Machine Learning Algorithm.

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BR113-ED-X

Embracing EQUIP in Our Daily Mammography Environment: Best Practices and Lessons Learned (The EQUIP Way or the Highway)

All Day Room: NA Digital Education Exhibit

Participants
Emily Marshall, PhD, Chicago, IL (*Presenter*) Nothing to Disclose
Yue Zhang, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Zheng Feng Lu, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
David V. Schacht, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Ingrid Reiser, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Kirti M. Kulkarni, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Understanding the rationale for implementing Enhancing Quality Using the Inspection Program (EQUIP). 2. Initiatives taken at our institution to successfully implement EQUIP. 3. Demonstrate how a strong, interdisciplinary team can create a manageable workflow. 4. Understand how the EQUIP workflow supports medical outcomes audit preparation.

TABLE OF CONTENTS/OUTLINE

In our institution, we have successfully implemented EQUIP since July of 2017. The team comprises of lead radiologist, mammography manager, QC technologist and imaging physicists. A dedicated tool for monthly retrospective review was developed by in-house IT support, which tracks and quantifies quality scores and comments per individual technologist. A competency check-list has been developed and is reviewed quarterly by the team to: (1) evaluate equipment performance (2) identify technical problems with our imaging systems (3) review technologists' and physicists' mandated QC outcomes (4) track reject rates. This comprehensive team approach has enabled the lead technologist and radiologist to (1) oversee mammography QC process in a timely manner (2) review technologists' performance and offer positive and constructive feedback (3) encourage technologists to take ownership of their patients (4) to address issues identified through these meetings sooner than later.

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BR114-ED-X

Cone Beam CT: A Promising Approach to Non-Oncologic Imaging of the Surgically-Altered Breast

All Day Room: NA Digital Education Exhibit

Participants
Alison J. Matich, MD, Rochester, NY (*Presenter*) Nothing to Disclose
Avice M. O'Connell, MD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Paige Myers, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Megan Pencek, MD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Howard Langstein, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

To understand the indications, advantages, and limitations of Cone Beam CT in post-operative imaging evaluation of the non-oncologic post-operative breast.

TABLE OF CONTENTS/OUTLINE

A. Introduction to Cone Beam CT technologyB. Indications for imaging in the non-oncologic, post-operative setting * Reduction mammoplasty * Breast augmentationC. Advantages & limitations from the patient's perspectiveD. Advantages & limitations from the plastic surgeon's perspectiveE. Possibilities for the future * Fat grafting

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BR115-ED-X

Diagnostic Breast Imaging and Interventions in the Age of Digital Breast Tomosynthesis: How We Do It

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Amy Maduram, MD , San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Mohammad Eghtedari, MD, PhD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
Rebecca Rakow-Penner, MD, PhD, San Diego, CA (*Abstract Co-Author*) Research Grant, General Electric Company
Vivian Lim, MD, La Jolla, CA (*Abstract Co-Author*) Consultant, CureMetrix, Inc
Haydee Ojeda-Fournier, MD, La Jolla, CA (*Presenter*) Research Consultant, View Point

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TEACHING POINTS

A quasi-three dimensional technology, digital breast tomosynthesis (DBT) has become widely available because of multiple studies showing increased cancer detection rates and lower call back rates in the screening setting. While most practices start their DBT program with screening, soon the benefits of DBT in diagnostic evaluation and guiding interventions become evident. At the end of this educational exhibit the learner will: 1. Understand the importance of DBT as a unique imaging modality, 2. Learn to localize breast lesions with DBT, 3. Become familiar with the imaging appearance of malignancy by BDT, and 4. Present an algorithm for diagnostic evaluation based on DBT.

TABLE OF CONTENTS/OUTLINE

Introduction; Historical perspective; DBT basics; Localization: Skin, Quadrants, O'clock positions; DBT evaluation of: masses, asymmetries, architectural distortions, and calcifications; DBT as supplemental imaging; DBT assessment of extent of disease; Workflow simplification by addition of DBT; Algorithm for diagnostic evaluation based on DBT; Conclusion; Test yourself with image and multiple choice questions.

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BR116-ED-X

Breast Cancer in Younger Women: Screening and Diagnostic Imaging Examinations

All Day Room: NA Digital Education Exhibit

FDA Discussions may include off-label uses.

Participants
Takayoshi Uematsu, MD, PhD, Nagaizumi, Japan (*Presenter*) Nothing to Disclose

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TEACHING POINTS

Breast cancer in younger women aged < 40 years represents a challenge to public health due to the considerable number of years of life lost, difficult early detection, and often late diagnosis. We will: 1. Propose screening algorism using multimodality breast imaging based on breast cancer risk stratification including breast cancer genetics and mammographic breast density. 2. Discuss most effective usage of multimodality breast imaging to faster and accurate diagnosis of breast cancer in younger women with less costly care.

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Epidemiology of breast cancer in younger women 3. Risk factors of breast cancer in younger women 4. Screening algorism for breast cancer in younger women 5. Multimodality breast imaging for breast cancer in younger women 6. Summary

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BR117-ED-X

Breast Diseases Arising in Patient of Chronic Renal Failure or Kidney Transplantation: What Radiologists Should Know

All Day Room: NA Digital Education Exhibit

Participants
Eunji Lee, MD , Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yun Woo Chang, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jinah Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hwa jin Cha, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jiyoung Hwang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seong Sook Hong, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. To review the various breast diseases arising in patients with chronic renal failure (CRF)/ kidney transplantation (KT) and to explain the affecting factors of the breast lesions in these patients. 2. Although breast screening is not routinely required in CRF/KT patients, knowlegde of related disease spectrum for CRF/KT patients would be helpful for differential diagnosis and decision to undergo biopsy.

TABLE OF CONTENTS/OUTLINE

1. Cyclosporine related breast disease in patients with KT; benign and malignant 2. Breast disease related with CRF with hemodialysis; collateral vessel engorgement, diffuse breast enlargement, post-traumatic hematoma or fat necrosis. 3. Diabetic mellitus related mastopathy in CRF patients. 4. Screening imaging evaluation for patients with CRF/KT.

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Encouraging Mammography Screening: Strategies for Designing a Culturally and Linguistically Targeted Breast Cancer Educational Program for a Multicultural Population

All Day Room: NA Digital Education Exhibit

Participants
Jenny Fung, BA, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Alicia Li, BA, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Lina Jandorf, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Laurie R. Margolies, MD, New York, NY (*Presenter*) Research Consultant, FUJIFILM Holdings Corporation

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TEACHING POINTS

Though advancements have been made in decreasing breast cancer incidence and mortality rates, minority groups still experience significant disparities in breast cancer-related health outcomes. This has been partly attributed to low mammography screening rates. These populations face group-specific barriers to screening related to low health literacy, limited English proficiency, and cultural beliefs. Our intervention involved designing culturally and linguistically targeted breast cancer educational presentations for African American women, African-Born women, Chinese women, Latina women, LGBTQ individuals, and Muslim women. Preliminary findings demonstrate high levels of participant engagement and positive response across all target cultural groups. We believe that this intervention has the potential to become a model for effective educational outreach to minority patients.

TABLE OF CONTENTS/OUTLINE

1. Review breast cancer statistics and screening rates among different minority groups 2. Identify barriers to screening for different minority groups 3. Describe systematic approach to creating a culturally and linguistically targeted presentation 4. Illustrate examples of addressing common misconceptions regarding breast cancer and screening through a narrative-based presentation

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BR119-ED-X

How to Identify Women Who Are Above Average Risk for Developing Breast Cancer: Retrospective Review of our Institution's First Year Experience After Implementing a Breast Cancer Risk Assessment Program in Breast Imaging

All Day Room: NA Digital Education Exhibit

Participants
Jessica L. Fournier, MD, Burlington, MA (*Presenter*) Nothing to Disclose
Cathleen M. Kim, MD, Burlington, MA (*Abstract Co-Author*) Nothing to Disclose
Jeanette Y. Chun, MD, Burlington, MA (*Abstract Co-Author*) Nothing to Disclose
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Meaghan Mackesy, MD, Burlington, MA (*Abstract Co-Author*) Nothing to Disclose
Meera Sekar, MD, Lexington, MA (*Abstract Co-Author*) Nothing to Disclose
Michelle R. McSweeney, DO, Burlington, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Review who is considered high risk for developing breast cancer and recommended screening guidelines. Review high risk screening breast MRI data. Review our implementation and workflow of a breast cancer risk assessment program performed in our breast imaging centers. Review our institution's first year results.

TABLE OF CONTENTS/OUTLINE

Women at above average risk for developing breast cancer benefit from earlier mammographic screening in addition to more robust supplemental screening with MRI. However, most high risk women and their providers are unaware of their elevated risk. In 2017, our institution implemented a breast cancer risk assessment program starting in breast imaging. All breast imaging patients were offered breast cancer risk assessment using a risk assessment software, CRA Health, which used Tyrer-Cuzick and BRCAPRO models. Over a 1 year period, 88% of patients agreed to have risk assessment. 14% of patients were calculated to be above average risk. 9% of above average risk patients underwent MRI. 3% of these patients were recommended for biopsy. All biopsied pathology revealed no cancers. 1. Above Average Risk Review. 1a. Current ACR Above Average Risk Screening Guidelines. 2. Breast Cancer Risk Assessment Program 2a. CRA Health Risk Assessment Software Tool. 2b. Workflow 3. Single Institutional Retrospective Review. 3a. Results

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BR120-ED-X

Diagnostic Imaging for Accelerated Partial Breast Irradiation

All Day Room: NA Digital Education Exhibit

Participants
Kazunori Kubota, MD, PhD, Bunkyo-Ku, Japan (*Presenter*) Nothing to Disclose
Tomoyuki Fujioka, MD, PhD, Bunkyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Ukihide Tateishi, MD,PhD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Mio Mori, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Accelerated Partial Breast Irradiation (APBI) is becoming a treatment for breast conservation therapy in early breast cancer, and radiologists also need to know about the indication and the procedure with diagnostic imaging. The objective of this exhibit is 1. To understand the therapeutic indications and to determine MRI diagnosis of breast cancer suitable for APBI. 2. To know the postoperative condition of the breast and the method to insert the applicator under the ultrasound image guide.

TABLE OF CONTENTS/OUTLINE

1. Preoperative diagnostic imaging and indications for APBI - Early stage breast cancer, negative surgical margin, negative lymph node metastasis - Preoperative MRI diagnosis - Preoperative ultrasonography for mapping of breast cancer 2. APBI insertion method and early postoperative diagnostic imaging - The state of breast soon after the surgery with ultrasound - Where is the true cavity? - Where to puncture and which way to insert the applicator (from inframammary fold via retromammary space) Preoperative diagnosis, interventional technique for inserting the applicator, and radiation therapy can be implemented at the radiology department. In this educational exhibit, We introduce diagnostic images and procedures of the istrut-adjusted volume implant (SAVI), which is APBI using a sealed brachytherapy source.

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BR121-ED-X

Extent of Breast Cancer: Assessment with Sonography (US), Realtime Elastography (EG), and Magnetic Resonance Imaging (MRI)

All Day Room: NA Digital Education Exhibit

Participants
Orlando Catalano, MD, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Antonio Nunziata, MD, Ercolano, Italy (*Presenter*) Nothing to Disclose
Roberta Fusco, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Salvatore Filice, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Antonella Petrillo, MD, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

US has a tendency to underestimate breast cancer size. In this singlecenter, prospective study we evaluate the potential additional value of EG in measuring lesions size.

TABLE OF CONTENTS/OUTLINE

We performed US, EG, and MRI within 30 days before surgery. The maximal diameter was measured by two blinded radiologists for each modality as well as on the fresh specimen. Inclusion criteria were patients candidate to surgery, BIRADS 5 and 6 lesions, absence of contraindication to MRI, insite surgery. Exclusion criteria were previous neoadjuvant therapy, postsurgical recurrence, lesions >5 cm, T4 lesions, multicentric lesions, insufficient images quality. We enrolled 19 patients with 23 malignant lesions (15 infiltrating ductal carcinomas, 7 infiltrating lobular carcinomas, 1 insitu ductal carcinoma). MRI made the lowest error in terms of mean and standard deviation. Pearson coefficient was 0.893 for US, 0,886 for EG, 0.998 for MRI. MannWitney test ranked 0.3674 between US and MRI, 0.5309 between US and EG, 0.8432 between EG and MRI. Using Kruskall Wallis test to assess the mismatch between the three modalities the p value resulted <0.0001. The Intraclass Correlation Coefficient between the three modalities was 0.89. Both US and EG underestimate breast lesions. In selected cases, merging the two modalities may improve the final measurement.

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BR122-ED-X

Male Breast Masses: A Multimodality Pictorial Review with Radiopathologic Correlation

All Day Room: NA Digital Education Exhibit

Participants
Cristina J. Quintero, MD , Bryn Mawr, PA (*Presenter*) Nothing to Disclose
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Mohammad S. Hussain, DO, Bryn Mawr, PA (*Abstract Co-Author*) Nothing to Disclose
Kristin Alman, Bryn Mawr, PA (*Abstract Co-Author*) Nothing to Disclose
Maria Montano, Bryn Mawr, PA (*Abstract Co-Author*) Nothing to Disclose
Jiao Wang, Bryn Mawr, PA (*Abstract Co-Author*) Nothing to Disclose
Ronald A. Pitt, MD,MSc, Bryn Mawr, PA (*Abstract Co-Author*) Nothing to Disclose
Anahid Pahlawanian, DO, Bryn Mawr, PA (*Abstract Co-Author*) Nothing to Disclose
Alicia L. Picard, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The male breast is affected by the same variety of pathologies affecting female breasts. Gynecomastia is the most common male breast disorder, however, malignant breast tumors can be encountered and these usually present at a more advanced stage of disease than women due to a delay in diagnosis. In this educational exhibit the learner will review: Anatomy and physiology of the male breast with a focus on the differences compared to female breastEpidemiology and risk factors of male breast masses ACR Appropriateness Criteria for imaging the male breast Imaging features of male breast masses on a case-based format with pathologic correlationManagement of male breast pathologyA proposed diagnostic algorithm for evaluating breast male masses

TABLE OF CONTENTS/OUTLINE

Review of male breast anatomy Epidemiology, demographics and risk factors of male breast masses with a focus on male breast cancer ACR Appropriateness Criteria for imaging male breast Case-based radiologic and pathologic correlation of benign and malignant etiologies such as but not limited to gynecomastia (and its different types), fat necrosis, granulomatous inflammation, myofibroblastoma, primary breast cancer, lymphoma, metastatic disease and axillary lymphadenopathyReview of work-up, treatment, and follow-up

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BR123-ED-X

Granulomas in the Breast: Do I Need to Worry?

All Day Room: NA Digital Education Exhibit

Participants
Eileen Delaney, MD, Worcester, MA (*Presenter*) Nothing to Disclose
Farhana Sharmeen, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Vincent G. Champion, MD, Westwood, MA (*Abstract Co-Author*) Nothing to Disclose
Jordana Phillips, MD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company; Consultant, General Electric Company
Priscilla J. Slanetz, MD, MPH, Belmont, MA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Granulomatous lesions of the breast are rare and represent a broad array of benign diseases, including sarcoidosis, mammary duct ectasia, periductal mastitis, infection, granulomatous mastitis, and foreign body reaction. 2. Histopathology is key in diagnosing granulomatous lesions of the breast as many of these entities mimic malignancy on imaging. 3. The treatment and management of granulomatous lesions of the breast vary depending on the etiology.

TABLE OF CONTENTS/OUTLINE

1. Overview of granulomatous disease and key histologic features. 2. Granulomatous Mastitis a. Types of Granulomatous Mastitis i. Idiopathic ii. Cystic Neutrophilic Mastitis b. Clinical and imaging findings c. Management 3. Reaction to Foreign Bodies/Trauma a. Types of Foreign Bodies i. Suture Granuloma ii. Silicone Granuloma iii. Fat Necrosis b. Clinical and Imaging Findings c. Management 4. Mammary Duct Ectasia and Chronic PeriductalMastitis a. Clinical and Imaging Findings b. Management 5. Infectious etiologies a. Types of Infectious Pathogens i. Mycobacterial ii. Fungal iii. Parasites b. Clinical and Imaging Findings c. Management 6. Sarcoidosis a. Clinical and Imaging Findings b. Management

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BR124-ED-X

MRI-Detected Breast Lesions: Comparison with Second-look US Using Real-time Virtual Sonography and Histopathological Findings

All Day Room: NA Digital Education Exhibit

Awards
Cum Laude

Participants
Kazuaki Nakashima, MD, Nagaizumi, Japan (*Presenter*) Nothing to Disclose
Takayoshi Uematsu, MD, PhD, Nagaizumi, Japan (*Abstract Co-Author*) Nothing to Disclose
Kaoru Takahashi, MD, Nagaizumi, Japan (*Abstract Co-Author*) Nothing to Disclose
Seiichirou Nishimura, MD, Nagaizumi, Japan (*Abstract Co-Author*) Nothing to Disclose
Takashi Sugino, MD, Nagaizumi, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

MRI-detected breast lesions are difficult to diagnose because other modalities are usually not helpful. Real-time virtual sonography improves lesion detectability and enables comparison of the MRI and ultrasonographic findings. The aims of this exhibit are: To understand ultrasonographic and histopathological findings of MRI-detected breast lesions. To discuss appropriate management of MRI-detected lesions depending on each institution and patient background to reduce unnecessary biopsy.

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Frequency and histopathology of MRI-detected lesions 3. Further examinations Second-look ultrasonography with/without real-time virtual sonography Biopsy Follow-up examinations 4. Illustrative cases with histopathologic findings 5. How do we manage MRI-detected lesions? 6. Summary

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BR125-ED-X

Tomosynthesis and Its Benefits in the Diagnosis of Architectural Distortions: A Way to Increase Our Diagnostic Capacity

All Day Room: NA Digital Education Exhibit

Participants
Flavia B. Sarquis, MD, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose
Lucia I. Beccar Varela, MD, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose
Soledad Nocetti, MD, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose
Maria Belen Pulido, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose
Paola Pucci, MD, Vicente Lopez, Argentina (*Presenter*) Nothing to Disclose
Rita Polo, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose
Bernardo O. Blejman, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Florencia Melendez, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

To define Architectural distortion (AD) of the breast according to the description of the American College of Radiology (ACR) in the Breast Imaging Reporting and Data System (BI-RADS). To identify the most common benign and malignant etiologies that can be seen with clinical presentation of AD. To examine the diagnostic utility of tomosynthesis in the identification of architectural distortions on mammographic views. To discuss and compare the role of other imaging modalities To recommend practical tools for appropriate management of tomosynthesis detected architectural distortions.

TABLE OF CONTENTS/OUTLINE

Introduction. Definition of AD. What is Tomosynthesis and how does it work? Brief review of the principles of DBT advantages of Digital breast tomosynthesis in improving architectural distortion visibility and characterization. Understanding the addition of 3D Mammography to current practice. Implementation of tomosynthesis-guided breast biopsy. Case-based illustration. Conclusion and take-home points.

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BR126-ED-X

A Multi-Modality, Case-Based Review of the 8th Edition AJCC Breast Cancer Staging and Prognosis Algorithm: The Why and How It Impacts Staging

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Katrina Korhonen, MD , Philadelphia, PA (*Presenter*) Nothing to Disclose
Austin Pantel, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Elizabeth S. McDonald, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Amy Clark, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
David A. Mankoff, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Speaker, Koninklijke Philips NV; Consultant, General Electric Company; Advisory Board, RefleXion Medical Inc; Consultant, Blue Earth Diagnostics Ltd; Research Funded, Siemens AG; Advisory Board, ImaginAb, Inc; Spouse, Owner, Trevarx
Emily F. Conant, MD, Philadelphia, PA (*Abstract Co-Author*) Grant, Hologic, Inc; Consultant, Hologic, Inc; Grant, iCAD, Inc; Consultant, iCAD, Inc; Speaker, iiCME

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TEACHING POINTS

The 8th edition AJCC breast cancer staging guidelines modify the TNM anatomic staging model with the incorporation of prognostic biomarkers such as tumor grade, hormone and HER2-receptor status, and gene expression panels. These new biomarkers provide prognostic information, guide patient treatment selection, and predict patient outcomes to therapy. Newly incorporated biomarkers such as Oncotype Dx may result in some patients with estrogen-receptor positive, lymph-node-negative cancers being downstaged to stage IA. 18F-FDG-PET/CT plays a valuable role in patients with clinical stage IIB or higher cancer by identifying extra-axillary lymph node metastases and unsuspected distant metastatic disease.

TABLE OF CONTENTS/OUTLINE

1. Summary of salient changes to TNM categories 2. Overview of new prognostic biomarkers incorporated into the updated guidelines, including tumor grade, hormone and HER2 expression status, and Oncotype Dx recurrence score 3. Multi-modality case-based review underscoring the importance of radiology in the new staging guidelines a. Case examples highlighting the role of imaging, including both conventional breast imaging modalities and FDG-PET/CT, in changing management b. Cases highlighting how the inclusion of new biomarkers may result in a prognostic stage that differs from the anatomic stage

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/ David A. Mankoff, MD, PhD - 2013 Honored EducatorDavid A. Mankoff, MD, PhD - 2018 Honored Educator

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BR127-ED-X

Developing Asymmetry: Learning Algorithm

All Day Room: NA Digital Education Exhibit

Participants
Yesenia Bermudez Cano, MD, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose
Veronica Gonzalez Bascon, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Karina Pesce, Capital Federal, Argentina (*Abstract Co-Author*) Nothing to Disclose
Carolina Hadad, Capital Federal, Argentina (*Abstract Co-Author*) Nothing to Disclose
Silvina Cadullo, Bueno Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Virginia Secco, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose

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yesebeca@hotmail.com

TEACHING POINTS

1. Review and incorporate the concept of developing asymmetry in mammographic reports. 2. In the search for carcinoma hidden in a developing asymmetry, highlight the importance of comparing with previous studies. 3- Very useful learning algorithm in case of developing asymmetry, as a guide to know the next step to follow when this finding is presented

TABLE OF CONTENTS/OUTLINE

Table of Contents: 1. Introduction 2. Objectives 3. Definition of developing Asymmetry 4. Learning algorithm: Additional projections - Ultrasound as a complementary diagnostic study - Biopsy 5. Causes of developing asymmetry (benign or malignant): radio-pathologic correlation. 6. Recommendations 8. Conclusion.

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BR128-ED-X

What Can It Be Except Gynecomastia?: Imaging Findings of the Common and Uncommon Causes of the Breast Lump in Male Patients

All Day Room: NA Digital Education Exhibit

FDA Discussions may include off-label uses.

Participants
Gamze Durhan, MD, Ankara, Turkey (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

1. Familiarity with the imaging findings of various benign and malignant male breast lesions allows correct imaging interpretation avoiding unnecessary biopsies and treatment. 2. Majority of breast lumps in male patients are benign and the most common reason is gynecomastia. Three mammographic patterns of gynecomastia are nodular, dendritic and diffuse glandular forms. Except gynecomastia, other common and uncommon benign conditions of the male breast are pseudogynecomastia, lipoma, ductal hyperplasia, cyst, chronic inflammation, ductal ectasia, intraductal papilloma, myofibroblastoma and pilomatricoma. 3. The incidence of breast cancer is very low in male patients. The most common histological type of primary breast cancer is ductal carcinoma. They are usually detected as spiculated, lobulated, microlobulated masses or ill-defined hypoechoic lesions. Microcalcifications unlike in female patients are rarely seen. Other malignant causes of breast lump in male patients include metastases to the breast and breast involvement by the hematologic malignancies.

TABLE OF CONTENTS/OUTLINE

Epidemiology and overview of the male breast tissue and diseases. Radiologic investigation of the common and uncommon benign breast lesions in male patients. Imaging features of the primary breast cancer and metastatic tumors to the breast in male patients. Summary.

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A Standardized Approach and Lexicon for Effective Reporting of Breast Cancer MRIs Pre and Post-Neoadjuvant Chemotherapy

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
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TEACHING POINTS

1. Understand the importance and clinical impact of findings on breast magnetic resonance imaging (MRI) pre and post-neoadjuvant chemotherapy 2. Know that variations in MRI interpretation exist due to the lack of a standardized reporting approach and lexicon 3. Recognize important imaging findings that should be included in the report that can impact a patient's treatment plan 4. Provide terminology that effectively communicates treatment response

TABLE OF CONTENTS/OUTLINE

- Sample cases illustrating typical MRI findings pre- and post-neoadjuvant therapy - Standardized approach and lexicon to use as a template when interpreting MRI in the neoadjuvant setting, including: a. Reproducible measurement of index tumor and extent in two dimensions b. Methods of describing multifocal/multicentric disease c. Presence or absence of pertinent findings that impact management (i.e. involvement of the nipple areolar complex) d. Reporting of axillary and internal mammary lymph nodes e. Lexicon for change in tumor and lymph nodes post-treatment f. Standardized terms to communicate residual enhancement in the tumor bed g. Concise impression that accurately reflects body of the report without repeating it, including a statement indicating presence or absence of a complete imaging response post-neoadjuvant chemotherapy h. Appropriate BI-RADS assessment post-treatment

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Breast Cancer Screening in Transgender Patients

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS

In the United States, 1.4 million adults identify as transgender. Despite growing national awareness, the transgender population faces barriers to healthcare. Also, due to the infrequency of transgender breast cancer cases, there is a lack of evidence-based screening guidelines. Several gender-affirming hormonal and surgical interventions are available which impact appearance on imaging and risk of breast cancer. Familiarity with expected imaging findings in the transgender population can help avoid medically-induced physiologic changes being mistaken for pathology. Breast cancer risk is thought to increase with estrogen, family history, BRCA mutation, radiation, and BMI >35. Mastectomy significantly reduces but does not eliminate risk of breast cancer.

TABLE OF CONTENTS/OUTLINE

(1) Clarification of transgender terminology. (2) Discussion of challenges to delivering sensitive and quality healthcare to transgender patients. (3) Description of hormonal therapies and surgical options for gender-affirmation. (4) Review of cases demonstrating common mammographic and ultrasound findings in this population. (5) Summarization of breast cancer incidence and risk factors in transgender patients. (6) Presentation of existing screening guidelines while highlighting areas for further research.

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Contrast-Enhanced Spectral Mammography (CESM): Lessons Learned from Early Clinical Implementation

All Day Room: NA Digital Education Exhibit

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Participants
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TEACHING POINTS

Contrast-enhanced Spectral Mammography (CESM) has been in clinical use at our institution since November 2012. We have performed over 2,500 CESM cases, with over 250 cases of biopsy-proven malignancy. This educational exhibit will illustrate various clinical applications of CESM in both the screening and diagnostic settings. The lessons learned in the early clinical implementation of CESM will be highlighted with multimodality imaging and pathologic correlation.

TABLE OF CONTENTS/OUTLINE

Review technique, indications, and clinical applications of CESM Demonstrate how we use CESM in clinical practice in the screening and diagnostic setting Show normal and abnormal cases, with MRI and pathology correlation Discuss limitations and CESM-specific artifacts

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CESM as a Tool for Staging and Post-Neoadjuvant Chemotherapy Treatment Response

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS

1. CESM provides improved lesion detection and characterization by combining digital mammography with the added assessment of lesion vascularity following contrast administration, thus introducing a physiologic component into diagnostic imaging. 2. With these benefits in mind, we have performed CESM for staging of known breast cancer and to assess response to neoadjuvant chemotherapy based on residual tumor enhancement in a small subset of patients unable to undergo breast MRI. 3. The goal of neoadjuvant chemotherapy is to achieve complete pathologic response. CESM is a quick and effective way of guiding these clinical decisions.

TABLE OF CONTENTS/OUTLINE

1. Introduction to CESM What is CESM? CESM technique and protocol 2. Indications for CESM High risk screening, diagnostic work up, staging, restaging post neoadjuvant chemotherapy 3. Advantages of CESM 4. Limitations of CESM 5. When CESM can be used for staging over MRI 6. Pictorial depiction of CESM use for assessing response to neoadjuvant chemotherapy CESM initial staging, CESM post neoadjuvant chemotherapy staging and final pathology at excision

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The Art of Diagnosing

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

1. Develop skills of observation and interpretation 2. Describe how artists portray manifestation of pathology breast 3. Transfer the skills learnt from appreciation of artworks to patient care

TABLE OF CONTENTS/OUTLINE

In this review of masterpieces, we will propose hypothetical diagnoses according to the findings observed in the anatomy of the breasts and armpits, with a speculative approach on how the mammographic study of the muses would be observed had they been assisted by today's technology. Combining pictorial art with the mammographic diagnosis of breast pathology can be used as an attractive tool for teaching the specialty.

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Breast Cancer In Patients Under The Age Of Forty: Imaging, Assessment, and Management

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS

Women under the age of 40 constitute 3% of in situ breast cancer, 4% of invasive breast cancer and 2% of breast cancer related deaths. While in women over the age of 40 cancers are mostly detected by mammographic screening, in younger women breast cancers present with clinical symptoms more often than are detected by high-risk screening. The radiologist must have an appropriate level of suspicion while evaluating young women so as not to miss breast cancer. At the end of this educational exhibit the learner will: 1. Know the incidence and types of breast cancers seen in women under age 40, 2. Learn the optimal imaging modalities for evaluating young women with breast cancer, 3. Recognize the imaging appearance of breast cancers seen in young women, and 4. Review the updated protocols for high risk screening in young women.

TABLE OF CONTENTS/OUTLINE

Introduction; Facts and figures of breast cancer in the patient under age 40; Breast cancer profile in the young women; The triple negative breast cancer; Pregnancy associated breast cancer; High-risk screening recommendations for young women; Multimodality breast imaging in women under 20, 20-29, and 30-40 year of age; The clinical management of breast cancer in young women; Reproductive considerations; Conclusion.

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Incidental FDG Uptake in the Breast: A "Hot" Topic

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS

1. 18F-fluorodeoxyglucose (FDG) PET/CT continues to increase in frequency to stage and monitor most types of malignancy. 2. Incidental foci of 18F-fluorodeoxyglucose uptake in the breasts on PET/CT occurs in approximately 0.8-6.3% of cases, with 37.5-88.3% of these representing malignancy. 3. Broad differential diagnosis exists for PET positive findings, including malignancy (primary breast carcinoma, metastasis, and lymphoma) as well as benign entities (fibroadenoma, post-partum lactation, fibrocystic change, papilloma, infection, fat necrosis, gynecomastia, or normal breast tissue). 4. Given relatively high rate of malignancy in patients with incidental FDG-avid breast lesions, diagnostic evaluation and, if appropriate, tissue diagnosis is warranted. More controversial factors to consider include SUVmax, patient age, and lesion size.

TABLE OF CONTENTS/OUTLINE

1. Discuss the incidence, significance, and work-up of incidental breast lesions identified on PET-CT performed for reasons other than known breast malignancy. 2. Develop a differential for these incidental findings incorporating clinical data into the management decision. 3. Understand the limitations of current imaging modalities around management of incidental foci of FDG uptake in the breast.

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The Value of Adding Contrast Enhanced Spectral Mammography to the Diagnostic Breast Imaging Practice: How to Implement a Program and Examples of the Utility of CESM as a Problem Solving Tool

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

1. To discuss role of contrast enhanced mammography in current day breast imaging and scenarios where contrast enhanced mammography can be offered2. To discuss the benefits to patient care seen with the use of contrast enhanced mammography in routine practice3. To identify the steps required to implement a contrast enhanced mammography program

TABLE OF CONTENTS/OUTLINE

1. Background regarding development of contrast enhanced mammography2. Review of image acquisition and physics including radiation dose to patients3. Discussion of indications for contrast enhanced mammography4. Discussion of value of contrast enhanced mammography to improvement in patient care5. Steps to starting a contrast enhanced mammography program, including: a. Equipment/ software requirements b. Personnel training c. Scheduling/protocol development d. Patient safety6. Review of cases to illustrate early examples from our institution and the variety of findings and uses including: a. Mammographically occult cancer b. Multicentric cancer c. Phylloides d. Incidental contralateral breast cancer e. Mastitis f. Benign masses and causes of asymmetry

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What Radiologists Should Know About Artifacts in Breast MRI

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

1. Analyze the types of breast magnetic resonance imaging artifacts 2. Discuss the origin and appearance of the most common artifacts encountered in breast MRI along with possible correcting methods to avoid or reduce them

TABLE OF CONTENTS/OUTLINE

1. Introduction: A wide variety of artifacts can be seen in clinical breast MR imaging. Although the elimination of some artifacts may require a service engineer, the radiologist and MR technologist have the responsibility to recognize MR imaging problems and the way to solve them in daily practice. 2. Techniques in breast MRI. 3. Types of artifacts A)Machine hardware- and software- related artifacts B)Patient-related artifacts 4. Illustration of different types of artifacts. 5. Tips and tricks to avoid them 6. Conclusion

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Out With the Old... Let Go with the New BI-RADS MRI Guide for the Resident

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

1. Describe breast lesions by using proper BI-RADS descriptors. 2. Determine the appropriate BI-RADS category for the lesion of interest. 3. Learn through pictures, diagrams, with interactive cases of normal and abnormal commonly encountered findings in everyday practice.

TABLE OF CONTENTS/OUTLINE

1. Introduction: The ACR BI-RADS structure provides a systematic and efficient method to evaluate MRI findings and facilitate resident and breast imaging fellowship training. Both the ACR and the Society of Breast Imaging recommend that breast imaging education within residency and fellowship training should be designed to require the use of BI-RADS terminology, assessment categories, and management recommendations. Educating radiologists on the use of BI-RADS is an effective way to improve their interpretive skills in MRI breast exams. 2. History of BI-RADS 3. Lexico 4. Description of the variables studied in breast MRI. 5. Interpretation of MRI findings 6. Assessment Categories 7. Self-testing section in multiple choice form at 8. Conclusion: In this educational exibit of the changes and new descriptors in the MRI section of the fifth edition of BI-RADS with pictorial examples, the resident would be able to achieve improved understanding of the MRI BI-RADS lexicon and its appropriate applications.

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False Negative Breast Lesions - What They Can Teach

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

The purpose of this exhibit is: -To present the findings of false negatives exams from our institution in both mammograms and breast MRI. -To discuss the possible causes of mistakes using these cases as examples of a teachable moment and how to learn from them to prevent similar errors in the future. -To briefly discuss the importance of medical audit in a Breast Imaging Center and how to learn from these cases;

TABLE OF CONTENTS/OUTLINE

We will present selected different cases of false negative mammograms and breast MRI from our teaching file, from 2011-2018. Key points and possible causes for these false negative results will be discussed in each case, as well as how to prevent error reoccurrence; The list of cases includes: 1. False negative Mammogram (the lesion was there and was not visible even in retrospect) 2. Mammogram missed lesions (the lesion was there and was not detected but was visible in retrospect) 3. Misinterpreted Mammogram lesions (the lesions was detected, but misinterpreted) 4. False negative MRI (the lesion was there and was not visible even in retrospect) 5. MRI missed lesions (the lesion was there and was not detected but was visible in retrospect) 6. Misinterpreted MRI lesions (the lesions was detected, but misinterpreted)

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Looking Beyond: Extramammary Findings in Breast MRI

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

1. Analyze the clinical relevance of these unexpected findings. 2. Describe the sites and the nature of the extramammary findings in magnetic resonance imaging. 3. Illustrate with examples the findings found, and if there were the methods used for correct characterization.

TABLE OF CONTENTS/OUTLINE

1. Introduction: Breast MRI is typically confined to a small field of view (FOV) and it is mainly focused on the assessment of the mammary gland, pectoralis muscles, skin and axillary lymph nodes. However, other structures are also partially visible, such as the lungs, mediastinum, chest wall, spine, and upper abdomen. Some of these findings can sometimes be clinically significant and could modify the patient's management, requiring more complementary examinations. 2. General description of breast MIR protocol 3. Interpretation of MRI 4. Tips to optimize the handling of the relevant extramammary findings. 5-Conclusion

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Breast Density Issues and Impacts on Mammography Screening

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TEACHING POINTS

Mammographic breast density issues are rapidly becoming a hot topic in the medical community and the media worldwide. It is important for radiologists to understand the context, scientific evidence, and controversies. We will: 1. Review current practice guidelines and new clinical implications improving radiologists' understanding of the relevant subject of breast density. 2. Enable them to respond appropriately to questions from patients, clinicians, and the media.

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Clinical implications of breast density 3. How to assess mammographic breast density 4. Possible supplemental breast cancer screening modality for women with dense breasts 5. How to deal with breast density issues 6. Summary

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The Role of Diffusion Weighted MR Imaging in Breast Lesions

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TEACHING POINTS

• To review the usefulness of Diffusion Weighted Magnetic Resonance Imaging (DW-MRI) in the assesment of breast lesions • To illustrate benign and malignant breast lesions with different techniques: mammography, ecography, and MRI; focusing on the value of Diffusion-WI to discriminate between both types of lesions • To describe potential uses of this technique and its limitations

TABLE OF CONTENTS/OUTLINE

1.- DW-MRI: Technique, concept of Brownian motion, concept of restricted diffusion and ADC value 2.- Imaging findings of breast lesions in mammography, ecography and MRI: • Benign lesions: - Fibroadenoma - Tubular Adenoma - Radial Scar - Intraductal Papilloma - Stromal Fibrosis - Benign Phyllodes Tumour - Fibroadenosis • Malignant lesions: - Ductal invasive carcinoma - Colloid carcinoma - Lobular carcinoma - Ductal invasive carcinoma with fibrosis - We analyze the behaviour of these lesions in DW and ADC maps and how this correlates with its nature (benign vs. malignant) 3.- Potential clinical applications: Evaluation of treatment response and locoregional staging (lymph nodes)

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Common and Uncommon Breast Lesions in Women Under 30: Clinical Presentation, Diagnosis, and Management

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS

1. Women younger than 30 frequently present with symptoms of palpable abnormality, breast pain, or nipple discharge. 2. According to ACR appropriateness criteria, first line imaging should be ultrasound (US), and if biopsy is warranted, US guided needle biopsy. If biopsy reveals malignancy, mammography is warranted for presurgical planning. 3. Young women can present during pregnancy or lactation period. Common findings are galactocele, enlarging fibroepithelial lesions, and less likely malignancy. Appropriate diagnosis of abscess associated with puerperal mastitis is critical in order to appropriately route the patient to drainage. 4. Rare lesions include granular cell tumor, sarcoma, and malignancy. 5. While malignancy is rare, triple-negative breast cancer can mimic a benign lesion. All newly palpable solid lesions should therefore be evaluated with care.

TABLE OF CONTENTS/OUTLINE

I. Review of ACR appropriateness criteria for imaging women <30 II. Approach to solid, benign-appearing lesions: when to biopsy, follow up or do nothing III. Infectious mastitis and abscess IV. Idiopathic granulomatous mastitis: clinical presentation and constellation of pathognomonic findings. V. Breast cancer, and rare neoplasms

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The Medical Student Experience: From Diagnosis to Treatment of Breast Cancer Improving the Medical Student Rotation in the Breast Care Center

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS

1. Improve the medical student mammography rotation experience through interactive targeted learning experiences.2. Focus of the medical student rotation on the patient experience in the breast care center through the diagnosis and treatment process. 3. The medical student follows various patients through a screening mammography, diagnostic mammography, biopsy and surgery.

TABLE OF CONTENTS/OUTLINE

1. Traditional medical student rotation.2. Purposes of improving the medical student rotation.3. Ways to make the experience in women's imaging and the breast care center more interactive.- Structured experiences to distinguish between screening mammography and diagnostic mammography.- Opportunity for Radiology-Pathology correlation.i. Observe ultrasound and stereotactic core biopsy.ii. Observe needle localization for surgical planning.iii. Follow the patient from needle localization to the Operating Room.iv. Review pathology with the pathologistv. Review the pathology and imaging and determine concordance.- Attend breast surgery clinic and discuss surgical and treatment options with the Breast Surgeon.- Attend breast tumor board with the Radiologist, Pathologist, Oncologist and Breast Surgeon to understand the multi-disciplinary approach.

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/ Matthew S. Hartman, MD - 2016 Honored Educator

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Utilization of Molecular Breast Imaging in Women with Breast Foreign Bodies

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS

Molecular breast imaging (MBI) is a promising tool for adjunctive screening to mammography in women with dense breast tissue. However, questions arise regarding its utility in women with foreign bodies, such as silicone/saline implants, silicone/paraffin injections, and pacemakers. The purpose of this educational exhibit is to demonstrate effectiveness of MBI in evaluation of breasts with foreign bodies, including normal imaging features, variations in imagining appearance, as well as advantages and limitation of MBI compared to mammography in this patient population. Knowledge regarding the varied appearance of implants and foreign bodies on MBI is important for interpretation, and familiarity with the appearance of benign and malignant findings will allow radiologists to more confidently and accurately interpret MBI.

TABLE OF CONTENTS/OUTLINE

Review the appearance of breast implants and other foreign bodies on MBI. Explain the varied appearance of foreign bodies on the upper/lower detectors. Illustrate pathologic findings seen in patients with implants and foreign bodies in the breast. Demonstrate the utility of supplemental screening with MBI for patient with silicone injections or implant ruptures.

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Breast Invaders: Atypical Infectious and Parasitic Breast Diseases

All Day Room: NA Digital Education Exhibit

Awards
Magna Cum Laude

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TEACHING POINTS

1. Discuss the common presentations and challenges in diagnosing atypical infectious and parasitic diseases of the breast. 2. Describe the imaging findings of some atypical infectious and parasitosis of the breast, such as paracoccidioidomycosis, filariasis, cutaneous myiasis, cat-scratch disease and tuberculosis of the breast. 3. Describe the epidemiology, histopathological features and peculiarities of each disease. 4. Establish a radiologic histopathologic correlation with the clinical aspects of each infection. 5. Discuss the importance of the multimodality imaging findings in association with histopathological aspects to achieve the essential diagnosis and proper treatment of each pathology.

TABLE OF CONTENTS/OUTLINE

1 - Common clinical presentations and imaging challenges in diagnosing atypical infections and parasitic breast diseases. 2 - Specific imaging findings, epidemiology and histopathological features of: - paracoccidioidomycosis, - filariasis, - cutaneous myiasis, - cat-scratch disease, - tuberculosis of the breast. 4 - Summary and Conclusion.

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Second Look Breast Ultrasound: A Practical Approach

All Day Room: NA Digital Education Exhibit

Participants
Fleur Kilburn-Toppin, MBBChir, MA, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose
Katy Hickman, MBBS, Cambridge , United Kingdom (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The purpose of this exhibit is:To understand indications for second look US after breast MRITo review tips and tricks on techniques for second look US to maximise lesion detectionTo review the management of cases undergoing second look US

TABLE OF CONTENTS/OUTLINE

- When to do second look US -What am I likely to see on second look US-Techniques for second look US(subsections on breast positioning, defining location based on MRI, lesion appearances on US based on MRI, use of anatomical landmarks and clips)-What to do if lesion not found on second look US- Summary of key messages for second look US

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BR148-ED-X

Pathologic Nipple Discharge: Evaluation, Management, and Imaging Findings

All Day Room: NA Digital Education Exhibit

Participants
Alexandra M. Millet, BS,MD, New York, NY (*Presenter*) Nothing to Disclose
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TEACHING POINTS

The purpose of this exhibit is: 1. Identify the common clinical presenting symptoms of pathologic nipple discharge, and contrast this with the presentation of physiologic nipple discharge. 2. Describe the initial imaging approach and clinical management of the different causes of pathologic nipple discharge in patients of varying ages. 3. Illustrate the different pathologic causes for nipple discharge with case examples at mammography, ultrasound, and MRI.

TABLE OF CONTENTS/OUTLINE

I. Clinical symptoms of pathologic discharge versus physiologic discharge II. Causes of pathologic discharge: Benign and malignant III. Approach to imaging patients with pathologic nipple discharge IV. Clinical management of pathologic discharge V. Case examples of imaging findings on mammogram, ultrasound, and MRI in patients with pathologic nipple discharge VI. Summary

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Catch Me If You Know It: Common Image Quality Problems in 2D Versus 3D Mammography

All Day Room: NA Digital Education Exhibit

Participants
Mythri M. Reddy, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Christopher Doyle, MD , Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

1. Identifying image quality issues in 2D and 3D mammography before they necessitate a technical recall. 2. Creating awareness in both technologists and radiologists to adhere to EQUIP-driven criteria and to recognize image quality problems. 3. Case-based demonstration of common image quality problems in 2D versus 3D mammography imaging.

TABLE OF CONTENTS/OUTLINE

With the advent of full-field digital mammography detectors, image quality in mammography has improved tremendously. Technical problems are less severe and less frequent, but are more subtle and difficult to identify. This exhibit will highlight common image quality problems and will compare their appearance in 2D versus 3D mammography. These include, in no particular order, (1) patient motion/insufficient compression, (2) biopsy clips, (3) large calcifications, (4) EMI artifacts, (5) detector pixel artifacts, (6) detector line artifacts, (7) grid artifacts. The overall goal of this exhibit is to help technologists and radiologists recognize these problems while the patient is still in the mammography suite, preventing a technical repeat.

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Architectural Distortion Revisited: Pearls and Pitfalls in the Detection of Architectural Distortion on Mammography and Spectrum of Pathologies

All Day Room: NA Digital Education Exhibit

Participants
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Amer Alaref, MD, Thunder Bay, ON (*Presenter*) Nothing to Disclose
Anatoly Shuster, MD, Thunder Bay, ON (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

1)Architectural distortion (AD) is the third most common mammographic abnormality indicating breast carcinoma (CA) 2)AD is often found on prior mammograms of newly detected cancers. 3)Identification of AD is facilitated by diligent inspection of normal architecture of ductal & lobular units, Coopers ligaments, interspersed islands of fat & distortion of these structures thereof. 4) Fat necrosis, sclerosing adenosis, complex sclerosing lesions, tubular, invasive lobular & ductal CA may present as AD. 5)Central lucency in complex sclerosing lesions, extension to the skin surface in postsurgical scars, curvilinear calcifications in fat necrosis & associated suspicious calcifications in invasive CA help assessment.

TABLE OF CONTENTS/OUTLINE

Familiarity with patterns of normal parenchymal architecture on screening mammography enables detection of AD when present. Examples of invasive ductal, lobular and tubular CA, radial scars, complex sclerosing lesions, fat necrosis & sclerosing adenosis among others, presenting as AD will be provided, with an emphasis on missed cancers. Comparing with serial prior mammograms, attention to previous negative biopsies and challenges encountered in dense breasts will be discussed. A systemic approach enabling detection of AD, and minimizing the probability of missed cancers in routine radiology practice will be provided.

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Treatment of Breast Fibroadenoma with High Intensity Focused Ultrasound (HIFU)

All Day Room: NA Digital Education Exhibit

Participants
Alana A. Lewin, MD, New York, NY (*Presenter*) Nothing to Disclose
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TEACHING POINTS

1. Describe the theory of high-intensity focused ultrasound (HIFU).2. Discuss the use of HIFU in treating patients with a symptomatic fibroadenoma (FA) using Echopulse® (Theraclion, Paris, France).3. Demonstrate the clinical and imaging outcomes of patients with a FA treated with HIFU.

TABLE OF CONTENTS/OUTLINE

1. Theory of HIFU and mechanism of action2. Use of HIFU for treating breast fibroadenoma3. Clinical and imaging outcomes of patients with a fibroadenoma treated with HIFU

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The Wire and Beyond: A Review of Recent Advances in Breast Imaging Pre-Operative Needle Localization Technology

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Megha Madhukar Kapoor, MD, Houston, TX (*Presenter*) Nothing to Disclose
Miral Patel, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Marion E. Scoggins, MD, Houston, TX (*Abstract Co-Author*) Institutional Research Grant, General Electric Company

TEACHING POINTS

Review pre-operative breast localization and available methods for localization. Illustrate how potential complications of wire localization such as wire migration can be avoided by using non-wire localization techniques. Discuss major advantages of the non-wire localization techniques (device can be placed 5-30 days before surgery thus avoiding potential delays in operating room start times, less nontarget (healthy) tissue is removed and the approach to localization does not affect surgical approach). Compare and contrast the different localization techniques

TABLE OF CONTENTS/OUTLINE

A. Overview of pre-operative localization as an aid to surgical excision B. Wire Localization (advantages and disadvantages) i. Case examples of wire migrated into chest wall, implant rupture, retained wire fragment C. Non-Wire Localization Techniques (advantages and disadvantages) i. I-125 Radioactive Seed, Case example with lost seed ii. Infrared SAVI SCOUT Radar, Case example iii. Magnetic Seed, Case example iv. Radiofrequency Identification, Case example D. Summary table comparing different Localization techniques

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Inflammatory Breast Cancer: A Multimodality Approach

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TEACHING POINTS

1. To review the pathophysiology of inflammatory breast cancer(IBC) and the major differential diagnoses.2. To describe the role of imaging not only in diagnosis but also in staging, planning treatment and follow-up.3. To gain an awareness of the importance of multidisciplinary approach in IBC to designing the best treatment.

TABLE OF CONTENTS/OUTLINE

IBC is an aggressive form of locally advanced breast cancer involving more than a third of the skin of the breast. It is a rare breast cancer with a highly virulent course and low 5-year survival rate. The "inflammatory" skin changes are due to lymphedema caused by tumor emboli within the dermal lymphatics.The symptoms arise rapidly compared to non IBC, typically less than 3 months. Patients present with enlarged,warm, and tender breast as mastitis. Both tissue diagnosis of malignancy and clinical evidence of infammatory disease are required to confirm the diagnosis. Proper diagnosis and staging of IBC is critical to treatment planning and requires a multidisciplinary approach that includes imaging. We describes the typical imaging features of IBC at mammography, ultrasound, MRI and PET/CT. Radiolologists play an integral role as part of the multidisciplinary team caring for patients with IBC and will play a mayor role in the future with "Radiogenomics" and minimally invasive therapeutic procedures.

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Metastasis to the Breast: Where Do They Come From?

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TEACHING POINTS

- Techniques to differentiate extra-mammary metastasis from primary breast lesions. - Imaging features of the main tumors that metastasize to the breast. - Case studies. - Explain the findings and offer advice on work-up.

TABLE OF CONTENTS/OUTLINE

- Define the types of intra-mammary and extra-mammary metastasis. - Patient workup (clinical history, diagnostic methods and biopsy to confirm). - Imaging appearance by modality and histological findings as well as potential pitfalls. - Learning which are the major tumors that metastasize to the breast and the patterns of dissemination. - Describe the management and prognosis of patients who present with this diagnosis.

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Contrast Enhanced Spectral Mammography (CESM) - Principle, Protocol, Interpretation, and Challenge

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS

Contrast-enhanced spectral mammography(CESM) is known to have high sensitivity for detecting breast cancers and it has the potential to become an essential modality for assessing breast lesions, using CT contrast to detect breast cancer by providing morphologic and functional information detecting abnormal anatomic structures. In a multi-center study, we have done more than 400 cases of tissue diagnosis proven breast cancer. The focus of this presentation is to discuss CESM mechanism, value added in breast cancer screening, staging, and treatment monitoring. The illustration cases focus on the morphology and the enhancement characteristics of both malignant and benign lesions on CESM.

TABLE OF CONTENTS/OUTLINE

1. To introduce the principle of CESM, contrast protocol. abnormal enhancing characteristics 2. To illustrate cases where CESM aided in appropriate BIRADS assessment and management of equivocal mammographic lesions 3.To show diagnostic performance of contrast-enhanced spectral mammography for suspicious malignant microcalcifications (BI-RADS 4) 4. To discuss strategies for appropriate utilization of CESM in challenging, equivocal, or complicated mammographic abnormalities.

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Breast Cancer MRI Staging: An Easy to Follow Algorithm

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

Breast magnetic resonance imaging (MRI) is the most accurate imaging modality in local staging of breast cancer. Allows radiologist to describe precisely the T (tumor) and N (nodes) descriptors of the TNM staging. In addition to evaluating the extent of disease in the ipsilateral breast, MRI could distinguish synchronous cancers in the contralateral breast that were otherwise mammographically and clinically occult. Radiologist must be familiar with the BI-RADS® and TNM classifications to refer satisfactory information for the clinicians.

TABLE OF CONTENTS/OUTLINE

The essential findings in breast MRI, following the guidelines of BI-RADS® classification, firstly include parameters that document breast characterization, then parameters that describe the tumor and finally, other descriptors that assess the extent of disease such as associated features like skin or pectoralis invasion or the presence of pathologic lymph nodes. We introduce a case based algorithm, based on BI-RADS® classification and according to TNM staging category, that may facilitate the interpretation of findings, an adequate staging and the report to a multidisciplinary unit.

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MRI BI-RADS 3: When It Is and When It Is Not

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

To review MRI candidates of probably benign (BI-RADS 3) lesions To illustrate challenging clinical situations affecting assessment and management To present a pictorial review of BI-RADS 3 lesions, and situations of reclassificate benign or suspect, with teaching points

TABLE OF CONTENTS/OUTLINE

Background - definition - pillars lesion were correctly assessed as probably benign oncological safety of follow-up Which lesions can be classified as B3? focus mass enhancement non-mass enhancement Patient follow-up protocol B3. Lesions that can not be classified as B3. Situations to change B2 or B4. Importance of clinical context and complete imaging workup before BIRADS 3 classification

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Male Breast: The Good, the Bad, and the Ugly

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

Normal anatomy of male breast Review imaging features of gynecomastia and its differentiation from breast cancer. Recognize and illustrate radiologic and pathologic features of benign and malignant male breast diseases, and how they differs from its female counterpart Discuss the epidemiology, work-up and treatment of male breast cancer Discuss which breast diseases can affect transgender women

TABLE OF CONTENTS/OUTLINE

Review the anatomy and histology of the male x female breast, to understand the differential diagnosis of male breast diseases. Review the different radiographic features of gynecomastia, the most common disease affecting the male breast. Illustrate benign and malign diseases with pathologic correlation. Review the most prevalent breast tumors in men and their main imaging features What to do with high risk patients. Breast diseases in transgender women: what are the differences and how to follow up these patients

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MRI vs Pathology: Evaluation of Pathologic Complete Response of Breast Cancer Subtypes After Neoadjuvant Chemotherapy - Can We Avoid Breast Surgery in the Era of Personalized Medicine?

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS

Describe the molecular subtypes and review their different biology , clinical features , prognosis and treatment outcomes Describe the utility of MRI sequences (Dynamic and Diffussion Weighted Imaging) in staging, in evaluation of response to neoadyuvant chemotherapy , and in determining pathologic complete response of breast cancer. Define the accuracy of MRI in determining pathologic complete response in breast cancer subtypes . Relate a comparative approach of Radiological and Pathologic Response Criteria Discuss the role of breast MRI in the plannig of surgery and of the therapeutic protocols , with respect to the quantification of residual disease Review cases of degree of response after neoadyuvant chemotherapy in the breast cancer subtypes

TABLE OF CONTENTS/OUTLINE

Classification of Molecular Subtypes of breast cancer and evaluation the main differences . Imaging features Utility of pre-operative MRI in staging and in evaluation of response to chemotherapy Correlation between Radiological response criteria (RECIST) and Pathologic response criteria (Miller-Payne) Role of breast MRI in treatment decisions Ilustrative cases

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Beyond Ducts and Lobules: Imaging of Non-Epithelial Tumors of the Breast

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

- Radiation-induced angiosarcoma is a rare but severe lesion. The diagnosis relies on clinical- radiological correlation and skin biopsy of every cutaneous lesion appearing within the field of radiation therapy - Lipoma is the most frequent non-epithelial tumor of the breast. The diagnosis is made by imaging, yet a lipoma increasing in size requires biopsy to differentiate it from a well-differenciated liposarcoma - Breast fibromatosis appears as a spiculated fibrous chest wall mass. It requires specialized care given the high risk of local recurence after surgery - Diagnosis of hemopathies and metastases of the breast relies on clinical context and the imaging appearance of well-defined multiple breast masses located in both fibroglandular and subcutaneous tissue - Benign phyllods are fibro-epithelial tumors with imaging features similar to those of fibroadenoma, except for an increase in size, requiring pathology examination

TABLE OF CONTENTS/OUTLINE

Part 1. Masses mimicking ductal carcinoma : benign (granular cell tumor, hemangioma, lymphocytic mastitis) and malignant (sarcomas with focus on angiosarcoma, hemopathies, metastases) Part 2. Masses mimicking a fibroadenoma (phylloid, 'omas') Part 3. Fat-containing masses Part 4. Chest wall masses Partie 5. Cutaneous lesions

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Palpable Lesions of Breast: What the Radiologist Should Know

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS

The perception of a palpable lesion is the second main complaint that leads the patient to the specialist. A palpable lesion commonly terrifies most patients, and although the majority are related to benign causes, this is the most common symptom reported by breast cancer patients. Anamnesis, physical examination and imaging tests should work together to correctly identify which patients can be reassured and which ones need to persist the diagnostic investigation because it is a suspected lesion. Data from the history and physical examination of the patients, as well as their age, dictate the choice of the best diagnostic tool, whether mammography, ultrasound, MRI or tomosynthesis. Algorithms: To discuss current imaging guidelines for palpable breast abnormalities through a series of cases

TABLE OF CONTENTS/OUTLINE

Review the appropriate criteria to select the initial imaging method for a palpable lesion, according to age and clinical information, including a section of palpable circumscribed masses in women <40y. When the biopsy is imperative? To present illustrative cases of palpable malignant and benign lesions in the different imaging methods correlating with the pathology. To present algorithms based on the most common palpable lesions. Illustrate a particular section: lactating women and pregnant.

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Breast Implants: A Pictorial Review of Implant Complications

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Participants
Sumin L. Kong, MD, Winston-Salem, NC (*Presenter*) Nothing to Disclose
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TEACHING POINTS

-Review types and locations of breast implants-Discuss normal multimodality imaging appearance of breast implants-Discuss multimodality features of implant complications-Learn imaging optimization for implant complications and detection of breast cancer

TABLE OF CONTENTS/OUTLINE

-Types of breast implants -Saline, gel, cohesive gel silicone (gummy bear) -Single, double-lumen-Location of breast implants -Retroglandular -Retropectoral-Normal multimodality (MR, MG, US) imaging appearance of breast implants-Multimodality imaging (MR, MG, US, CT) features of implant complications -Early complications -Infection -Hematoma -Late complications -Implant rupture; intracapsular vs extracapsular -Implant herniation -Gel bleed -Capsular contracture -Granuloma formation-Discuss imaging techniques for implant complications-Breast Cancer Detection with Implants -Imaging optimization -Techniques for biopsy

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Ready for BI-RADS Mammography Assessment Categories? Take a Quiz!

All Day Room: NA Digital Education Exhibit

Participants
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Christian A. Zamora, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
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Jonathan Salazar Segovia, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Rosaura E. Fuentes Corona, MD, Mexico, Mexico (*Abstract Co-Author*) Nothing to Disclose
Jorge Vazquez-Lamadrid, MD, Mexico, Mexico (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Learn through pictures and cases the most proper BI-RADS mammography category for the lesion of interest2. Provide simple diagrams of the different lesions in relation to its corresponding category to help the residents to get into this lexicon3. Become familiar with the relevant points of ACR BI-RADS mammography and hopefully more experienced at time of diagnosis

TABLE OF CONTENTS/OUTLINE

- Introduction- Illustrative cases exposure - Analysis of conflictive categories- BI-RADS mammography categories assessment resume- Summary

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

BR164-ED-X

Pseudoangiomatous Stromal Hyperplasia of the Breast: What the Pathology May Explain from Different Imaging Findings

All Day Room: NA Digital Education Exhibit

Participants
Carolina D. Rossi, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Daniela G. Giannotti, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Katia Pincerato, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Patricia A. Teixeira, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Rafaela C. Bastreghi, MD, Sao Paulo , Brazil (*Abstract Co-Author*) Nothing to Disclose
Vivian N. Omura, MD, SAO PAULO, Brazil (*Abstract Co-Author*) Nothing to Disclose
Ligia A. Yamashita, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Vera Christina C. Ferreira, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Larissa Moyses, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Su J. Hsieh, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Marco A. Costenaro, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Carla B. Dequi, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Marcos F. Docema, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Giovanni G. Cerri, MD,PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

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TEACHING POINTS

The purpose of this exhibit is: 1. To analyze the imaging findings of PASH at Ultrasound, Mammography and MRI. 2. To identify the interface of PASH lesions with surrounding breast tissue at histological sections, and to correlate the relation of this limit with the imaging findings. 3. To classify the histological type of PASH as to the predominance of cellularity: hypercellular or hypocellular (collagenized) and the relation with MRI enhancement. 4. To evaluate the number of fragments obtained and if the biopsy performed includes the periphery of the lesion, where there is representation of the interface with the surrounding tissue.

TABLE OF CONTENTS/OUTLINE

Imaging aspects of PASH: - Mammography. - Ultrasound. - MRI. Pathological features of PASH: - Correlation with histological and imaging margins. - Interface with the surrounding breast tissue. - Correlation with cellularity and MRI enhancement. - Type of biopsy and number of fragments obteined.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

BR169-ED-X

Comparison of DCIS and Invasive Ductal Carcinoma on Digital 2D versus Synthesized 2D Mammography

All Day Room: NA Digital Education Exhibit

Participants
Shreena Shah, MD, New York, NY (*Presenter*) Nothing to Disclose
Katerina Dodelzon, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Janine T. Katzen, MD, New York, NY (*Abstract Co-Author*) Travel support, Seno Medical Instruments, Inc

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shb9167@nyp.org

TEACHING POINTS

- Recently, the implementation of synthesized 2D (s2D) mammography has been evaluated as a potential replacement for conventional 2D digital mammography in an effort to reduce patient radiation - Recognize the limitations in using s2D imaging due to its inferior spatial resolution - Illustrate differences in imaging appearance of ductal carcinoma in situ (DCIS) presenting as microcalcifications in s2D and DM (digital mammography) with digital breast tomosynthesis (DBT) - Demonstrate differences in appearance of invasive cancer on s2D and DM - Highlight important similarities and differences in imaging features of DCIS and invasive cancer in an effort to make readers aware of the advantages and potential limitations of s2D imaging

TABLE OF CONTENTS/OUTLINE

- Summary of the recently published literature that has compared outcomes of screening with S2D/DBT vs DM/DBT - Case-based pictorial essay of several (10-15) cases of DCIS and invasive carcinoma from our institution demonstrating imaging characteristics seen on screening DM and s2D - Highlight imaging features of biopsy-proven carcinoma of varying size, distribution, and morphology at the time of screening examination - Self-assessment with sample cases for readers to compare and contrast these features on both types of imaging

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

ED001-SU

Breast Sunday Case of the Day

Sunday, Nov. 25 7:00AM - 11:59PM Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Jessica H. Porembka, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Amy M. Fowler, MD, PhD, Madison, WI (*Abstract Co-Author*) Research support, General Electric Company
Susan O. Holley, MD, PhD, Raleigh, NC (*Abstract Co-Author*) Nothing to Disclose
Alexander B. Sevrukov, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Chandni Bhimani, DO, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Catherine A. Young, MD, JD, Saint Louis, MO (*Abstract Co-Author*) Research support, Hologic, Inc
Cheryl R. Herman, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Michelle V. Lee, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Mai A. Elezaby, MD, Madison, WI (*Abstract Co-Author*) Research Grant, Exact Sciences Corporation
Lonie R. Salkowski, MD,PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Roberta M. Strigel, MD, Madison, WI (*Abstract Co-Author*) Research support, General Electric Company
Ryan W. Woods, MD, MPH, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Urvi A. Tailor, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Lindsay Compton, MD, Dallas, TX (*Abstract Co-Author*) Researcher, QT Ultrasound, LLC
Ramapriya Ganti, MD, Dallas, TX (*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.

VW23

Automated Breast Volume Scanner (ABVS) Physician Training Workshop: An Interactive Learning Experience: Siemens Healthineers Vendor Workshop

Sunday, Nov. 25 10:15AM - 11:25AM Room: Booth 5530

Participants

Terri A. Gizienski, MD, Greenwood Village, CO (*Presenter*) Nothing to Disclose

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 unique coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

VW21

Wide-angle Digital Breast Tomosynthesis and Contrast Enhanced Mammography Self-guided Reading Sessions: Siemens Healthineers Vendor Workshop

Sunday, Nov. 25 10:30AM - 5:00PM Room: Booth 5530

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 and contrast enhanced mammography cases presented as problem cases with a solution enables you to develop and test your reading skills.

VW22

Automated Breast Volume Scanner (ABVS) Self-guided Reading Sessions: Siemens Healthineers Vendor Workshop

Sunday, Nov. 25 10:30AM - 5:00PM Room: Booth 5530

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.

VW51

Tomosynthesis Guided Prone Breast Biopsy Solutions: Hologic Vendor Workshop

Sunday, Nov. 25 10:30AM - 11:30AM Room: Booth 5524

Participants

Daniel E. Lehrer, MD, CABA, Argentina (*Presenter*) Speaker, Hologic, Inc; Institutional research agreement, Siemens AG

Program Information

Clinical benefits of tomosynthesis guided biopsy which includes a hands-on demonstration of the Affirm® Prone Biopsy System and the Brevera® Breast Biopsy System (Affirm® Prone Biopsy System and Brevera® Breast Biopsy System)

Registration

https://hologicrsna.com

SSA01

Breast Imaging (Update on Screening)

Sunday, Nov. 25 10:45AM - 12:15PM Room: E450A

BR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Catherine S. Giess, MD, Wellesley, MA (*Moderator*) Nothing to Disclose
Debra L. Monticciolo, MD, Temple, TX (*Moderator*) Nothing to Disclose

Sub-Events

SSA01-01 Interval Cancers in a Large Prospective Breast Tomosynthesis Screening Trial

Sunday, Nov. 25 10:45AM - 10:55AM Room: E450A

Participants
Kristin Johnson, MD, Lund, Sweden (*Presenter*) Nothing to Disclose
Kristina Lang, MD,PhD, Malmo, Sweden (*Abstract Co-Author*) Travel support, Siemens AG Speaker, Siemens AG
Debra M. Ikeda, MD, Stanford, CA (*Abstract Co-Author*) Scientific Advisory Board, Grail, Inc; Reviewer, Siemens AG
Hanna Sartor, MD,PhD, Malmo, Sweden (*Abstract Co-Author*) Travel support, Siemens AG Speaker, Siemens AG
Ingvar T. Andersson, MD, PhD, Malmo, Sweden (*Abstract Co-Author*) Nothing to Disclose
Sophia Zackrisson, Malmo, Sweden (*Abstract Co-Author*) Speaker, AstraZeneca PLC ; Speaker, Siemens AG; Travel support, AstraZeneca PLC; Travel support, Siemens AG

For information about this presentation, contact:

kristin.johnson@med.lu.se

PURPOSE

To assess interval cancer rate in a large, prospective digital breast tomosynthesis (DBT) screening trial in comparison with a concurrent screening population and to assess tumor characteristics of interval cancers in DBT-screening.

METHOD AND MATERIALS

The prospective ****Trial, comparing digital breast tomosynthesis (DBT) with digital mammography (DM) in 14,848 women has shown a significantly increased sensitivity with DBT. Interval cancer rate in the trial was compared with a concurrent screening population; i.e. women participating in DM screening at the same screening site during the same time period (2010-15, n=100,273 screens). Interval cancers and concurrent screens were identified through linkage with the Radiology Information System, the **Cancer Registry and the National Quality Register Breast Cancer. Confidence intervals (CI) 95 % were calculated for rates and difference between rates. Tumor characteristics were retrieved from pathology reports and invasive cancers classified according to St Gallen subtypes.

RESULTS

In total, there were 22 interval cancers in the ****Trial. The interval cancer rate was 1.5 per 1000 screens [22/14,848] (95% CI 0.9-2.2) in the ****Trial and 1.8 per 1000 screens [179/100,273] (95% CI 1.5-2.1) in the concurrent population. Although the interval cancer rate was lower in the trial, the difference of 0.3 was not statistically significant (95 % CI -0.5-0.9). Among the interval cancers in the ****Trial, the mean cancer size was 17 mm (range 2-37 mm), 2 were DCIS (grade 2 and 3), 5 luminal A-like, 9 luminal B-like HER2-, 2 luminal B-like HER2+ and 4 triple negative.

CONCLUSION

The slightly lower interval cancer rate in the trial might indicate that DBT-screening leads to the detection of clinically relevant cancers. Still, a relatively large proportion of the interval cancers had unfavorable prognostic characteristics.

CLINICAL RELEVANCE/APPLICATION

Analysis of interval cancers is important in order to elucidate the future value of DBT in screening.

SSA01-02 Does Tomosynthesis Work For Everyone?

Sunday, Nov. 25 10:55AM - 11:05AM Room: E450A

Participants
Ethan O. Cohen, MD, Houston, TX (*Presenter*) Spouse, Consultant, Medtronic plc; Spouse, Consultant, Novo Nordisk AS; Spouse, Consultant, Eli Lilly and Company; Spouse, Consultant, AstraZeneca PLC
Rachel E. Perry, MD, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose
Ashmitha Srinivasan, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Hilda H. Tso, DO, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Kanchan Phalak, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Michele D. Lesslie, DO, Bellaire, TX (*Abstract Co-Author*) Nothing to Disclose

Karen E. Gerlach, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Jessica W. Leung, MD, Houston, TX (*Abstract Co-Author*) Scientific Advisory Board, Hologic, Inc; Speakers Bureau, Hologic, Inc; Speakers Bureau, FUJIFILM Holdings Corporation

For information about this presentation, contact:

ecohen@mdanderson.org

PURPOSE

To compare the performance of full-field digital screening mammograms (FFDM) with and without digital breast tomosynthesis (DBT) in women with and without breast implants.

METHOD AND MATERIALS

An IRB-approved, HIPAA-compliant retrospective review was performed of 103,070 consecutive screening mammograms obtained from February 2011 through June 2014. Recall rates (RRs), cancer detection rates (CDRs), and positive predictive values for recall (PPV1s) were analyzed.

RESULTS

The following data compare FFDM and FFDM-DBT: 67,331 FFDM and 28,835 FFDM-DBT from women *without* implants yielded RRs of 8.0% and 6.3%, respectively (p<0.00001); CDRs of 4.1 and 5.0 per 1000 exams, respectively (p=0.07); and PPV1s of 5.1% and 8.0%, respectively (p<0.0001). 4325 FFDM and 2579 FFDM-DBT from women *with* implants yielded RRs of 5.2% and 4.1%, respectively (p=0.040); CDRs of 1.8 and 2.7 per 1000 exams, respectively (p=0.46); and PPV1s of 3.6% and 6.7%, respectively (p=0.25). The same data is also used to evaluate the effect of implants on screening: 67,331 FFDM *without* implants and 4325 FFDM *with* implants yielded RRs of 8.0% and 5.2%, respectively (p<0.00001); CDRs of 4.1 and 1.8 per 1000 exams, respectively (p<0.00001); and PPV1s of 5.1% and 3.6%, respectively (p=0.30). 28,835 FFDM-DBT *without* implants and 2579 FFDM-DBT *with* implants yielded RRs of 6.3 and 4.1, respectively (p<0.00001); CDRs of 5.0 and 2.7, respectively (p=0.11); and PPV1s of 8.0 and 6.7, respectively (p=0.63).

CONCLUSION

Tomosynthesis improves the performance of digital screening mammography, while the presence of implants reduces its performance. Specifically, tomosynthesis improved RRs, CDRs, and PPV1s for all women (*with* and *without* implants), though statistically significant differences were seen only for RRs in women *without* implants, RRs in women *with* implants, and PPV1s for women *without* implants. Implants were associated with decreased RRs, worse CDRs, and worse PPV1s for all screening exams (FFDM and FFDM-DBT), but statistically significant differences were seen only for RRs for all screening exams and CDR for FFDM. Further study with larger populations is warranted.

CLINICAL RELEVANCE/APPLICATION

The benefit of tomosynthesis has been incompletely studied in screening mammography patients with implants. This research suggests that tomosynthesis is useful for screening women *with* implants in addition to those *without* implants.

SSA01-03 Disparities in Screening Mammography Cost-Sharing and Utilization Before and After the Affordable Care Act (ACA) and the Revised USPSTF Guidelines

Sunday, Nov. 25 11:05AM - 11:15AM Room: E450A

Awards
Trainee Research Prize - Resident

Participants
Soudabeh Fazeli Dehkordy, MD, MPH, San Diego, CA (*Presenter*) Nothing to Disclose
A. Mark Fendrick, MD, Ann Arbor, MI (*Abstract Co-Author*) Consultant, Abbott Laboratories; Consultant, AstraZeneca PLC; Consultant, sanofi-aventis Group; Consultant, F. Hoffmann-La Roche Ltd; Consultant, GlaxoSmithKline plc; Consultant, Merck & Co, Inc; Consultant, Neocure Group LLC; Consultant, Pfizer Inc; Consultant, POZEN Inc; Consultant, Precision Health Economics LLC; Consultant, The TriZetto Group, Inc; Consultant, Zanzors; Speakers Bureau, Merck & Co, Inc; Speakers Bureau, Pfizer Inc; Researcher, Abbott Laboratories; Researcher, AstraZeneca PLC; Researcher, sanofi-aventis Group; Researcher, Eli Lilly and Company; Researcher, F. Hoffmann-La Roche Ltd; Researcher, GlaxoSmithKline plc; Researcher, Merck & Co, Inc; Researcher, Novartis AG ; Researcher, Pfizer Inc
Sarah Bell, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Emily Kobernik, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Vanessa Dalton, MD, Ann Arbor, MI (*Abstract Co-Author*) Expert Witness, Bayer AG
Ruth C. Carlos, MD, MS, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

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PURPOSE

To assess changes in screening mammography cost-sharing and utilization before and after the Affordable Care Act (ACA) and the revised USPSTF guidelines by race and income level.

METHOD AND MATERIALS

We used patient-level analytic files between 2004 and 2014 from Optum™ Clinformatics™ Data Mart. We included women 40-74 years 1) without a history of breast cancer or mastectomy with 2) at least one year of continuous enrollment in a given plan, examining out-of-pocket payments and utilization for screening mammography. Trends for screening mammography utilization and cost sharing elimination over time by race and income level were visually inspected. We then specifically calculated the slopes and compared trends before and after 2009 and 2010 to assess the impact of ACA implementation and USPSTF guideline revisions on screening mammography cost sharing elimination and utilization.

RESULTS

We identified an average of 2,173,686 commercially insured women ages 40-74 years with at least 12 months of continuous enrollment in a given plan per year. Overall, an upward trend was seen in the proportion of women with zero cost sharing over time among all races and income level. Comparing trends for cost-sharing elimination before and after 2010, a statistically significant upward but small trend was found among all races and income levels with no racial or income disparities evident. Screening mammography utilization plateaued or showed a significant decline after 2009 in all income and racial groups except for African Americans in whom screening rates continued to increase after 2009.

CONCLUSION

Impact of ACA cost-sharing elimination did not differ among various racial and income groups. Among our population of employer-based insured women, the racial gap in screening mammography appeared to have closed and potentially reversed among African American women.

CLINICAL RELEVANCE/APPLICATION

It is important to continue monitoring screening mammography utilization as health care policies and guidelines change, as these changes may affect disparities in screening between different racial and income groups.

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/ Ruth C. Carlos, MD, MS - 2015 Honored EducatorRuth C. Carlos, MD, MS - 2018 Honored Educator

SSA01-04 Screening Mammography: There is Value in Screening Women Aged 75 and Over

Sunday, Nov. 25 11:15AM - 11:25AM Room: E450A

Participants
Stamatia V. Destounis, MD, Scottsville, NY (*Presenter*) Research Grant, Hologic, Inc; Research Grant, Delphinus Medical Technologies, Inc
Andrea L. Arieno, BS, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Amanda Santacroce, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

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PURPOSE

To review outcomes of screening mammography performed in women 75 and over to determine the rate of cancer diagnosed and associated histology and surgical excision performed.

METHOD AND MATERIALS

Patients 75 years of age and over who presented for screening mammography and underwent biopsy with resultant malignant pathology were retrospectively collected and analyzed to record patient demographics, lesion information, pathology results and treatment. Cases of non-breast malignancy, cases of breast cancer diagnosed by modality other than mammography, and cases with missing or incomplete records were excluded.

RESULTS

From 2007-2016 there were a total of 679,168 screening appointments, with 3,480 patients diagnosed with screen-detected cancers (5.1/1000). 68,218 (10%) screenings were performed in women aged 75 and over; 530 of these women were diagnosed with 560 breast cancers, for a cancer detection rate of 7.8/1000. Average patient age 80.3 (range 75-98). Lesions most frequently presented as a mass (74%). A large majority (81%) of the malignancies diagnosed were invasive; 55.7% grade 2 or 3. Positive lymph nodes were reported at surgical excision in 7.0% of patients. Tumor stage was largely stage 0 or 1 (64%); 12% were determined to be stage II or III. 98% of cancers were surgically excised; twelve cancers were not due to advanced patient age or overall degraded patient health.

CONCLUSION

For the relatively small percentage of our screening population that women 75 and over comprise (10%), the patients diagnosed in this population made up 16% of all patients diagnosed with screen-detected cancers, a substantial cancer detection rate (7.8/1000). Most of the cancers diagnosed were low grade, a significant number were invasive (81%), over half were grade 2 or 3, and a majority were lower stage (0 or I). Most (98%) underwent surgical excision, suggesting that most women 75 and over are in good health and want to pursue surgical excision. Screening mammography should be performed in this age group given the incidence of breast cancer that exists.

CLINICAL RELEVANCE/APPLICATION

Ongoing debate exists regarding the age to cease screening mammography, citing lack of research in the aging population. Our study demonstrates the value of screening women 75 and over.

SSA01-05 Risk of Breast Cancer After a False-Positive Screening Mammogram in Relation to Mammographic Abnormality: Potential for Prevention?

Sunday, Nov. 25 11:25AM - 11:35AM Room: E450A

Participants
Rasika Rajapakshe, PhD, Kelowna, BC (*Presenter*) Nothing to Disclose
Miao Hui, PhD, Singapore, Singapore (*Abstract Co-Author*) Nothing to Disclose
Brenda A. Farnquist, MD, Chestnut Hill, MA (*Abstract Co-Author*) Nothing to Disclose
Janette Sam, RT, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Mikael Hartman, MD,PhD, Singapore, Singapore (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

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PURPOSE

False positive recall rates have consistently been identified as a harm of organized breast cancer screening. The extent to which these recalled women are at increased risk of future breast cancer remains unclear.

METHOD AND MATERIALS

All women who had two or more screening mammograms between 1988-2013 in a large organized breast screening program were included in the study. They were followed until a breast cancer diagnosis, last screen date +5 years, or end of follow-up on Dec 31, 2013, whichever came first. The relative risk (RR) of breast cancer for women with a false-positive test compared with women with negative tests was estimated with Poisson regression, adjusted for age, and five calendar periods.

RESULTS

A total of 772,289 women with 4.82 million screening mammograms and a median follow up of 11.8 years were included. There were 238,860 women with false positive findings and 26,950 cancers of which 16,084 screen detected and 10,866 non screen detected. The adjusted RR [Value (95% CI)] of breast cancer after the first false-positive test was 1.73(1.68-1.77) for all, 1.65(1.61-1.70) for invasive, and 2.13(2.01-2.27) for in situ cancers respectively. The RR remained increased beyond 8 years after the first false-positive test. Of the 5157 screen detected cancers after the first false positive test, 3358 (65%) were on the ipsilateral breast while 1799 (35%) were on the contralateral breast. Women with breast density >50% at the time of false positive test had a twofold risk of breast cancer; RR 2.07(1.99-2.14) while those with breast density <50% had a RR of 1.58(1.54-1.63). When stratified for mammographic features found on the first false positive mammogram, architectural distortion plus mass had the highest RR 4.68(3.16-6.93) for invasive cancers while calcifications alone and calcifications plus asymmetry had highest RR 5.57(4.88-6.36) and 4.07(2.49-6.66) for in situ cancers. These findings would require further validation.

CONCLUSION

False positive mammogram correlates with an increased risk of developing breast cancer. Screen detected breast cancers post false positive mammogram most likely to occur in the ipsilateral breast.

CLINICAL RELEVANCE/APPLICATION

Mammographic features at the time of recall predict the risk of subsequent cancer and may warrant increased surveillance and/or chemo-prevention.

SSA01-06 Stratification of Ductal Carcinoma in Situ in a Screening Population by Age and Grade Over a 16-Year Period

Sunday, Nov. 25 11:35AM - 11:45AM Room: E450A

Participants
Angela Sie, MD, Long Beach, CA (*Presenter*) Nothing to Disclose
Gretchen M. Stipec, MD, Manhattan Bch, CA (*Abstract Co-Author*) Nothing to Disclose
Maya S. Hsieh, MD, Long Beach, CA (*Abstract Co-Author*) Nothing to Disclose
Ryan Kobayashi, Long Beach, CA (*Abstract Co-Author*) Nothing to Disclose
Tiesha Jones, Long Beach, CA (*Abstract Co-Author*) Nothing to Disclose
Stephen A. Feig, MD, Orange, CA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

asie@memorialcare.org

PURPOSE

To determine if there is a correlation between age and grade of screening-detected ductal carcinoma in situ (DCIS).

METHOD AND MATERIALS

We performed an IRB approved, retrospective review of screening-detected cases of DCIS at our large, community-based breast center, diagnosed between 2001 and 2016. All cases of DCIS diagnosed from 2001 through 2016 were collated. Odds ratios were produced from logistic regression analyses.

RESULTS

DCIS accounted for 20.9% (372/1781) of all cancers detected in our screening practice between 2001 and 2016.The total number of cases in our study was 372, with a mean age of 60.6 years, median age of 60.0 years, mean size of 2.1 cm, median size of 1.8 cm. Age distribution showed 31.7% (118/372) were <55 years old, and 68.3% (254/372) were >= 55 years old. The tumor grade was identified in 366 (98.4%) of the cases and included 6.8% (25/366) low grade, 46.4% (170/366) intermediate grade, and 46.7% (171/366) high grade. Mammographic findings were 80.9 % (301/372) calcifications and 16.9% (63/372) mass or focal asymmetry. Estrogen receptor (ER)/Progesterone receptor (PR) status was identified in 240 (64.5%) cases and included 81.3% (195/240) ER + and 72.9% (175/240) PR+ cases. Logistic regression analysis revealed that for each unit decrease in age, the odds ratio of intermediate versus low grade was 4 times higher (p=0.038), and high versus low grade was 5 times higher (p=0.009). No patient (0/19) under 45 years old had low grade DCIS. Younger women were slightly more likely to have DCIS that was ER+ and PR+.

CONCLUSION

The vast majority of screening-detected DCIS cases (93.1%) were intermediate or high grade. Younger patients had a statistically significant greater chance of intermediate or high grade DCIS versus low grade DCIS.

CLINICAL RELEVANCE/APPLICATION

Grade and age have an inverse relationship in the screening-detected DCIS at our institution during the 16 year period studied. Since screening- detected DCIS in younger patients tends to be high or intermediate grade, screening mammography in younger

patients remains clinically important.

SSA01-07 Frequency and Cancer Yield of Probably Benign Breast Findings in Clinical Practice in the National Mammography Database (BI-RADS Category 3)

Sunday, Nov. 25 11:45AM - 11:55AM Room: E450A

Participants
Mai A. Elezaby, MD, Madison, WI (*Presenter*) Research Grant, Exact Sciences Corporation
Colin Longhurst, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Priyadarshini Karthik, Reston, VA (*Abstract Co-Author*) Nothing to Disclose
Debapriya Sengupta, MBBS,MPH, Reston, VA (*Abstract Co-Author*) Nothing to Disclose
Elizabeth S. Burnside, MD,MPH, Madison, WI (*Abstract Co-Author*) Dr. Burnside has a research grant from Hologic
Margarita L. Zuley, MD, Pittsburgh, PA (*Abstract Co-Author*) Investigator, Hologic, Inc
Wendie A. Berg, MD, PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Mythreyi Bhargavan-Chatfield, PhD, Reston, VA (*Abstract Co-Author*) Nothing to Disclose
Judy Burleson, Reston, VA (*Abstract Co-Author*) Nothing to Disclose
Cindy S. Lee, MD, Garden City, NY (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The Breast Imaging Reporting and Data System (BI-RADS) assessment category 3 describes a probably benign finding with a low likelihood of malignancy of <= 2%. Since 2013, the BI-RADS Atlas discouraged its use at screening, which was reinforced in Medicare's pay-for-performance Physician Quality Reporting System (PQRS) initiative. However, there are sparse data on the frequency of use and cancer yield of BI-RADS 3 findings in clinical practice. This study assesses the frequency and cancer yield of probably benign findings in screening and diagnostic mammography in the National Mammography Database (NMD), which is the largest national database of mammography.

METHOD AND MATERIALS

This HIPAA-compliant and IRB-exempt study retrospectively analyzed data from screening and diagnostic mammograms performed between 1/1/2009 and 12/31/2015 in the NMD. We calculated the overall frequency and cancer yield of BI-RADS 3 findings in screening and diagnostic mammography. Cancer yield is defined as the number of breast cancers diagnosed among women with probably benign findings within the study period. Exams with BI-RADS 3 findings but lacking biopsy or 12-month follow-up were excluded . Exams from NMD facilities contributing data for < 2 years were excluded to ensure adequate follow-up.

RESULTS

Data from 6,421,365 screening and 1,264,929 diagnostic mammograms performed in 3,345,013 women at 261 NMD facilities in 31 states were analyzed. A total of 215,403 mammograms had probably benign findings, with frequency of 0.3% (20,060/6,421,365) in screening and 15% (193,850 /1, 264,929) in diagnostic mammograms. Among the 101,025 women with BI-RADS 3 findings and at least one follow up , 948 (0.94%, 95%CI 0.91, 1.03) women had a diagnosis of malignancy. Rates of BI-RADS 3 use were stable over the 6 calendar years analyzed.

CONCLUSION

A probably benign, BI-RADS 3, assessment was rarely used in screening but common in diagnostic mammography in the NMD. The overall cancer yield of probably benign findings was 0.94%, consistent with BI-RADS Atlas threshold of <= 2%. These results support use of probably benign assessment in clinical practice for findings with low risk of malignancy.

CLINICAL RELEVANCE/APPLICATION

In the NMD, BI-RADS 3 showed appropriately low cancer yield of 0.9%. Proper use of BI-RADS 3 helps reduce cost, morbidity and patient anxiety while increasing cost-effectiveness of screening.

SSA01-08 Digital Breast Tomosynthesis Improves Performance Metrics of Screening Mammogram in Women Aged 40 to 54 Compared to Full Field Digital Mammogram

Sunday, Nov. 25 11:55AM - 12:05PM Room: E450A

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PURPOSE

The starting age for screening mammogram has been a controversial subject mostly due to reported low cancer detection rate (CDR) and high false positive recall rate (RR) in younger women. However, digital breast tomosynthesis (DBT) may improve performance of screening mammogram and change the justification of screening guidelines. The purpose of this study is to compare the performance of screening mammogram in women aged 40-54 between full field digital mammogram (FFDM) and DBT.

METHOD AND MATERIALS

In an IRB approved study, we retrospectively analyzed screening mammograms performed in women aged 40-54 at 2 of our imaging

centers from August 2008 through April 2017. We included all FFDM screening mammograms performed before and all DBT screenings performed after installation of DBT at each site. DBT screening was offered to all women after installation at no additional charge. RR, CDR, and characteristics of screen-detected cancers were compared between FFDM and DBT screening in 3 age groups: 40-44 (group 1), 45-49 (group 2) and 50-54 (group 3).

RESULTS

16938 FFDM and 28313 DBT were performed in women aged 40-54. In FFDM, RR significantly decreased from group 1 (17.4%) to group 2 (14.0%) and group 3 (11.3%); however, in DBT screening, RR was only significantly decreased from group 1 (12.2%) to group 2 (9.1%) and there was no significant difference between group 2 and group 3 (8.4%). RR of all 3 age groups were significantly lower for DBT compared to FFDM. CDR per 1000 exams in FFDM was significantly lower in groups 1 and 2 (2.4 and 2.3) compared to group 3 (5.0), but in DBT, there was no significant difference in CDR among the 3 groups (3.0, 4.4, and 3.8 in groups 1,2, and 3, respectively). There was significant increase in CDR from FFDM to DBT in women aged 45-49 (p=0.03). The ratio of invasive to in-situ carcinomas were similar in FFDM and DBT subgroups.

CONCLUSION

DBT screening decreases RR and increases CDR compared to FFDM in women aged 40-49, and more prominently for 45-49 age group. As a result, unlike FFDM, there is no significant difference in RR and CDR of ages 45-49 and 50-54 with DBT screening.

CLINICAL RELEVANCE/APPLICATION

Improved performance of DBT screening in women aged 40-49 compared to FFDM screening, may further justify recommendations for starting screening mammogram at younger age.

SSA01-09 Six Years of Consecutive, Population-Based Screening with Digital Breast Tomosynthesis: Outcomes by Screening Year and by Screening Round

Sunday, Nov. 25 12:05PM - 12:15PM Room: E450A

Participants
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PURPOSE

Digital breast tomosynthesis (DBT) improves screening outcomes by decreasing recalls and increasing cancer detection. However, most DBT studies have analyzed prevalence rather than incidence screening. We investigate outcomes from 6 years of consecutive DBT screening, at both the population level by year (DBT Y1-6) and patient level by round (DBT R1-6).

METHOD AND MATERIALS

71535 consecutive DBT screens in 33245 women were performed from 10/2011 to 9/2017 with 31246, 17801, 11067, 6560, 3553, and 1308 screens in rounds 1-6, respectively. Recall rate % (RR), cancer detection (CDR), biopsy (BX) and false negative (FN) rates per 1000 screens for each year (DBTY1-Y6) and each round (R1-R6) were analyzed. Outcomes were compared the prior year of digital mammography (DM) screening (DMY0, n=10765). Cancer registry data was used to determine FN (defined as cancer diagnosed <1 yr after negative screen) for DMY0-DBTY5 and DBT R1-R5.

RESULTS

At the Population Level, RR for DBTY1-6 was lower than DMY0 (7.9 vs 10.4%). However, DBT RR increased in DBTY1-3 (8.8, 9.0, 9.2%) before decreasing in DBTY4-6 (7.1, 6.1, 7.4%). CDR increased in DBTY1-3 (5.5, 5.8, 6.5) then decreased in DBTY4-6 (6.3, 5.1, 5.5) however, DBT CDR was higher in each year than DMY0 (4.8). Invasive CDR for DBTY1-4 and DBTY6 (3.9, 4.5, 4.5, 4.9, respectively) were also higher than DM0 (3.4) however, DBTY5 was lower (2.9). BX increased from DMY0 of 1.9 to 2.2, 1.9, 2.0 in DBTY1-3; in DBTY4-6, BX rates were lower (1.5, 1.3, 1.5). FN remained without significant change from DMY0 (1.1) to DBT1-5 (0.5, 0.3, 0.4, 0.8, 1.0). By Screening Round, RR decreased from DBTR1 to R5 from 10.6, 7.0, 5.1, 4.5, 4.1 until R6= 4.2%. CDR for R1-6 were 6.4, 5.5, 6.1, 4.4, 4.2, 3.1, respectively. BX rate decreased after DBTR1 (2.5) for R2-6 (1.4, 1.4, 1.0, 0.8, 1.0). FN were 0.5, 0.5, 1.3, 0.6, 0.8 for R1-5. Whether by year or round, DBT PPV1 was higher than DM.

CONCLUSION

At the population level, DBT screening had higher overall CDR and lower RR than DM with FN rates remaining relatively stable. Little data exists on outcomes by round of screening, however, our data may help guide DBT screening benchmarks.

CLINICAL RELEVANCE/APPLICATION

Consecutive years of DBT screening show decreased recall and increased PPV1 compared to DM alone. Further long term DBT outcome data may help guide new, personalized screening algorithms by age, density and risk.

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SSA02

Breast Imaging (Contrast Enhanced Spectral Mammography)

Sunday, Nov. 25 10:45AM - 12:15PM Room: E450B

BR CT OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
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Sub-Events

SSA02-01 Background Parenchymal Enhancement at Contrast-Enhanced Spectral Mammography (CESM) as a Breast Cancer Risk Factor

Sunday, Nov. 25 10:45AM - 10:55AM Room: E450B

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PURPOSE

To assess the extent of background parenchymal enhancement (BPE) at contrast-enhanced spectral mammography (CESM), inter-reader agreement in BPE classification, and correlation between BPE and breast cancer.

METHOD AND MATERIALS

Between 2012 and 2015 a total of 516 women underwent CESM imaging for screening and diagnostic purposes. BPE on CESM images was retrospectively, independently and blindly graded by 4 reviewers using the following scale: minimal, mild, moderate or marked. Inter-reader agreement was estimated using correlation coefficient (ICC). Associations between BPE and clinical factors, biopsy rate and histopathology results were examined using a multivariate logistic regression analysis.

RESULTS

A total of 412 (80%) of women underwent CESM for screening purposes. Mean age was 53 (range 28-77) years and 86.2-94% had a breast density BI-RADS score of C-D. Most women (76.4-90.5%) had minimal or mild BPE at CESM. Overall inter-reader agreement on BPE scores was good (ICC 0.88, 95%CI 0.81-0.92). A total of 122 (24%) biopsies were performed with a malignant histopathology result in 45 (37%) cases. On a multivariate analysis BPE demonstrated a significant association with age (P=0.004, OR 0.942, 95%CI 0.905-0.981) and with biopsy performance rate (P=0.006, OR 2.646, 95%CI 1.319-5.307). Moderate or marked BPE was predictive of a malignant biopsy result (P=0.002, OR 3.105, 95%CI 1.541-6.259).

CONCLUSION

CESM BPE is correlated with age and biopsy rate. Moderate or marked BPE is associated with malignant biopsy results, and hence may predict an increased risk for breast cancer.

CLINICAL RELEVANCE/APPLICATION

CESM BPE grading may be used as an additional risk assessment tool for breast cancer.

SSA02-02 Contrast Enhanced Digital Mammography (CEDM) Helps to Safely Reduce Benign Breast Biopsies

Sunday, Nov. 25 10:55AM - 11:05AM Room: E450B

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PURPOSE

One criticism of breast imaging is the harm caused by the relatively high rate of biopsy of benign breast lesions -- particularly BIRADS 4A and 4B lesions. The purpose of this project is to assess if CEDM during diagnostic evaluation could increase biopsy PPV for soft tissue density lesions by reducing benign biopsies while not impacting biopsy of cancers.

METHOD AND MATERIALS

This HIPPA compliant IRB approved protocol accrued 57 consenting women aged 34-74 (avg 49) years with 60 BIRADS 4A or 4B soft tissue lesions scheduled for ultrasound (US), stereotactic or tomosynthesis (DBT) directed biopsy from April 2016-November 2017. CEDM was performed immediately prior to biopsy. The cohort included 46 masses, 6 asymmetries and 8 distortions. Pathology confirmed 9 cancers and 51 benign concordant lesions. Four MQSA qualified radiologists reviewed and provided a BIRADS score 3 times for each lesion: first for mammography (M)/DBT only, next with US added and third with CEDM added. Readers recorded if the lesion enhanced, how enhancement compared to background and background parenchymal enhancement. Differences in BIRADS ratings were compared.

RESULTS

After M/DBT and US, prior to CEDM, 173/240 (72%) ratings were classified as > BIRADS 4. After viewing CEDM, 60 of these were re-classified as < BIRADS 3; a 35% average [range 0-59%] reduction in biopsy recommendation ($p<0.05$). Cancers enhanced in 32/36 (89%) ratings and 32/36 cancers were rated as BIRADS >4 before and after CEDM. Benign lesions enhanced in 77/204 (38%) (false positives). With US 3/36 cancer and 44/204 benign were converted to BIRADS>4 and 2/36 cancer and 10/204 benign to BIRADS <3 rating. With CEDM, 1/36 cancer and 8/204 benign were converted to BIRADS>4 and 1/36 cancer and 60/204 benign to BIRADS<3. Hence 1/36 cancer ratings (2.7%) were adversely affected (false negative) by CEDM.

CONCLUSION

CEDM use during diagnostic evaluation of BIRADS 4A or 4B lesions may result in a significant increase in PPV with minimal impact on cancer diagnosis rates.

CLINICAL RELEVANCE/APPLICATION

CEDM use during diagnostic evaluation of BIRADS 4A or 4B soft tissue lesions may significantly reduce the number of women recommended for benign biopsy while missing very few cancers.

SSA02-03 Diagnostic Performance of Contrast-Enhanced Spectral Mammography for Suspicious Malignant Microcalcifications (BI-RADS 4)

Sunday, Nov. 25 11:05AM - 11:15AM Room: E450B

Participants
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PURPOSE

To assess the diagnostic performance of contrast-enhanced spectral mammography (CESM) for evaluation of suspicious malignant microcalcifications (BI-RADS 4) comparing with full-field digital mammography (FFDM).

METHOD AND MATERIALS

Patients with mammographic calcifications without associated mass or distortions and were originally reported as BI-RADS 4 during Jan 2015 to Jan 2018 were retrospectively collected. Lesions that proven through pathological diagnosis either by biopsy or operation were included in the study and grouped as FFDM or CESM according to the examination they received. The microcalcification morphology and associated enhancement (CESM group) were reviewed by two radiologists to analyse the accuracy of the diagnosis . Diagnostic accuracy was assessed respectively for FFDM and CESM versus the results of pathology. Statistical differences of the two methods were compared using Chi-square test.

RESULTS

48 lesions (13 malignant and 35 benign) from 48 patients were enrolled in FFDM group, and 31 lesions (10 malignant and 21 benign) from 30 patients were in CESM group. The diagnostic sensitivity, specificity, positive predictive value, negative predictive value and accuracy were 92.3%, 42.9%, 37.5%, 93.8%and 56.3% for FFDM group, and were 100%, 71.4%, 62.5%, 100% and 80.6% for CESM group, respectively. The specificity and accuracy of CESM were significantly higher than that of FFDM ($p<0.05$). All 10 cancers including 8 DCIS in CESM group were judged as enhancement (table 1).

CONCLUSION

Comparing with FFDM, CESM improve the diagnostic performance on BI-RADS 4 mammographic calcifications, especially on specificity and overall accuracy. The detectability of all DCIS lesions in this small cohort may validate its potential use in previously "calcification only" disease, but still need further large sample to confirm.

CLINICAL RELEVANCE/APPLICATION

CESM improve the diagnostic performance on BI-RADS 4 mammographic calcifications, and decrease unnecessary biopsies.

SSA02-04 Participants

Quantitative Objective Evaluation of Contrast-Enhanced Spectral Mammogram in Predicting Response to Neo-Adjuvant Chemotherapy: A Comparative Study with RECIST 1.1 and Combined Evaluation Methods

Sunday, Nov. 25 11:15AM - 11:25AM Room: E450B

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PURPOSE

Initiating a new objective quantitative tool for evaluation of residual disease after neoadjuvant chemotherapy using CESM in comparison to RECIST 1.1 and combind evaluation methods.

METHOD AND MATERIALS

The study was approved by the ethical commitee of a multidisciplinary breast cancer hospital. It included 42 patients scheduled for receiving NAC. They underwent 2 CESM examinations; prior to and after NAC and maximum10 days prior to surgery. All patients were assessed using the RECIST 1.1 criteria, a combined approach (RECIST+ qualitative subjective assessment) and a new quantitaive approach using an image analysis software (MATLAB and Simulink, Release 2013b). The technique consists of 3 main steps: 1-preprocessing 2. extracting the region of Interest (ROI) and 3- Assessing the response to chemotherapy depending on the analysis of the tumour number of pixels included within the ROI. The difference in the intensity of enhancmenet between the pre and post NAC enahncement is calculated and compared between the 3 assessment methods in correlation to postoperative pathology using the Miller-Payne grading. For statistical evaluation, patients were classified into responders and non-responders.

RESULTS

The calculated correlation coefficient when comparing the residual disease on CESM and Miller payne grade using RECIST 1.1, the combined approach and the proposd quantitative method was 0.59, 0.89 and 0.69 respectively. According to Miller Payne grading 39/42 cases were classified as responders (Miller payne III, IV, and V). Using the new quantitive approach all 39/39 cases (100%) were considered responders in comparison to 38/39 using the combined approach and 34/39 using the RECIST 1.1 criteria. The calculated sensitivity, positive and negative predictive values of the quantitative objective evaluation (100, 97.5,100 % respectively) was higher than the RECIST method (87.2%, 97.1% 28.6%) and the combined response method (97.4%,97.4% and 66.7%).

CONCLUSION

Quantitative objective analysis of CESM allows accurate objective evaluation of the response of breast cancer to chemotherapy and evaluation of residual tumor prior to surgery.

CLINICAL RELEVANCE/APPLICATION

Objective analysis of CESM is an accurate tool for evaluation of the response of breast cancer post neo-adjuvant chemotherapy and is recommended as part of pre-operative work up

SSA02-05 Diagnostic Value of Contrast-Enhanced Spectral Mammography in Comparison to MRI in a Population of Breast Lesions

Sunday, Nov. 25 11:25AM - 11:35AM Room: E450B

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PURPOSE

To evaluate the diagnostic value between contrast-enhanced spectral mammography (CESM) and breast magnetic resonance imaging (MRI).

METHOD AND MATERIALS

Between July 2017 and February 2018, 235 patients who were suspected of breast abnormalities by clinical examination or mammography were underwent CESM and MRI examination. The image of CESM and MRI and the pathological specimens were analyzed. All lesions were evaluated independently by three experienced radiologists. Using histopathological results as the gold standard, the diagnostic performance of CESM and MRI were investigated. The areas under ROC curves was applied to analyze diagnostic efficiency. The data on maximum tumor size measurements were gathered on CESM and MRI. The Pearson's correlation coefficients and 95% confidents intervals between CESM vs. pathology and MRI vs. pathology were calculated.

RESULTS

263 breast lesions were found in 235 patients, in which 177 were malignant and 86 were benign. By evaluating the diagnostic value,

the sensitivity, positive prediction value, negative predictive value, and false-negative from CESM examination was comparable to that from MRI (91.5%,94.7%,83.7%,8.5% versus 91.5%,90.5%,82.1%,8.5%). Importantly, the accuracy and the specificity were higher for CESM than that for MRI (81%,89.5% Vs. 80.2%,71.7%) while the the false-positive was lower(10.5% Vs. 19.8%). The areas under ROC curves of CESM and MRI were 0.950 and 0.939, displaying the equivalent diagnostic efficiency (p=0.48). For the agreement between measurements, mean tumor size was 3.1 (range 0-16) cm for CESM and 3.4 (range0-17) cm for MRI compared with 3.2 (range 0-16) cm on histopathological results, the average difference of diameters between CESM, MRI and Histopathologic size was -0.01, -0.05cm, respectively, with 95% consistency interval range of -0.34 to 0.31, -0.87 to 0.22cm, respectively. The Pearson's correlation coefficients of CESM versus histopathology (r=0.774, p=0.000) was consistent with MRI (r=0.771, p=0.000).

CONCLUSION

Our results show better accuracy, specificity and the lower false-positive of CESM in breast cancer detection than MRI. CESM displayed a good correlation with histopathology in assessing the lesion size of breast cancer, which is consistence with MRI.

CLINICAL RELEVANCE/APPLICATION

CESM provides additional enhancement information for diagnosing breast lesions and measuring cancer sizes with high correlation to surgicohistology.

SSA02-06 Usefulness of Low-Dose Perfusion Breast CT: Quantification of Tumor Vascularity and Prediction of Histologic Biomarkers in Invasive Breast Cancer

Sunday, Nov. 25 11:35AM - 11:45AM Room: E450B

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PURPOSE

To investigate the usefulness of low-dose perfusion breast computed tomography (CT) for quantification of tumor vascularity and for prediction of histologic biomarkers in invasive breast cancer.

METHOD AND MATERIALS

This prospective study was approved by IRB with informed consent. A total of 139 patients with invasive breast cancers were enrolled. Low-dose perfusion CT was performed in the prone position with a spectral CT (iQon, Philips Healthcare) after contrast injection (Xenetix350, Guerbet). Effective dose was less than 1.2 mSv. Perfusion parameters were measured using a Philips Advanced Perfusion and Permeability application prototype in breast cancers, normal breast tissue, and fat; peak enhancement intensity (HU), perfusion on deconvolution model (mL/min/100/g), mean transit time (sec), time to peak (sec), blood volume (mL/100/g), permeability (mL/min/100/g), and blood volume permeability on Patlak model (mL/100/g). CT perfusion parameters of cancers and normal tissue or fat were compared using Mann-Whitney test. Correlation analysis was performed between CT perfusion parameters of cancers and histologic biomarkers including tumor grade, estrogen receptor (ER), progesterone receptor (PR), human epidermal growth factor receptor 2 (HER2), and Ki67 using Mann-Whitney or Kruskal-Wallis test.

RESULTS

In breast cancers, peak enhancement intensity, perfusion, blood volume, permeability, and blood volume permeability were significantly higher, and mean transit time, time to peak were shorter than those values in normal glandular tissues and fat (P<.001 for all). Peak enhancement intensity significantly increased in cancers with ER-, PR-, HER2+, Ki67+ or more than 20 mm (P<.05 for all). Time to peak decreased in cancers with ER-, PR-, HER2+, Ki67+, high grade, or more than 20 mm (P<.05 for all). Blood volume permeability increased in cancers with ER-, PR-, Ki67+, or high grade (P<.05 for all). HER2-enriched cancers showed higher peak enhancement intensity and blood volume permeability than luminal type cancers (P<.02 for all).

CONCLUSION

Low-dose perfusion breast CT can be useful in quantifying tumor vascularity and predicting prognostic biomarkers of invasive breast cancer.

CLINICAL RELEVANCE/APPLICATION

Low-dose perfusion breast CT can be used to quantify tumor vascularity and to predict biomarkers of invasive breast cancer and for patients who have difficulty with magnetic resonance imaging.

SSA02-07 Contrast-Enhanced Cone-Beam Breast-CT without Prior Non-Contrast Scan: Can We Reduce Radiation Exposure While Maintaining Diagnostic Accuracy?

Sunday, Nov. 25 11:45AM - 11:55AM Room: E450B

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PURPOSE

Contrast-enhanced cone-beam breast-CT (CE-CBCT) is a novel breast imaging technique with comparably high radiation dose. The current diagnostic standard includes one non-contrast scan (NC-CBCT) followed by intravenous contrast media injection and a contrast-enhanced scan (CE-CBCT). Performing only the CE-CBCT scan might reduce radiation exposure. Our study aims to evaluate whether CE-CBCT alone is comparable to combined NC + CE-CBCT regarding diagnostic accuracy while reducing radiation exposure.

METHOD AND MATERIALS

This prospective IRB-approved study included 48 women (61 breasts, 100 lesions) with median age 57.9 years (IQR: 49-66 years) and BI-RADS 4/5 lesions diagnosed on mammography/ultrasound in ACR density types c/d breasts. Two blinded breast radiologists read CE-CBCT alone versus NC-CBCT + CE-CBCT in consensus. Intra-observer variability was assessed by one reader performing independent double reading. Sensitivity, specificity and AUC were measured separately for CE-CBCT alone versus NC + CE-CBCT.

RESULTS

Of 100 lesions, 51 were rated as malignant, 6 as high risk and 43 as benign. Histopathological assessment was performed in 63 breast lesions and imaging follow-up over at least 1 year in another 37 lesions. Diagnostic accuracy for both CBCT approaches was comparable: AUC, sensitivity and specificity showed no significant differences comparing CE-CBCT alone versus NC + CE-CBCT (AUC: 0.84 vs. 0.83, p=0.643; sensitivity: 0.89 vs. 0.85, p=0.158; specificity: 0.73 vs. 0.76, p=0.655). Inter- and intra-observer agreement on BI-RADS readings were excellent (ICC=0.76, ICC=0.83, respectively). Radiation dose was significantly lower for CE-CBCT alone versus NC + CE-CBCT (median average glandular radiation dose 5.9 mGy vs. 11.7 mGy, p<0.001).

CONCLUSION

The diagnostic accuracy of CE-CBCT alone is comparable to that of combined NC + CE-CBCT in ACR type c/d breast. At the same time, CE-CBCT significantly reduces radiation exposure to the breast. Further research is warranted to confirm these findings in a larger and generalizable population.

CLINICAL RELEVANCE/APPLICATION

Assessment of CE-CBCT alone yields comparable diagnostic accuracy to combined NC + CE-CBCT and reduces radiation exposure by up to 50%. Additional acquisition of NC-CBCT might therefore be unnecessary.

SSA02-08 Automatic Classification of Breast Lesions in Contrast Mammography Using Deep Learning in Conjunction with Multimodal Information: BIRADS Lexicon Features and Raw Image Features

Sunday, Nov. 25 11:55AM - 12:05PM Room: E450B

Participants
Shaked Rose Perek, BSC, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose
Miriam Sklair-Levy, MD, Tel -Hashomer, Israel (*Presenter*) Nothing to Disclose
Gali Zimmerman Moreno, PhD, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Arnaldo Mayer, PhD, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Anat Shalmon, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Osnat Halshtok, MD, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Renata Faermann, MD, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose
Michael Gotlieb, MD, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Yael Yagil, MD, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To assess the combined usage of BIRADS lexicon and pixel data for multimodal automatic classification of breast lesions in dual energy contrast enhanced spectral mammography (CESM) and evaluate its potential for biopsy sparing in benign breast lesion.

METHOD AND MATERIALS

130 biopsy proven CESM breast lesions, (65 benign and 65 malignant) were manually contoured and described by the BIRADS lexicon. BIRADS data was encoded by a binary vector for each lesion which, together with the lesion pixels, formed a multimodal representation. A deep neural network was designed to process pixel data from its entry layer and merge it with BIRADS data in its deepest layers to better balance between low-level pixel information and high-level BIRADS data that need to be merged. The network was validated in a 5-folds cross-validation (CV) scheme, to tell apart benign/malignant lesions. In each fold, a different subset of 25 lesions was used for testing, and the rest for training. This CV was conducted using 3 different configurations, in order to assess and compare the contributions of different information modalities. (a) BIRADS-only classifier using SVM (BOC), (b) pixel-only network (PON), (c) and the multimodal BIRADS+pixels network (MBPN).

RESULTS

The results are shown in Fig.1, where blue is benign and red is malignant. The classification score (y axis) reflects malignancy probability. We seek a threshold, below which there are only benign lesions, so that no malignancy is missed, i.e. sensitivity=100% (green line Fig.1). With this condition in mind, the maximal specificities (SP) are: (a) BIRADS only, SP=12%; (b) pixel-only network, SP=37%; (c) multimodal BIRADS and pixel network (MBPN), SP=60%. This means that with MBPN we can safely spare unnecessary biopsy for 60% of benign lesions without missing any malignancies.

CONCLUSION

This research showed that the combined usage of BIRADS data, provided by the radiologist, with pixel data extracted from CESM strongly improves the specificity obtained for automatic lesion classification on pixel or BIRADS data alone.

CLINICAL RELEVANCE/APPLICATION

Multimodal lesion classification in CESM may significantly reduce benign breast biopsies, thus reducing cost and improving patient experience.

SSA02-09 Preoperative Diagnosis of Metastatic Axillary Sentinel Lymph Nodes in Breast Cancer with Quantitative Parameters Derived from Dual-Energy Spectral CT

Sunday, Nov. 25 12:05PM - 12:15PM Room: E450B

Participants
Chushan Zheng, Guangzhou, China (*Presenter*) Nothing to Disclose
Xiang Zhang, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Jun Shen, MD, Guagnzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to evaluate the diagnostic performance of gemstone spectral imaging (GSI) quantitative parameters derived from dual-energy spectral computed tomography (DEsCT) for the preoperative diagnosis of metastatic sentinel lymph nodes (SLNs) in patients with breast cancer.

METHOD AND MATERIALS

This prospective study was approved by the ethics committee, and all patients provided written informed consent. From June 2015 to December 2017, dual-phasic contrast-enhanced DEsCT was performed in 193 female patients with breast cancer. Quantitative GSI and morphological parameters were compared between metastatic and non-metastatic SLNs. The quantitative parameters were fitted to univariate and multiple logistic regression models. Their diagnostic abilities were analyzed by receiver operating characteristic curves and compared by the McNemar test.

CONCLUSION

DEsCT can be used as a complementary means for the preoperative identification of SLN metastases in patients with breast cancer.

CLINICAL RELEVANCE/APPLICATION

The slope of the Hounsfield unit curve in venous phase derived from dual-energy spectral CT, can be used to differentiate metastatic from non-metastatic axillary sentinel lymph nodes of breast cancer.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

VW24

Wide-angle Digital Breast Tomosynthesis and Contrast Enhanced Mammography Reading Sessions: Siemens Healthineers Vendor Workshop

Sunday, Nov. 25 11:40AM - 12:50PM Room: Booth 5530

Participants

Luis Pina, MD, PhD, San Sebastian, Spain (*Presenter*) Nothing to Disclose

Program Information

Learn about the value of wide-angle Digital Breast Tomosynthesis (DBT) and Contrast Enhanced Mammography (CEM) in the daily routine from one of our most experienced clinical experts. The differences and respective advantages of the morphological (DBT) and functional (CEM) breast imaging methods will be discussed. This, all with the flexible assistance of our multi-modality reading solution syngo® via and the syngo® Breast Care applications.

VW52

Triaging Dense Breast Patients in Clinical Practice: Hologic Vendor Workshop

Sunday, Nov. 25 12:00PM - 12:30PM Room: Booth 5524

Participants

Regina J. Hooley, MD, New Haven, CT (*Presenter*) Consultant, Hologic, Inc

Program Information

The Genius™ 3D Mammography™ is the only mammogram that is FDA approved as superior for women with dense breasts. Attend this 30 minute session to learn how to triage women with dense breasts using 3D Mammography. (3D Mammography™ Technology)

Registration

https://hologicrsna.com

BRS-SUA

Breast Sunday Poster Discussions

Sunday, Nov. 25 12:30PM - 1:00PM Room: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Bethany L. Niell, MD,PhD, Tampa, FL (*Moderator*) Nothing to Disclose

Sub-Events

BR220-SD-SUA1 Breast Density Classification and Follow-Up Decision Support System Using Deep Convolutional Models

Station #1

Participants
Sun Young Park, San Diego, CA (*Presenter*) Nothing to Disclose
Dustin Sargent, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Yoel Shoshan, Haifa, Israel (*Abstract Co-Author*) Employee, IBM Corporation
David Richmond, Newton, MA (*Abstract Co-Author*) Senior Data Scientist, IBM Watson Health
Ella Barkan, Haifa, Israel (*Abstract Co-Author*) Nothing to Disclose
Simona Rabinovici-Cohen, Haifa, Israel (*Abstract Co-Author*) Employee, IBM Corporation
Marwan Sati, PhD, Mississauga, ON (*Abstract Co-Author*) Employee, IBM Corporation

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PURPOSE

This paper presents two new deep learning models that achieve objective breast density classification with high accuracy. The models are integrated into a system that automates BI-RADS breast density reporting and aids in making additional screening recommendations for normal patients.

METHOD AND MATERIALS

We have trained two deep learning models that provide objective, accurate, and repeatable breast density classification to address the issue of inter-physician variability. Our first deep learning model, used for automated BI-RADS breast density reporting, was trained using four breast density labels (A-almost entirely fatty, B-scattered fibroglandular density, C-heterogeneously dense, D-extremely dense). Our second model was trained to distinguish between the 'scattered density' and 'heterogeneously dense' classes to aid in diagnostic follow-up decisions according to ACR guidelines. That is, the second model is a two-class classifier, combining labels A and B, and labels C and D, into single classes. The two models were combined to produce an optimal follow-up decision. The networks were trained on a large dataset with pre-processing and data augmentation. Performance was evaluated with five-fold cross validation, and ROC analysis was performed.

RESULTS

Our models were trained on 6528 MG studies (26112 images) acquired between 2004 and 2016, each with four standard views (L-CC, R-CC, L-MLO, and R-MLO). The age range of the patients was 24-93 years, with an (A, B, C, D) distribution of (24%, 52%, 20%, 4%). The breast densities in the clinical reports were used as ground truth. Our two-class model achieves training and test AUCs of (0.98, 0.96), and our four-class model achieves per-class training and test AUCs of (0.98, 0.96), (0.92, 0.88), (0.92, 0.93), and (0.97, 0.96). These initial results outperform existing breast density classification algorithms.

CONCLUSION

We report highly accurate breast density classification using deep learning models trained and evaluated on a large dataset of MG studies with a wide distribution of patient demographics. We are continuing this work with a multi-site clinical study and a comparison with inter-physician variance.

CLINICAL RELEVANCE/APPLICATION

We present a diagnostic aid system for automated classification and reporting of BI-RADS density. Breast density assessment is recommended by the ACR for proper assessment of breast cancer risk.

BR221-SD-SUA2 Accuracy of the Nodal Staging in Breast Carcinoma Using 18F-FDG-PET/MRI, Comparison with Pathological Findings

Station #2

Participants
Eva Ferdova, MD, Plzen, Czech Republic (*Abstract Co-Author*) Nothing to Disclose
Jiri Ferda, MD, PhD, Plzen, Czech Republic (*Presenter*) Nothing to Disclose
Jan Baxa, MD, PhD, Plzen, Czech Republic (*Abstract Co-Author*) Nothing to Disclose

Ilona Zednikova, Plzen, Czech Republic (*Abstract Co-Author*) Nothing to Disclose
Ondrej Hes, MD, PhD, Plzen, Czech Republic (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

to evaluate the sensitivity, specificity, positive and negative predictive value of 18F-PET/MRI in the nodal staging of the breast carcinoma.

METHOD AND MATERIALS

53 women (age 23-72) underwent the nodal staging of the breast carcinoma using 18F-FDG PET/MRI and all of them underwent surgery within two weeks with resection of the suspected lymph nodes including/or sentinel lymph node labeled by the99mTc-nannocolloid application. The examination was performed after intravenous application of 2.5 MBq/kg of 18F-FDG. PET/MRI examination consist of targeted breast imaging in prone position using dedicated 4-channel breast coil including the dynamic Gd-enhanced study after application of gadobutrol in the dose of 0.1 mmol/kg. The finding of PET/MRI was compared with the histological evaluation of the resected lymph nodes.

RESULTS

In 31 women, the nodal status was N0, in 17 N1, in 2 N2 and in 3 N3 respectively. Using the histological evaluations, there were following findings: 20 true positive, 2 false negative, 22 true negative, 1 false positive lymph node staging. The sensitivity reached 0.91, specificity 0.97, positive predictive value 0.95, and negative predictive value 0.94, respectively.

CONCLUSION

Targeted 18F-FDG-PET/MRI in breast carcinoma enables the valuable assessment of nodal metastatic involvement with high sensitivity and specificity

CLINICAL RELEVANCE/APPLICATION

To evaluate the sensitivity, specificity, positive and negative predictive value of 18F-PET/MRI in the nodal staging of the breast carcinoma

BR222-SD-SUA3 Automated Volumetric Breast Density Estimation: A Comparison with Radiologists' Qualitative Classification

Station #3

Participants
Yuan Tian, Beijing, China (*Presenter*) Nothing to Disclose
Jing Li, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Erni Li, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zhang Renzhi, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Ning Guo, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Shunan Che, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Chenglu Ke, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xiaohong R. Yang, Rockville, MD (*Abstract Co-Author*) Nothing to Disclose
Gretchen Gierach, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The purpose of our study was to assess the agreement of automated volumetric mammographic breast density with the radiologists' classification by using the BI-RADS density category (5th edition), and to analyze the clinical-radiologic factors that may influence the discordance between the two density measurements.

METHOD AND MATERIALS

A total of 7971 full-field digital mammograms with standard views were retrospectively analyzed. Breast density measurements evaluated by radiologists according to BI-RADS category (5th edition) and by an automated volumetric breast density method (VBDM) which was used to measure VBD (% breast density) and VDG (density grade) were compared. A weighted kappa value was calculated to assess the degree of agreement among the visual and volumetric assessments of the density category and each subject was classified into an concordance or discordance group. A number of clinical-radiologic factors including age, history of breast surgery, indication for mammography, volumes of fibroglandular tissue or total breast and the percentage breast density were compared between the two groups.

RESULTS

The agreement between breast density evaluations by radiologists and VDG was fair (kappa = 0.346) when using the four-grade scale (A/B/C/D), and moderate (k value = 0.597) when using the two-grade scale (A-B/C-D). VBD showed a significant positive correlation with visual assessment by radiologist (Spearman's $p=0.691$, $p < 0.01$), but the distribution of density category was statistically significantly different among visual and volumetric measurements ($p < 0.001$). Category D was more frequently assigned by VBDM (43.9%) than by the radiologists (17.1%). Discordant subjects were more likely to be younger ($p < 0.001$), had undergone mammography for diagnostic purposes ($p = 0.024$), and have higher volumetric breast density ($p < 0.001$) compared with concordant subjects.

CONCLUSION

More mammograms were classified as dense breast tissue using VBDM, as compared with visual assessments according to the BI-RADS fifth edition. And age, indication for mammography, and volumetric breast density may contribute to the differences between assessments by radiologists and by VBDM.

CLINICAL RELEVANCE/APPLICATION

Considering the significant positive correlation between VBD and radiologists' classification, the automated method may be used in the future to evaluate the quantitative breast density data.

BR223-SD-SUA4 The Many Faces of Contrast Enhancing Benign Breast Lesions in Digital Mammography

Station #4

Participants
Eleni Gioutlaki, MD, Athens, Greece (*Presenter*) Nothing to Disclose
Christos Tzimas, MD, Athens, Greece (*Abstract Co-Author*) Nothing to Disclose
Christina Gkali, MD, Athens, Greece (*Abstract Co-Author*) Nothing to Disclose
Sophia Papaioannou, Athens, Greece (*Abstract Co-Author*) Nothing to Disclose
Eleni Feida, Athens, Greece (*Abstract Co-Author*) Nothing to Disclose
Athanasios N. Chalazonitis, MD, MPH, Athens, Greece (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

CEDM is a quite new breast imaging method commercially available for clinical use.The aim of this study was to compare the degree and type of enhancement of benign lesions with pathology results.

METHOD AND MATERIALS

Evaluation of CEDM examination is based on enhancement intensity of the lesion according to a qualitative scale categorized in 4-steps as follows:Type -1(negative enhancement),Type 0(no enhancement),Type 1(low enhancement),Type 2(intense enhancement).Type 0 and type -1 findings were considered to be probably benign,and type 1 and type 2 findings were considered to be probably malignant.Within 5 years,1979 females 28 to 85 years,with suspicious finding(s) in DM,U/S,MR,underwent CEDM.29 of these females had bilateral findings,so 2008 lesions were in total examined.

RESULTS

Of the 2008 breast lesions in 1979 patients in this study, lesions 1363(67,8%)were benign.Among benign lesions,23,2% presented as enhancement on CEDM.More specific,317 out of 1363,had low or moderate enhancement on CEDM(type1:171/317,type2:146/317).Also 978 benign lesions,had no enhancement on CEDM(type-1:74/978,type0:904/978).Moreover,68 cases were non-mass like lesions which were benign.Histopathologically,the 171 benign lesions with type 1 enhancement were:87 sclerosing adenosis,63 fibroadenomas,5 postoperative scar,3 ductal ectasia,1 paget disease,2 intramammary lymph node,5 inflammation,5 no specific findings.Concerning,the 146 lesions with type 2 enhancement,histological proof of benign was:64 sclerosing adenosis,63 fibroadenomas,3 intramammary lymph node,4 ductal ectasia,2 inflammation,2 abscess,8 no specific findings.According to our findings,the specificity of the method is76,7%.

CONCLUSION

Fibroadenomas,and sclerosing adenosis,were more frequently characterized by moderate or medium enhancements on CEDM.It is very important to recognize the morphological features(as seen in DM)and hemodynamic patterns(as seen in CEDM)of benign lesions of the breast,in order to eliminate number of false positive enhancing lesions.

CLINICAL RELEVANCE/APPLICATION

The capability of CEDM is to depict tumor angiogenesis in breast cancer and have demonstrated contrast uptake in most malignant lesions independent of size as small as 1mm.Hence,CEDM may improve clinical decision making in breast cancer diagnosis.Breast biopsies in lesions which had type 0 or 1 enhancement(according to our recommendation)can be avoided,because these lesions are very likely to be benign.

BR165-ED-SUA5 Hematopoietic and Connective Tissue Diseases of the Breast

Station #5

Awards
Cum Laude

Participants
Katerina Konstantinoff, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Shani Aharon, BS, Worcester, MA (*Abstract Co-Author*) Nothing to Disclose
Christine O. Menias, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Catherine M. Appleton, MD, Saint Louis, MO (*Abstract Co-Author*) Scientific Advisory Board, Hologic, Inc Royalties, Oxford University Press
Michelle V. Lee, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Various hematologic and connective tissue diseases that arise from dysfunction of hematopoietic stem cells can present in the breast as primary disease or as a site of systemic involvement, and are important entities to keep in the differential diagnosis in breast imaging. 1. Review the imaging appearance of hematopoietic and connective tissue diseases that involve the breast 2. Review the typical presentation and workup of a patient presenting with suspected hematopoietic or connective tissue disease of the breast 3. Review the differential diagnosis of a patient with hematopoietic disease of the breast

TABLE OF CONTENTS/OUTLINE

A) Appearance of hematopoietic and connective tissue diseases of the breast in different imaging modalities Mammography US PET/CT MR B) Discussion of hematopoietic and connective tissue diseases of the breast and differential diagnosis of a suspected hematopoietic lesion of the breast with case examples Benign conditions - Amyloidosis, Rosai-Dorfman, scleroderma, dermatomyositis, diabetic mastopathy Malignant lesions - Lymphoma, leukemia, myeloid sarcoma, carcinoma C) Presentation and workup of a patient with a hematopoietic disease of the breast Symptomatic - palpable lump, skin thickening Asymptomatic - abnormality such as lesion or lymphadenopathy on imaging

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/ Christine O. Menias, MD - 2013 Honored EducatorChristine O. Menias, MD - 2014 Honored EducatorChristine O. Menias, MD - 2015 Honored EducatorChristine O. Menias, MD - 2016 Honored EducatorChristine O. Menias, MD - 2017 Honored EducatorChristine O. Menias, MD - 2018 Honored Educator

BR166-ED-SUA6 Ouch, That Hurts! Breast Trauma: What the Radiologist Needs to Know

Station #6

Participants
Alyssa R. Goldbach, DO, Philadelphia, PA (*Presenter*) Nothing to Disclose
Sana Hava, DO, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Shqiponja Hajdinaj, DO, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Suzanne A. Pascarella, MD, Cherry Hill, NJ (*Abstract Co-Author*) Nothing to Disclose
Dina F. Caroline, MD, Elkins Park, PA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Breast Trauma is a common and often underreported entity. Accidental injury to the female breast can cause symptoms and signs which may mimic carcinoma, including skin changes and palpable lumps. Breast trauma can also be painful or disfiguring. We will reinforce the imaging features of breast trauma including a review of mechanism of injury when applicable and discuss appropriate follow-up recommendations.

TABLE OF CONTENTS/OUTLINE

The primary goals are to provide a thorough review of imaging findings of breast trauma from our patient database. This will be achieved by: Illustrating the variety of imaging features of traumatic breast lesions. Describing the appropriate management recommendations for traumatic breast lesions. Providing a thorough review of traumatic breast pathologies with practical tips for aiding in diagnosis. Pathologies include gunshot wound, hematoma, hematoma complicated by abscess, seat belt injury, laceration, and pseudoaneurysm. Pathologic correlation from our patient database will be provided when available. It is important for the radiologist to recognize the imaging features of traumatic breast injuries as they can create confusion for both the patient and the clinician. The radiologist is a critical member of the multidisciplinary team working to make the diagnosis and direct patient management.

BR167-ED-SUA7 Inflammatory Processes of the Breast a Pictorial Review

Station #7

Participants
Maria Soledad Nocetti, MD, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose
Lucia I. Beccar Varela, MD, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose
Elizabeth Quiroga, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose
Veronica E. Grondona, MD, Capital Federal, Argentina (*Abstract Co-Author*) Nothing to Disclose
Vanina Kuznicki, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose
Flavia B. Sarquis, MD, Vicente Lopez, Argentina (*Presenter*) Nothing to Disclose

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TEACHING POINTS

• Review the clinical, radiographic and histologic features of commonly encountered inflammatory and reactive breast lesions. • Learn a diagnostic algorithm when examining women with mastitis, to distinguish between cancer-related and non cancer-related breast inflammation, since their clinical presentation can be misleading.

TABLE OF CONTENTS/OUTLINE

Mastitis is the inflammation of breast tissue. It always manifests clinically by three cardinal signs of inflammation, which are redness, heat and pain. From a pathophysiological point of view, mastitis reflects a variety of underlying etiologies. It can be due to non-infectious inflammation, infection (generally of bacterial origin) but can also be caused by inflammation resulting from malignant tumor growth. These processes include fat necrosis, mammary duct ectasia, granulomatous lobular mastitis, diabetic mastopathy, abscess and inflammatory cáncer. The radiologist must be familiar with the radiological signs of breast inflammation, and malignacy must be recognized and diagnosed without fail. Full use of breast imaging techniques is therefore crucial to ensure diagnosis, and subsequently to provide the patient with the most efficient treatment.

BR168-ED-SUA8 Testing the Waters: Multimodality Imaging Evaluation of Peri-Implant Effusions

Station #8

Awards
Magna Cum Laude

Participants
Merissa Harris, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Emily E. Knippa, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Nicholas Haddock, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Sumeet Teotia, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Sunati Sahoo, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
W. Phil Evans III, MD, Dallas, TX (*Abstract Co-Author*) Scientific Advisory Board, VuCOMP, Inc
Stephen J. Seiler, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

There are a few, but significant, differences in the differential diagnosis of immediate/early vs. delayed peri-implant effusions. Breast Implant Associated-Anaplastic Large Cell Lymphoma (BIA-ALCL) can be associated with either saline or silicone implants and is most frequently seen with textured implant surfaces. When performing an aspiration of a delayed peri-implant effusion, fluid should be sent for culture and cytologic analysis. Cytology should include Wright Giemsa staining as well as immunohistochemistry testing for cluster of differentiation (CD) and anaplastic lymphoma kinase (ALK) markers.

TABLE OF CONTENTS/OUTLINE

Multimodality appearance of a peri-implant effusion: Mammography Ultrasound Magnetic Resonance Imaging Effusion Mimics Early effusion differential considerations: Seroma Hematoma Infection Delayed effusion differential considerations: Non-specific inflammation Infection Malignant effusion (due to breast cancer) Malignant effusion (due to lymphoma): BIA-ALCL BIA-ALCL: Background Medical device report statistics Diagnostic evaluation Management considerations Procedural Considerations: Tips for performing an ultrasound-guided aspiration

BR204-ED-SUA10 Round Malignancies: A Pictorial Review with Radiologic-Pathologic Correlation

Station #10

Participants
Janice Y. Jeon, MD, Washington, DC (*Presenter*) Nothing to Disclose

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TEACHING POINTS

Breast malignancies encompass a host of heterogeneous tumors with a range of appearances on multimodality imaging. The updated BI-RADS lexicon predicts risk of malignancy based on various descriptors including shape and margins. While oval masses confer benignity, round masses warrant evaluation to exclude malignancy. Invasive ductal carcinoma (IDC) is the most common invasive cancer. While most radiologists are familiar with the classic appearance of poorly-differentiated (grade III) irregular IDC, decreased familiarity with the less common round, non-aggressive appearing well-differentiated (grade I) IDC may lead to misinterpretation and misdiagnosis. Other cancers often presenting as round masses are the well-differentiated IDC subtypes which include mucinous, medullary, metaplastic & papillary categories. The aforementioned entities will be presented via pictorial review with pathology correlation. This exhibit aims to increase awareness of the spectrum of round circumscribed malignancies for which cancer should not be excluded from the differential considerations.

TABLE OF CONTENTS/OUTLINE

1. Introduction/Background 2. Multimodality (2D FFDM, 3D Tomo, US & MRI) Pictorial Review with Pathology Correlation & Management A) Invasive Ductal Carcinoma - NOS B) Medullary C) Mucinous D) Metaplastic E) Papillary 3. Take-home Points & Pearls/Pitfalls

BR013-EB-SUA Beware of the Rare: A Pictorial Review of Unusual Breast Lesions

Hardcopy Backboard

Participants
Denny Lara Nunez, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose
Fernando Candanedo Gonzalez, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Monica Chapa, MD, Mexico, Mexico (*Abstract Co-Author*) Nothing to Disclose
Mariana Licano, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Antonio Hernandez Villegas, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Nancy Margarita Gutierrez Castaneda, MD, Cuautla, Mexico (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Recognize and familiarize with breast lesions that are not seen routinely on mammographic practice. 2. Identify mutlimodality imaging characteristics of benign and malignant unusual breast lesions. 3. Describe the histopathologic characteristics of rare tumors involving the breast and make correlation with imaging findings for an accurate diagnosis and management.

TABLE OF CONTENTS/OUTLINE

1. Introduction -General features of breast cancer -Epidemiology 2. A brief review including: -Epidemiology -General features -Clinical presentation -Multimodality imaging characteristics -Histopathologic analysis of the following lesions will be presented: -Sarcoma (angiosarcoma and fusocellular) -Primary neuroendocrine tumor -Lymphoma -Metastases from extramammary malignancies -Fibroadenolipoma -Phyllodes benign tumor, among others 3. Conclusions.

BR008-EB-SUA Where is the Lesion? Mammographic-Sonographic and Breast MR Imaging Correlation

Hardcopy Backboard

Participants
Jin Hee Moon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Joo Won, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Ji-Young Hwang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ji Young Woo, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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geenie-m@hanmail.net

TEACHING POINTS

Breast has very different position according to imaging modality. Lesion detection and accurate correlation in multimodality breast imaging is very important for preventing false or delayed diagnosis. We will provide process for correlation of lesions in mammography, ultrasound and breast MRI and show pearls and pitfalls through illustrations and sample cases.

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Basic concept of triangulation 3. Mammographic-sonographic correlation 4. Sonographic-MRI correlation 5. Targeted or second look sonography technique 6. MRI imaging navigated sonography system 7. Summary

VW01

Comparison between ABUS and Hand-Held Breast Ultrasound in the Screening of Dense Breasts: GE Vendor Workshop

Sunday, Nov. 25 12:30PM - 1:00PM Room: Booth 8156

Participants

Fernanda P. Pereira, MD, PhD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

Program Information

In this presentation, Dr. Fernanda will discuss her results from over 250 patients comparing ABUS (acquired by a trained person, read by a breast radiologist) with Hand-Held (fully completed by a radiologist) and the impact to cancer detection, recall rate and false positives. ***Registration is required; adding this session to the RSNA calendar tool alone does not secure your seat in this session. Click the link below to register.***

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2018-/agenda-e57e0b47e9aa4f5ba89b1a0da1e829b9.aspx

BRS-SUB

Breast Sunday Poster Discussions

Sunday, Nov. 25 1:00PM - 1:30PM Room: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

Participants
Bethany L. Niell, MD,PhD, Tampa, FL (*Moderator*) Nothing to Disclose

Sub-Events

BR224-SD-SUB1 Evaluation of Gd-Deposits in Healthy Women Participating in High Risk Screening Program for Early Breast Cancer Detection

Station #1

Participants
Barbara Bennani-Baiti, MD, Wien, Austria (*Presenter*) Nothing to Disclose
Barbara Krug, Cologne, Germany (*Abstract Co-Author*) Nothing to Disclose
Daniel Giese, Koln, Germany (*Abstract Co-Author*) Nothing to Disclose
Kilian Weiss, PhD, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Thomas H. Helbich, MD, Vienna, Austria (*Abstract Co-Author*) Research Grant, Medicor, Inc Research Grant, Siemens AG Research Grant, C. R. Bard, Inc
Pascal A. Baltzer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine whether patients at high risk to develop breast cancer, that undergo contrast enhanced breast MRI at regular intervals for early breast cancer detection, exhibit brain signal alterations in the dentate nucleus and globus pallidus.

METHOD AND MATERIALS

In this IRB-approved, dual centre randomized, prospective study 73 healthy women with no history of cancer or neurological disease that had received at least 6 doses of macrocyclic Gadolinium based contrast agents in the course of a national high risk screening program for the early detection of breast cancer were included. Patients underwent 3T/1.5T MRI of the brain, with a dedicated head coil, including T1 mapping and mpRAGE sequences. T1 times and T1 signal intensities were measured for dentate nucleus (ND), pons, globus pallidus (GP), and crus posterior of the capsula interna (CP) bilaterally, employing Horos software. Ratios of GP to CP as well as ND to pons were calculated for respective signal intensities and further statistical analyses were carried out with SPSS and Medcalc including multivariate regression analysis.

RESULTS

There were 73 participants (median age 46 +/- 9 years) that had received an average of 9 cumulative dosages of Gd based macrocyclic contrast agents (median 8, SD 3, range 6 - 23). Spearman's rank correlation coefficient analysis revealed a mild correlation between age and number of dosages (R 0.31, $p < 0.01$) but no statistically significant correlations were found for signal intensity ratios or T1 times in relation to age or number of dosages. T1 times displayed no significant differences between the analysed brain structures (Fig.1.). ANOVA testing reveiled an adjusted R2 of -0.026 and -0.004 for the number of cumulative dosages predicting T1 times and signal intensity ratios, respectively, confirming that the number of previous dosages did not affect T1 signal in globus pallidus or nucleaus dentatus.

CONCLUSION

Neither nucleus dentatus nor globus pallidus display altered T1 signals after high cumulative dosages of macrocyclic Gd-based contrast agents in healthy women.

CLINICAL RELEVANCE/APPLICATION

Breast MRI being the most sensitive method for breast cancer detection crucially relies on Gd-based contrast agents. These findings show that the currently employed macrocyclic Gd-based contrast agents do not result in Gd-deposits in the brain of healthy women participating in a high risk screening program for early breast cancer detection.

BR225-SD-SUB2 Radiomics Analysis with Contrast-Enhanced Dual-Energy Mammography for the Differentiation of Hormone Receptor Status and Tumor Invasiveness in Breast Cancer Patients

Station #2

Participants
maria adele marino, MD, New York,, NY (*Presenter*) Nothing to Disclose
Doris Leithner, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Katja Pinker-Domenig, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Janice S. Sung, MD, New York, NY (*Abstract Co-Author*) Research Grant, Hologic, Inc
Elizabeth A. Morris, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Maxine S. Jochelson, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

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PURPOSE

To investigate the potential of radiomics analysis of contrast-enhanced dual-energy mammography (CEDM) for differentiation of breast cancer invasiveness and hormonal status.

METHOD AND MATERIALS

In this IRB-approved retrospective data analysis, 53 patients with proven breast cancers were included and underwent pre-treatment CEDM. There were 58 lesions in 53 patients: 6 non-invasive (ductal carcinoma in situ) and 52 invasive breast cancers. Among the invasive cancers, 39 were hormone-receptor positive (HR+) and 12 hormone-receptor negative (HR-) Radiomics analysis was performed using MaZda software (Technical University of Lodz, Poland). Lesions were manually segmented and radiomic features were derived from the first-order histogram (HIS): co-occurrence matrix (COM), run-length matrix (RLM), absolute gradient (GRA), autoregressive model (ARM), the discrete Haar wavelet transform (WAV), as well as lesion geometry (GEO). Fisher, probability of error and average correlation (POE+ACC), and mutual information (MI) coefficients were used for feature selection. Linear discriminant analysis followed by k-nearest neighbor classification (with leave-one-out cross-validation) was used for pairwise texture-based separation of subtypes/hormonal status. Radiomics parameters were correlated with tumor histology (invasive vs non-invasive) and hormonal status (HR+ vs HR-).

RESULTS

Texture analysis yielded the following accuracies for differentiation between invasive/non-invasive breast cancers: 86.2% (based on COM and WAV features/MI), 84.4% (based on COM, WAV, and RLM features/POE+ACC), and 82.8% (mainly through COM+WAV/Fisher). For differentiation between HR+ and HR_ cancers, diagnostic accuracy was as follows: 76.4% (based on COM features/MI), 72.5% (based on COM+HIS+WAV features/POE+ACC), and 66.6% (mainly through COM features/Fisher).

CONCLUSION

Data indicate that radiomics analysis with CEDM might be able to differentiate between non-invasive and invasive breast cancer and hormone receptor status.

CLINICAL RELEVANCE/APPLICATION

Radiomics analysis with CEDM might provide additional imaging biomarkers for the non-invasive characterization of breast cancer and thus has the potential to guide treatment decisions.

BR226-SD-SUB3 Patient, Provider, and Facility Characteristics Associated with Observed Variations in Breast Cancer Screening Outcomes: Findings from A Learning Health System

Station #3

Participants
Nila H. Alsheik, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Firas Dabbous, Park Ridge, IL (*Abstract Co-Author*) Nothing to Disclose
Zhaohui Su, PhD, Boston, MA (*Abstract Co-Author*) Employee, OM1
Gregory Donadio, Park Ridge, IL (*Abstract Co-Author*) Employee, OM1
Richard Gliklich, MD, Cambridge, MA (*Abstract Co-Author*) Employee, OM1
Scott Pohlman, MSc, BEng, Cambridge, MA (*Abstract Co-Author*) Employee, Hologic, Inc
Kathleen Troeger, Marlborough, MA (*Abstract Co-Author*) Employee, Hologic, Inc
Vandana Menon, MD,PhD, Cambridge, MA (*Abstract Co-Author*) Employee, OM1
Emily F. Conant, MD, Philadelphia, PA (*Presenter*) Grant, Hologic, Inc; Consultant, Hologic, Inc; Grant, iCAD, Inc; Consultant, iCAD, Inc; Speaker, iiCME

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PURPOSE

To examine data from a learning health system to identify patient, provider, and imaging facility characteristics associated with optimal screening outcomes.

METHOD AND MATERIALS

A big data platform was used to integrate EMR, RIS, and tumor registry data to create a learning health system. The analysis included 411,355 screens, performed 2015 to 2017, from 64 imaging facilities across three large healthcare organizations. The imaging facilities were stratified into quartiles of increasing recall rates (RR) (Quartile 1 (Q1) range=6.78-8.37%, Q2=8.84-9.98%, Q3=10.09-10.81%, Q4=10.88-21.00%) and by digital breast tomosynthesis (DBT) conversion (75-100% DBT, 50-75% DBT, 25-50% DBT, 0-25% DBT). Patient, provider and site characteristics, PPV1, biopsy (BX) rate and cancer detection (CDR) were evaluated overall and stratified by modality.

RESULTS

There were no consistent trends in distribution of age, ethnicity or breast density across quartiles but facilities in the lower recall quartiles had more Caucasian patients and were predominantly DBT. Facilities with higher DBT conversion had lower RR than hybrid or predominantly 2D digital mammography (DM) sites (75-100% DBT: 8.87%, 50-75% DBT: 10.72%, 25-50% DBT:11.39%, 0-25%: 10.11%, p value for trend <0.001). Screening outcomes varied between quartiles. PPV1 decreased from 6.0% in Q1 to 3.3% in Q4; BX rate and CDR were lowest in Q1 (1.0%, 4.0), Q2 had the highest BX rate and CDR (1.7%, 4.7) and Q4 had a high BX rate and low CDR (1.7%, 4.2). DBT had higher PPV1, and higher CDR, in Q1 (6.7% vs 3.3%; 4.4 vs 2.6), Q2 (6.1% vs 3.6%; 5.5 vs 3.5) and Q3 (5.1% vs 3.8%; 5.3 vs 3.8) compared to DM, but not in Q4 (3.2% vs 3.3%; 4.2 vs 4.2).

CONCLUSION

Recall rates were influenced by race and DBT conversion. Across quartiles, DBT had lower RR and higher PPV1 and CDR, except in Q4. Facilities that were predominantly DBT had consistently lower RR than hybrid DBT/DM sites. These data demonstrate that DBT offers a more efficient screening option and increasing DBT utilization is associated with improved outcomes. There is an optimal balance between RR, BX rate and CDR and, as RR increased above 9.18%, there were increased BX but no significant gains in either

PPV1 or CDR.

CLINICAL RELEVANCE/APPLICATION

Digital Breast Tomosynthesis in hybrid sites, and sites with higher conversion to DBT, have better screening outcomes than 2D Digital Mammography, across all strata of age, race and breast density.

BR227-SD-SUB4 Breast Imaging (Contrast Enhanced Spectral Mammography)

Station #4

Participants
Norran H. Said, MD, FRCR, Cairo, Egypt (*Presenter*) Nothing to Disclose
Ashraf Selim, MD, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To identify the typical CEDM imaging characteristics and morphological enhancement patterns of different breast cancer pathological subtypes.

METHOD AND MATERIALS

From Jan 2016 to Jan 2018, 147 patients with pathology proved breast cancer who had undergone CEDM were retrospectively reviewed. Imaging findings were recorded and divided into mass, non mass enhancement & focus. Morphological enhancement criteria for mass and non mass enhancement were interpreted as follows; mass enhancement was described by shape (round, oval, irregular), margin (circumscribed, noncircumscribed : irregular / spiculated), and uptake pattern (rim, homogenous , heterogenous). Non mass enhancement was described by uptake pattern (homogenous, heterogenous, clumped, clustered ring) and distribution (focal, linear, segmental, regional, multiple regions, diffuse). All descriptors were correlated with pathology including subtypes; Triple negative (TN), Estrogen receptor (ER) positive, Human epidermal growth factor receptor 2 (Her 2) positive.

RESULTS

Out of the 147 cases, there were 24 (16.3%) TN, 90 (61.2%) ER positive and 33 (22.4%) Her 2 positive. Enhancement patterns according to subtype were as follows; TN cases demonstrated 79.2% mass and 20.8% non mass enhancement. ER positive cases included 72.2% mass, 22.2% non mass enhancement and 5.6% foci. Her 2 positive included 45.5% mass, 48.5 %non mass enhancement and 6.1% foci. TN tumors demonstrated 68.4% rim enhancement with 73.3% circumscribed margins, and 68.4% round shape. ER positive demonstrated 78.5% heterogenous enhancement , 63% spiculated margins, and 91% irregular shape. Her 2 positive demonstrated 53.3% heterogenous enhancement with spiculated margins, and 100% irregular shape. P value was found significant ($p<0.001$). There were no significant differences on the non mass enhancement descriptors and foci.

CONCLUSION

Our findings conclude that the rim enhancement feature on CEDM, along with circumscribed margins and round shape, are significant morphological descriptors for TN cancers compared to other subtypes. No significant difference was detected in non mass and focus uptake patterns.

CLINICAL RELEVANCE/APPLICATION

Application of contrast enhancement characteristics of masses by CEDM, allow detailed estimation of pathological subtypes with radiological-pathological correlation.

BR228-SD-SUB5 Does Tomosynthesis Work For Everyone?

Station #5

Participants
Ethan O. Cohen, MD, Houston, TX (*Presenter*) Spouse, Consultant, Medtronic plc; Spouse, Consultant, Novo Nordisk AS; Spouse, Consultant, Eli Lilly and Company; Spouse, Consultant, AstraZeneca PLC
Rachel E. Perry, MD, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose
Ashmitha Srinivasan, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Hilda H. Tso, DO, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
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Michele D. Lesslie, DO, Bellaire, TX (*Abstract Co-Author*) Nothing to Disclose
Karen E. Gerlach, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Jessica W. Leung, MD, Houston, TX (*Abstract Co-Author*) Scientific Advisory Board, Hologic, Inc; Speakers Bureau, Hologic, Inc; Speakers Bureau, FUJIFILM Holdings Corporation

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PURPOSE

To compare the performance of full-field digital screening mammograms (FFDM) with and without digital breast tomosynthesis (DBT) in women with and without breast implants.

METHOD AND MATERIALS

An IRB-approved, HIPAA-compliant retrospective review was performed of 103,070 consecutive screening mammograms obtained from February 2011 through June 2014. Recall rates (RRs), cancer detection rates (CDRs), and positive predictive values for recall (PPV1s) were analyzed.

RESULTS

The following data compare FFDM and FFDM-DBT: 67,331 FFDM and 28,835 FFDM-DBT from women *without* implants yielded RRs of

8.0% and 6.3%, respectively (p<0.00001); CDRs of 4.1 and 5.0 per 1000 exams, respectively (p=0.07); and PPV1s of 5.1% and 8.0%, respectively (p<0.0001). 4325 FFDM and 2579 FFDM-DBT from women *with* implants yielded RRs of 5.2% and 4.1%, respectively (p=0.040); CDRs of 1.8 and 2.7 per 1000 exams, respectively (p=0.46); and PPV1s of 3.6% and 6.7%, respectively (p=0.25). The same data is also used to evaluate the effect of implants on screening: 67,331 FFDM *without* implants and 4325 FFDM *with* implants yielded RRs of 8.0% and 5.2%, respectively (p<0.00001); CDRs of 4.1 and 1.8 per 1000 exams, respectively (p<0.00001); and PPV1s of 5.1% and 3.6%, respectively (p=0.30). 28,835 FFDM-DBT *without* implants and 2579 FFDM-DBT *with* implants yielded RRs of 6.3 and 4.1, respectively (p<0.00001); CDRs of 5.0 and 2.7, respectively (p=0.11); and PPV1s of 8.0 and 6.7, respectively (p=0.63).

CONCLUSION

Tomosynthesis improves the performance of digital screening mammography, while the presence of implants reduces its performance. Specifically, tomosynthesis improved RRs, CDRs, and PPV1s for all women (*with* and *without* implants), though statistically significant differences were seen only for RRs in women *without* implants, RRs in women *with* implants, and PPV1s for women *without* implants. Implants were associated with decreased RRs, worse CDRs, and worse PPV1s for all screening exams (FFDM and FFDM-DBT), but statistically significant differences were seen only for RRs for all screening exams and CDR for FFDM. Further study with larger populations is warranted.

CLINICAL RELEVANCE/APPLICATION

The benefit of tomosynthesis has been incompletely studied in screening mammography patients with implants. This research suggests that tomosynthesis is useful for screening women *with* implants in addition to those *without* implants.

BR170-ED-SUB6 Imaging of Free Liquid Silicone Injections in the Transgender Breast

Station #6

Participants
Emily B. Sonnenblick, MD, New York, NY (*Presenter*) Nothing to Disclose
Karen A. Lee, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Shabnam Jaffer, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Zil Goldstein, MA, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Nishi Talati, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Laurie R. Margolies, MD, New York, NY (*Abstract Co-Author*) Research Consultant, FUJIFILM Holdings Corporation
Susan Boolbol, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jess Ting, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Review considerations in breast imaging unique to transgender patients on hormone treatment (HT). 2. Free liquid silicone (FLS) injections, while not always symptomatic, may cause pain, palpable masses and disfigurement prompting some patients to seek medical care. 3. FLS breast injections present a challenge in the setting of diagnostic imaging or cancer screening. 4. Specific patterns and distribution of FLS seen with mammography, ultrasound and MRI correlate with surgical pathology and histology.

TABLE OF CONTENTS/OUTLINE

1. Background • Prevalence, guidelines for transgender care • Expected radiographic and histology correlates of HT for transgender individuals • Historical review of liquid silicone • Radiographic aspects and complications of FLS used for breast augmentation 2. Pre-mastectomy evaluation • Role of pre-op imaging/screening for cancer with consideration of trans population breast cancer risk • Distribution of silicone: superficial location, pectoralis involvement • Fibrotic masses masquerading as cancer • Diffuse silicone granulomas 3. Diagnostic evaluation • Palpable silicone granulomas • Bloody nipple discharge • Post-op peri-prosthetic collection • Free silicone on CT • Post-op residual silicone 4. Silicone may migrate, make calcified granulomas and fibrotic masses, obscure normal tissue, complicating diagnosis of malignancy.

BR171-ED-SUB67 Breast Implants for Residents Test Your Knowledge in Common and Uncommon Findings

Station #7

Participants
Lucia I. Beccar Varela, MD, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose
Maria Soledad Nocetti, MD, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose
Veronica E. Grondona, MD, Capital Federal, Argentina (*Abstract Co-Author*) Nothing to Disclose
Elizabeth Quiroga, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose
Flavia B. Sarquis, MD, Vicente Lopez, Argentina (*Presenter*) Nothing to Disclose

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TEACHING POINTS

• Learn through pictures and diagrams to recognize different types of breast implants, including saline, double lumen and silicone gel. • Utilizing clinical cases, analyze the multimodality imaging appearances of common and uncommon complications, including mammographic, ultrasonographic and MRI findings.

TABLE OF CONTENTS/OUTLINE

An increasing number of patients have breast implants for cosmetic augmentation of the breast, reconstruction after mastectomy or correction of congenital malformations. Any radiologist who interprets breast imaging studies should be familiar with the normal and abnormal findings of common implants. Clinical diagnosis of implant rupture is difficult and the aim of imaging is to provide essential information about tissue and prothesis integrity and detect breast diseases unrelated to implants, such as breast cancer. This work is a resident primer on successfully recognizing common and uncommon findings related to breast implants, learning specific strengths and weaknesses of each imaging technique, to make the correct choice for each individual patient.

Participants

BR171-ED-SUB8 Law and Order: Staying aBREAST of Medicolegal Issues in Mammography

Station #8

Michael S. Morrow, DO, Worcester, MA (*Abstract Co-Author*) Nothing to Disclose
Gopal R. Vijayaraghavan, MD, MPH, Shrewsbury, MA (*Presenter*) Nothing to Disclose
Suma C. Kannabiran, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
David E. March, MD, Springfield, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Review current malpractice trends in Radiology with an emphasis on breast imaging. Highlight pitfalls in mammography that commonly lead to false negatives. Present best practices/policies regarding disclosing error to patients.

TABLE OF CONTENTS/OUTLINE

Review of recent general trends in medical malpractice across specialties Detail malpractice as it relates to breast imaging Highlight types of errors in mammography interpretation Present common pitfalls in mammography leading to false negatives Introduce best practices in mitigating errors in an effort to minimize litigation

BR173-ED-SUB9 Breast Elastography: How Does It Help? Interactive Case Review Including Helpful Tips for Incorporating Elastography in Your Practice

Station #9

Participants
Ana DiPrete, BA, Providence, RI (*Presenter*) Nothing to Disclose
Robert C. Ward, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Elizabeth Lazarus, MD, Barrington, RI (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

-Breast elastography utilizes static and dynamic ultrasound techniques to provide information about the "stiffness" of a lesion.-As malignant lesions tend to be stiffer than benign lesions, qualitative and quantitative assessments are used to score lesions as soft, intermediate or hard.-Adding elastographic qualities to BI-RADs features improves diagnostic accuracy and aids decision-making regarding clinical management (i.e. biopsies), especially with BIRADs category 3 and 4a lesions.-Our objective is to provide an engaging case-based imaging approach with questions and answers to discuss basic principles of elastography, commonly applied techniques, and the elastographic appearance of benign and malignant lesions to emphasize the implications of adding elastography to the diagnostic evaluation of breast disease.

TABLE OF CONTENTS/OUTLINE

Users will be faced with diagnostic scenarios and management questions regarding the following areas:1. Comparing strain and shear wave elastography techniques2. Illustrating how elastographic features of benign and malignant breast disease differ3. Highlighting the clinical application of elastography and how it improves diagnostic accuracy of breast ultrasound 4. Reviewing the literature of breast elastography with a focus on how it supplements screening and diagnostic grey scale breast ultrasound

BR174-ED-SUB10 New Findings on Breast MRI with Benign or Probably Benign Characteristics: Evaluation, Differential, and Management Dilemmas

Station #10

Participants
Sonia P. Sahu, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Sona A. Chikarmane, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Emily Mungovan, BA, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Catherine S. Giess, MD, Wellesley, MA (*Abstract Co-Author*) Nothing to Disclose
Mirelys Barrios, MD , Boston, MA (*Presenter*) Nothing to Disclose

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TEACHING POINTS

1. To understand the criteria for BIRADS 2 and BIRADS 3 lesions on screening breast MRI. 2. To recognize imaging features that may be new on screening MRI but support a benign or probably benign assessment. 3. To avoid pitfalls in assessing new MRI findings as benign or probably benign and become familiar with imaging features that should prompt immediate biopsy.

TABLE OF CONTENTS/OUTLINE

1. Provide a brief overview of the qualifying features for BIRADS 2 and BIRADS 3 lesions on MRI. 2. Demonstrate a rich pictorial review of new lesions and imaging features found on screening MRI that are consistent with a BIRADS 2 or 3 assessment including fat necrosis, asymmetric and diffuse background parenchymal enhancement, and enhancing foci. 3. Present teaching points to help guide management of new benign and probably benign findings on screening MRI. 4. Discuss pitfalls in assessing new MRI findings as benign or probably benign and review imaging features that should prompt immediate biopsy.

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 EducatorCatherine S. Giess, MD - 2017 Honored Educator

BR175-ED- Imaging Findings Following Image Guided Cryoablation Of Breast Cancer: A New Normal

SUB11

Station #10

Participants

Kenneth R. Tomkovich, MD, Freehold, NJ (*Presenter*) Consultant, Scion Medical Technologies, LLC;

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ktomkovich@princetonradiology.com

TEACHING POINTS

The purpose of this exhibit is:1. To introduce the concept of cryoablation as a primary treatment for certain types of breast cancers without the need for surgical excision2. To demonstrate the techniques utilized in the ICE 3 trial for successful treatment of low grade breast cancers with ultrasound guided cryoablation 3. To illustrate different imaging findings as a "new normal" in patients who have undergone cryoablation as a primary treatment for breast cancer including:Mammographic findings post cryoablation Ultrasound findings post cryoablation MRI findings post cryoablation 4. To discuss imaging findings that led to post cryoablation biopsies and why they can be observed if encountered in the future to avoid unnecessary biopsies

TABLE OF CONTENTS/OUTLINE

Cryoablation as a primary treatment for certain types of breast cancersTechniques of ultrasound guided breast cancer cryoablation Brief description of the ICE 3 trialReview of imaging findings post cryoablation: the "new normal"- Mammography - Ultrasound - MRI- Biopsy examples Future implications and summary

VW53

A Clinical Perspective on Increasing Confidence with Synthesized 2D Imaging Technology: Hologic Vendor Workshop

Sunday, Nov. 25 1:00PM - 2:00PM Room: Booth 5524

Participants

Jacqueline S. Holt, MD, Wilmington, DE (*Presenter*) Nothing to Disclose

Program Information

Clinical perspective of Synthesized 2D Imaging Technology to increase reading confidence. This session includes a facilitated review of relevant cases.

Registration

https://hologicrsna.com

VW25

Automated Breast Volume Scanner (ABVS) Physician Training Workshop: An Interactive Learning Experience: Siemens Healthineers Vendor Workshop

Sunday, Nov. 25 1:05PM - 2:15PM Room: Booth 5530

Participants

Terri A. Gizienski, MD, Greenwood Village, CO (*Presenter*) Nothing to Disclose

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 unique coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

VW02

Breast Density and Improved Risk Assessment: GE Vendor Workshop

Sunday, Nov. 25 1:30PM - 2:00PM Room: Booth 8156

Participants

Jack Cuzick, London, United Kingdom (*Presenter*) Nothing to Disclose

Program Information

In this talk, Professor Cuzick will review several large cohort studies demonstrating not only the univariate strength of mammographic density, but also its near independence and added value to both questionnaire-based risk factors and single nucleotide polymorphism (SNP) panels. The value of changes in breast density after endocrine therapy as markers of treatment effectiveness is also briefly reviewed. *Registration is required; adding this session to the RSNA calendar tool alone does not secure your seat in this session. Click the link below to register.*

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2018-/agenda-e57e0b47e9aa4f5ba89b1a0da1e829b9.aspx

RC115

Screening for Breast Cancer

Sunday, Nov. 25 2:00PM - 3:30PM Room: E353C

BR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Jennifer A. Harvey, MD, Charlottesville, VA (*Moderator*) Stockholder, Hologic, Inc; Research Grant, Volpara Health Technologies Limited; Stockholder, Volpara Health Technologies Limited;

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Sub-Events

RC115A Screening Data: Where Are We?

Participants
Debra L. Monticciolo, MD, Temple, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review key data for breast cancer screening from randomized controlled trials and observational studies. 2) To understand the risks and benefits of mammography screening for the woman of average risk. 3) To understand the differences between various screening recommendations.

RC115B Risk Models

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

For information about this presentation, contact:

jharvey@virginia.edu

LEARNING OBJECTIVES

1) Cite pros and cons of different risk models in use. 2) Describe how risk models can be used in practice. 3) List which patients at risk may not be identified using risk models.

RC115C Personalized Screening Paradigms

Participants
Wendie A. Berg, MD, PhD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Distinguish and define average risk, intermediate risk, and high-risk populations. 2) Understand existing recommendations for supplemental screening beyond mammography and/or screening at an earlier age. 3) Discuss potential strategies for elective supplemental screening and expected outcomes.

RC124

The Best of RADIOLOGY in 2018: The Editors of RADIOLOGY Keep You Up to Date

Sunday, Nov. 25 2:00PM - 3:30PM Room: E353A

BR CA CH NR RS

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Sub-Events

RC124A Review of 2018: New Research That Should Impact Your Practice

Participants
David A. Bluemke, MD,PhD, Bethesda, MD (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Identify key publications over the past year that may affect your clinical practice. 2) Evaluate new research developments in the field of radiological imaging. 3) Describe new developments in radiology that may affect the management of your patients.

ABSTRACT

RADIOLOGY is the leading journal for publications leading to new, important and translatable discoveries in imaging research. In the past year, there continue to be basic developments in radiology, as well as new guidelines and clinical trials in imaging that affect your practice. Overall trends for new scientific studies reflect an increasing number of clinical trials being submitted from around the world in addition to those of North America. Publications from Europe have been prominent in recent years, but new research programs from countries such as Japan, South Korea and China are developing quickly. Large numbers of study subjects in clinical trials are now common, and tends to result in more robust demonstration of the efficacy of imaging interventions. Artificial intelligence applications are becoming commonplace in our publications, as are radiomics studies with increasing large numbers of study subjects. This seminar will highlight the results of key publications in the past year that are most likely to affect your practice in the near future, as well as presenting novel topics that are likely to be important to the field over the next 5 years.

RC124B Innovations in Cardiothoracic Imaging in 2018

Participants
Albert De Roos, MD, Leiden, Netherlands (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Key publications in cardiothoracic imaging 2018 will be highlighted.

ABSTRACT

Cardiothoracic manuscripts are frequently introducing new technology, acquisition techniques and clinical evaluation. Major advances in cardiothoracic imaging over the last year published in Radiology will be discussed for their innovation and potential impact.

RC124C Research and Innovations in Breast Imaging in 2018

Participants
Linda Moy, MD, New York, NY (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) To highlight key publications on breast imaging over the past year. 2) To discuss the implications of these publications for patient care

RC124D New Developments in Neuroimaging in 2018

Participants
Birgit B. Ertl-Wagner, MD, Toronto, ON (*Presenter*) Spouse, Stockholder, Siemens AG; ;

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LEARNING OBJECTIVES

1) Identify key publications over the past year that may affect your clinical practice. 2) Evaluate new research developments in the field of radiological imaging. 3) Describe new developments in radiology that may affect the management of your patients.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
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RC150

MR Imaging-guided Breast Biopsy (Hands-on)

Sunday, Nov. 25 2:00PM - 3:30PM Room: E260

BR MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Manisha Bahl, MD,MPH, Boston, MA (*Presenter*) Nothing to Disclose
Rosalind P. Candelaria, MD, Houston, TX (*Presenter*) Nothing to Disclose
Sarah M. Friedewald, MD, Chicago, IL (*Presenter*) Consultant, Hologic, Inc; Research Grant, Hologic, Inc;
Brian Johnston, MD, Gilbert, AZ (*Presenter*) Nothing to Disclose
Jennifer R. Kohr, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Lizza Lebron, MD, West Harrison, NY (*Presenter*) Nothing to Disclose
Diana L. Lam, MD, Seattle, WA (*Presenter*) Grant, General Electric Company
Santo Maimone IV, MD, Jacksonville, FL (*Presenter*) Research Consultant, GRAIL Inc
Cecilia L. Mercado, MD, New York, NY (*Presenter*) Nothing to Disclose
Bethany L. Niell, MD,PhD, Tampa, FL (*Presenter*) Nothing to Disclose
Jessica H. Porembka, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Elissa R. Price, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Jean M. Seely, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
Toma Omofoye, MD , Houston, TX (*Presenter*) Nothing to Disclose
Gaiane M. Rauch, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose
Roberta M. Strigel, MD, Madison, WI (*Presenter*) Research support, General Electric Company
Jocelyn A. Rapelyea, MD, Washington, DC (*Presenter*) Speakers Bureau, General Electric Company; Consultant, Transmed7;
Ryan W. Woods, MD, MPH, Madison, WI (*Presenter*) Nothing to Disclose
Beatriu Reig, MD, New York, NY (*Presenter*) Nothing to Disclose
Erin I. Neuschler, MD, Chicago, IL (*Presenter*) Research Grant, Seno Medical Instruments, Inc; Speaker, Northwest Imaging Forums, Inc; ; ;

For information about this presentation, contact:

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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) radiology/pathology concordance. 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

http://abstract.rsna.org/uploads/2018/4426451/Strigel-RSNA-MRIBx-2018-Handout RC150.pdf

VW03

Invenia ABUS 2.0 - Live Scanning Demo: GE Vendor Workshop

Sunday, Nov. 25 2:30PM - 3:00PM Room: Booth 8156

Participants
Doug Whisler, Sunnyvale, CA (*Presenter*)

Program Information

This thirty minute session will cover the latest technological advancements in ABUS design and performance. Attendees will learn how improvements in workflow and image quality have the potential to increase cancer detection in women with dense breast tissue. *Registration is required; adding this session to the RSNA calendar tool alone does not secure your seat in this session. Click the link below to register.*

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2018-/agenda-e57e0b47e9aa4f5ba89b1a0da1e829b9.aspx

VW26

AI-based Mammography Reading (Hands-on session): Siemens Healthineers Vendor Workshop

Sunday, Nov. 25 2:30PM - 3:40PM Room: Booth 5530

Participants

Nico Karssemeijer, PhD, Nijmegen, Netherlands (*Presenter*) Director and Shareholder, ScreenPoint Medical BV Shareholder, Volpara Health Technologies Limited Consultant, QView Medical, Inc Shareholder, QView Medical, Inc

Program Information

You will learn about the use of the AI-supported Transpara™* system from Screenpoint in combination with syngo® Breast Care to support 2D or 3D mammography reading. Transpara™ provides detection and decision support together with an overall exam based score for prioritization of reading. You will experience a case review session to explore the use of artificial intelligence in mammography reading. *Transpara™ is pending 510(k) clearance, and is not yet commercially available in the United States.

VW54

Advancements in Real-time Breast Specimen Imaging: Hologic Vendor Workshop

Sunday, Nov. 25 2:30PM - 3:00PM Room: Booth 5524

Program Information

Learn how real-time breast specimen imaging can streamline workflow efficiency through specimen verification and automated post-biopsy specimen handling with the Brevera® Breast Biopsy System. (Brevera® Breast Biopsy System)

Registration

https://hologicrsna.com

VW55

Breast Density Assessment: Beyond Radiologist Visual Assessment: Hologic Vendor Workshop

Sunday, Nov. 25 3:30PM - 4:00PM Room: Booth 5524

Participants

Regina J. Hooley, MD, New Haven, CT (*Presenter*) Consultant, Hologic, Inc

Program Information

A brief session for radiologists interested in learning more about implementing Breast Density Assessment Software. Including decreasing inter/intra-reader variability and increasing confidence in selecting appropriate patients that may need additional screening. (Quantra™)

Registration

https://hologicrsna.com

VW27

A Practical Approach to Breast Magnetic Resonance Imaging (MRI) Interpretation: An Interactive Session: Siemens Healthineers Vendor Workshop

Sunday, Nov. 25 3:50PM - 5:00PM Room: Booth 5530

Participants

Susan Weinstein, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Program Information

This interactive session will include both didactic and hands-on case review at workstations equipped with syngo® MR Brevis. A practical approach to breast MRI interpretation will be discussed as well as utilizing the available sequences and techniques to improve interpretive skills.

PS12

Sunday Afternoon Plenary Session

Sunday, Nov. 25 4:00PM - 5:45PM Room: Arie Crown Theater

BR CA CH GI GU MK NR PD VA

AMA PRA Category 1 Credits ™: 1.75
ARRT Category A+ Credit: 1.75

Participants
Vijay M. Rao, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Sub-Events

PS12A Report of the RSNA Research and Education Foundation

Participants
N. Reed Dunnick, MD, Ann Arbor, MI (*Presenter*) Royalties, Wolters Kluwer nv; Editor, Reed Elsevier

PS12B Image Interpretation Session

Participants
Donald P. Frush, MD, Durham, NC (*Moderator*) Nothing to Disclose
John Eng, MD, Cockeysville, MD (*Introduction*) Nothing to Disclose
Laura W. Bancroft, MD, Orlando, FL (*Presenter*) Author with royalties, Wolters Kluwer nv; Speaker, World Class CME; Editor, Thieme Medical Publishers, Inc; Travel support, Thieme Medical Publishers, Inc ; ;
Matthew S. Davenport, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Tomas C. Franquet, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose
R. Paul Guillerman, MD, Houston, TX (*Presenter*) Consultant, Guerbet SA
Christopher P. Hess, MD, PhD, Mill Valley, CA (*Presenter*) Nothing to Disclose
Andrea Laghi, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Elizabeth A. Morris, MD, New York, NY (*Presenter*) Nothing to Disclose
Pamela K. Woodard, MD, Saint Louis, MO (*Presenter*) Research agreement, Siemens AG; Research, Eli Lilly and Company; Research, F. Hoffmann-La Roche Ltd; ; ; ; ; ;

For information about this presentation, contact:

woodardp@wustl.edu

VW05

Patients Respond Positively to Supplemental Screening with ABUS and Report an Added Sense of Security: GE Vendor Workshop

Sunday, Nov. 25 4:00PM - 4:25PM Room: Booth 8156

Program Information

Supplemental screening with ultrasound is proving to be an effective tool in detecting mammographically occult breast cancers. The aim of this study is to identify characteristics of breast cancers detected by supplemental ABUS for women with dense breast tissue, and to detect small, majority node negative, clinically significant, invasive breast cancers. *Registration is required; adding this session to the RSNA calendar tool alone does not secure your seat in this session. Click the link below to register.*

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2018-/agenda-e57e0b47e9aa4f5ba89b1a0da1e829b9.aspx

VW06

Hearing from the Voices That Matter: The Patients: GE Vendor Workshop

Sunday, Nov. 25 4:30PM - 5:00PM Room: Booth 8156

Program Information

In this study, patients report low anxiety, greater physical comfort and increased security that ABUS will detect a breast cancer that mammography may miss in the setting of dense breast tissue. In addition, current patient research, including density notification and attitudes toward screening, will be presented. *Registration is required; adding this session to the RSNA calendar tool alone does not secure your seat in this session. Click the link below to register.*

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2018-/agenda-e57e0b47e9aa4f5ba89b1a0da1e829b9.aspx

VW56

True Patient Comfort: Genius™ 3D Mammography™ Exam and SmartCurve™ Breast Stabilization System (In Spanish): Hologic Vendor Workshop

Sunday, Nov. 25 4:30PM - 5:00PM Room: Booth 5524

Program Information

A clinical perspective on the implementation of Genius™ 3D Mammography™ exam and the SmartCurve™ Breast Stabilization System without compromising image quality, exam time, dose or workflow. This session includes clinical feedback and tips to increase patient comfort. (Genius™ 3D Mammography™, SmartCurve™ Breast Stabilization System)

Registration

https://hologicrsna.com

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ED001-MO

Breast Monday Case of the Day

Monday, Nov. 26 7:00AM - 11:59PM Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Jessica H. Porembka, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Amy M. Fowler, MD, PhD, Madison, WI (*Abstract Co-Author*) Research support, General Electric Company
Susan O. Holley, MD, PhD, Raleigh, NC (*Abstract Co-Author*) Nothing to Disclose
Alexander B. Sevrukov, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Chandni Bhimani, DO, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Catherine A. Young, MD, JD, Saint Louis, MO (*Abstract Co-Author*) Research support, Hologic, Inc
Cheryl R. Herman, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Michelle V. Lee, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Mai A. Elezaby, MD, Madison, WI (*Abstract Co-Author*) Research Grant, Exact Sciences Corporation
Lonie R. Salkowski, MD,PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Roberta M. Strigel, MD, Madison, WI (*Abstract Co-Author*) Research support, General Electric Company
Ryan W. Woods, MD, MPH, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Urvi A. Tailor, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Lindsay Compton, MD, Dallas, TX (*Abstract Co-Author*) Researcher, QT Ultrasound, LLC
Ramapriya Ganti, MD, Dallas, TX (*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.

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SPSC20

Controversy Session: Screening Breast MRI: Abbreviated versus Full Protocol

Monday, Nov. 26 7:15AM - 8:15AM Room: E350

BR MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Margarita L. Zuley, MD, Pittsburgh, PA (*Moderator*) Investigator, Hologic, Inc

For information about this presentation, contact:

zuleyml@upmc.edu

LEARNING OBJECTIVES

1) Understand the acquisition parameters for full vs abbreviated protocols for screening MRI. 2) Understand the literature surrounding the benefits and limitations of each methodology. 3) Improve your interpretive skills for screening MRI.

Sub-Events

SPSC20A Abbreviated Protocol

Participants
Christopher E. Comstock, MD, New York, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

comstocc@mskcc.org

LEARNING OBJECTIVES

1) Describe the concept of abbreviated breast MRI (AB-MR) for breast cancer screening. 2) Review the data and current studies evaluating AB-MR. 3) Discuss the possible benefits and future direction of the use of AB-MR.

SPSC20B Full Protocol

Participants
Bonnie N. Joe, MD, PhD, San Francisco, CA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

bonnie.joe@ucsf.edu

LEARNING OBJECTIVES

1) Describe the components of a full protocol breast MRI exam. 2) Understand the benefits and limitations of the full protocol breast MRI exam in contrast to an abbreviated protocol.

ABSTRACT

This session will review the main components of the full-protocol breast MRI exam, including technical considerations. Benefits and limitations of the full protocol versus an abbreviated protocol for breast cancer screening will be discussed.

URL

NA

CS22

Contrast Enhanced Mammography: Incorporating CEM Into Your Clinical Practice: Presented by Hologic, Inc.

Monday, Nov. 26 8:30AM - 9:30AM Room: S102AB

Participants
Bhavika K. Patel, MD, Phoenix, AZ (*Presenter*) Speaker, Hologic, Inc

PROGRAM INFORMATION

This CME accredited symposium will focus on the implementation and advancement of utilizing contrast enhanced mammography (CEM) to advance your clinical confidence. Areas of discussion include: 1) Requirements for building contrast-enhanced mammography into your practice. 2) Proper patient selection for utilizing CEM. 3) Evaluation and interpretation of CEM as a diagnostic tool.

CME

https://cine-med.com/rsna/

RSVP

https://cine-med.com/rsna/

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MSRO25

BOOST: Breast-Oncology Anatomy (Interactive Session)

Monday, Nov. 26 8:30AM - 10:00AM Room: S103CD

BR OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants

Stephanie Markovina, MD, PhD, Saint Louis, MO (*Moderator*) Nothing to Disclose
Amy M. Fowler, MD, PhD, Madison, WI (*Presenter*) Research support, General Electric Company
Maria A. Thomas, MD, PhD, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand breast and regional lymph node anatomy. 2) Become familiar with basic anatomic structures and breast pathology using various 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.

RC215

Breast Series: Hot Topics (The In-Person Presentation is Supported by an Unrestricted Educational Grant from Hologic)

Monday, Nov. 26 8:30AM - 12:00PM Room: Arie Crown Theater

AI BR

AMA PRA Category 1 Credits ™: 3.50
ARRT Category A+ Credits: 4.00

FDA Discussions may include off-label uses.

Participants
Linda Moy, MD, New York, NY (*Moderator*) Nothing to Disclose
Fiona J. Gilbert, MD, Cambridge, United Kingdom (*Moderator*) Research Grant, Hologic, Inc; Research Grant, General Electric Company; Research Grant, GlaxoSmithKline plc; Research Consultant, Alphabet Inc

Sub-Events

RC215-01 Radiomics

Monday, Nov. 26 8:30AM - 8:50AM Room: Arie Crown Theater

Participants
Karen Drukker, PhD, Chicago, IL (*Presenter*) Royalties, Hologic, Inc

For information about this presentation, contact:

kdrukker@uchicago.edu

Active Handout:Karen Drukker

http://abstract.rsna.org/uploads/2018/18000478/RSNA2018_Drukker_Handout RC215-01.pdf

LEARNING OBJECTIVES

1) Identify the scientific premise, motivation, and increasing role of radiomics in medical imaging. 2) Compare 'conventional' radiomics methods and deep learning-based radiomics methods. 3) Assess some of the challenges for radiomics-based decision support systems in becoming powerful players in modern precision medicine.

RC215-02 Quantitative Diffusion-Weighted MRI of Estrogen Receptor-Positive, Lymph Node-Negative Invasive Breast Cancer: Association between Whole-Lesion Apparent Diffusion Coefficient Metrics and Recurrence Risk

Monday, Nov. 26 8:50AM - 9:00AM Room: Arie Crown Theater

Participants
Jin You Kim, MD, Busan, Korea, Republic Of (*Presenter*) Nothing to Disclose
Lee Hwangbo, MD, Pusan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Joo Kim, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Suk Kim, MD, Pusan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

youdosa@naver.com

PURPOSE

To investigate possible associations between quantitative apparent diffusion coefficient (ADC) metrics derived from whole-lesion histogram analysis and breast cancer recurrence risk in patients with estrogen receptor (ER)-positive, lymph node-negative invasive breast cancer who underwent the Oncotype DX assay.

METHOD AND MATERIALS

Institutional review board approval was obtained for this retrospective study, which was conducted on 74 women (mean age, 49.3 years) with ER-positive, lymph node-negative invasive breast cancer who underwent the Oncotype DX assay and preoperative diffusion-weighted MRI from July 2015 to January 2018. Histogram analysis of pixel-based ADC data of whole tumors was performed by two radiologists using a software tool and various ADC histogram parameters (mean, minimum, maximum, and 5th, 25th, 50th, 75th, and 95th percentile ADCs) were extracted. The ADC difference value (defined as the difference between minimum and maximum ADC) was calculated to assess intratumoral heterogeneity. Associations between quantitative ADC metrics and Oncotype DX risk groups (low [recurrence score (RS) <18], intermediate (RS 18-30), and high [RS >30]) were evaluated by receiver operating characteristic (ROC) curve and logistic regression analyses.

RESULTS

Whole-lesion histogram analysis showed minimum ADCs, maximum ADCs, and ADC difference values were significantly different between low and non-low (ie, intermediate and high) risk groups (0.604, 1.478, and 0.874 × 10-3mm2/s versus 0.374, 1.687, and

1.321 × 10-3mm2/s, respectively; P<0.001, P=0.010, and P<0.001, respectively). The ADC difference value yielded the largest area under the ROC curve (0.771; 95% confidence interval [CI]: 0.650, 0.891; P<0.001) for differentiating the two groups. Multivariate regression analysis showed that the ADC difference value was the only significant factor associated with low Oncotype DX risk group (adjusted odds ratio = 0.998; 95% CI: 0.996, 0.999; P<0.001).

CONCLUSION

The ADC difference value derived from whole-lesion histogram analysis could be helpful for identifying ER-positive, lymph node-negative invasive breast cancer patients with low risk of recurrence.

CLINICAL RELEVANCE/APPLICATION

In estrogen receptor-positive, lymph node-negative breast cancer, the ADC difference value derived from whole-lesion histogram assessments might serve as quantitative biomarkers of recurrence risk.

RC215-03 Radiomic Phenotypes of Tumor Heterogeneity from Pre-Operative DCE-MRI Predict Breast Cancer Recurrence after 10-Year Follow-Up: Phenotype Discovery and Independent Validation

Monday, Nov. 26 9:00AM - 9:10AM Room: Arie Crown Theater

Participants
Rhea Chitalia, Philadelphia, PA (*Presenter*) Nothing to Disclose
Jennifer Rowland, MD, Philadelphia, PA (*Abstract Co-Author*) 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
Eric A. Cohen, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Aimilia Gastounioti, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Kathleen M. Thomas, BS, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Rebecca Batiste, 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*) Grant, Hologic, Inc; Consultant, Hologic, Inc; Grant, iCAD, Inc; Consultant, iCAD, Inc; Speaker, iiCME
Despina Kontos, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

rhea.chitalia@uphs.upenn.edu

PURPOSE

To validate intrinsic imaging phenotypes of tumor heterogeneity and evaluate their prognostic performance in predicting 10-year recurrence.

METHOD AND MATERIALS

Pre-treatment DCE-MRI scans of 94 women with primary invasive breast cancer and 10-year follow up data available were retrospectively analyzed from a clinical trial cohort at our institution (2002-2006). For each woman, a signal enhancement ratio map was generated for the most representative slice of the primary lesion from which morphologic features were calculated. Radiomic features (histogram, run-length, structural, and co-occurrence matrix features) were extracted and summarized over tumor quadrants. Intrinsic phenotypes of tumor heterogeneity were identified via unsupervised hierarchical clustering applied to the extracted feature vectors, with significant clusters found using Consensus Clustering and the SigClust method. Differences across phenotypes by hormone receptor status, tumor size, post-surgery therapy, TNM staging, and recurrence outcomes were assessed using Chi-square and Kruskal-Wallis tests. An independent dataset of 116 women diagnosed with primary invasive breast cancer (2002-2006), available via The Cancer Imaging Archive, was used to validate phenotype reproducibility. Survival probabilities across phenotypes were evaluated using Kaplan-Meier curves and phenotype cluster assignments were added to a baseline Cox proportional hazards model with established histopathologic prognostic factors to predict RFS.

RESULTS

Three significant phenotypes of low, medium, and high heterogeneity were identified in the discovery cohort and reproduced in the validation cohort (p<0.001). No recurrent cases were found in the low heterogeneity phenotype (p<0.001). Clinical stage, mitotic grade, lymph invasion, and nuclear grade were different across phenotypes (p<=0.02). Kaplan-Meier curves showed significant differences (p < 0.001) in RFS probabilities across phenotypes. The augmented model including phenotype assignment had a higher discriminatory capacity (c-statistic= 0.80) compared to a baseline model with only established prognostic factors (c-statistic= 0.65, p<0.01).

CONCLUSION

Intrinsic imaging phenotypes of tumor heterogeneity can predict 10-year recurrence as validated in an independent dataset.

CLINICAL RELEVANCE/APPLICATION

Radiomic phenotypes could provide a non-invasive characterization of tumor heterogeneity to augment personalized prognosis and treatment.

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

RC215-04 Robustness of Computer-aided Diagnosis of Breast Cancer Using Radiomics and Machine Learning Classification of 1,461 Lesions across Populations in China and the United States

Monday, Nov. 26 9:10AM - 9:20AM Room: Arie Crown Theater

Participants
Heather Whitney, PhD, Wheaton, IL (*Presenter*) Nothing to Disclose
Hui Li, PHD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Yu Ji, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Alexandra V. Edwards, Chicago, IL (*Abstract Co-Author*) Research Consultant, QView Medical, Inc; Research Consultant, Quantitative Insights, Inc
John Papaioannou, MSc, Chicago, IL (*Abstract Co-Author*) Research Consultant, QView Medical, Inc
Peifang Liu, MD, PhD, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Maryellen L. Giger, PhD, Chicago, IL (*Abstract Co-Author*) Stockholder, Hologic, Inc; Shareholder, Quantitative Insights, Inc; Shareholder, QView Medical, Inc; Co-founder, Quantitative Insights, Inc; Royalties, Hologic, Inc; Royalties, General Electric Company; Royalties, MEDIAN Technologies; Royalties, Riverain Technologies, LLC; Royalties, Mitsubishi Corporation; Royalties, Canon Medical Systems Corporation

For information about this presentation, contact:

hwhitney@uchicago.edu

PURPOSE

To assess the performance of computer aided diagnosis (CADx) in breast lesions imaged with DCE-MR in two patient cohorts, one in China and one in the United States (US), using extracted radiomic features and machine learning classification.

METHOD AND MATERIALS

Dynamic contrast-enhanced magnetic resonance (DCE-MR) images of 1,461 breast lesions (from China, GE scanners: 300 benign lesions, 302 malignant cancers; from the US, Philips scanners: 268 benign lesions, 591 malignant cancers) were collected under HIPAA and IRB compliance. The lesions were segmented automatically using a fuzzy c-means method. Thirty-eight radiomic features describing size, shape, morphology, kinetics, and texture were extracted using previously reported methods. The performance of CADx for classification between benign lesions and malignant cancers was evaluated with two methodologies: (a) independent training and testing of the datasets, with each set serving as a training set while the other served as a testing set; and (b) ten-fold cross validation within each set. Classification was performed using support vector machines with optimization of the hyperparameters. The area under the ROC curve (AUC) served as figure of merit, with its value and standard error determined using the conventional binormal model. The AUCs resulting from (a) and (b) were compared within and between each methodology. Difference in AUC was significantly different when $p < 0.05$.

RESULTS

When radiomic features extracted from MRIs acquired in China were used to train the machine classifiers and independent testing was conducted on MRIs acquired in the US, AUC = 0.77 (0.02), while the reverse resulted in AUC = 0.79 (0.02). For cross-validation within each set, AUC = 0.82 (0.02) for the US database and AUC = 0.80 (0.02) for the China database. AUCs compared across methodologies failed to show significant difference.

CONCLUSION

Computer aided diagnosis of breast lesions demonstrated potential robustness across independent populations in both independent training/testing and in cross validation.

CLINICAL RELEVANCE/APPLICATION

Radiomic features extracted from DCE-MRI may be robust for classifying breast lesions as benign or malignant across two cohorts (one in China, one in US), enhancing translation to clinical use.

RC215-05 Radiogenomics

Monday, Nov. 26 9:20AM - 9:40AM Room: Arie Crown Theater

Participants
Lars J. Grimm, MD, Durham, NC (*Presenter*) Editorial Advisory Board, Medscape, LLC; Educational program support, Hologic, Inc

For information about this presentation, contact:

lars.grimm@duke.edu

LEARNING OBJECTIVES

1) Define radiogenomics and describe how it differs from radiomics. 2) Examine the limitations of current radiogenomics research. 3) Assess the utility of radiogenomics in clinical practice. 4) Develop a framework to evaluate future radiogenomics research.

RC215-06 Proteomic Expression Underlying Quantitative MRI Features in Breast Cancer: A Radioproteomics Study

Monday, Nov. 26 9:40AM - 9:50AM Room: Arie Crown Theater

Participants
Ryan M. Hausler, BS, Pittsburgh, PA (*Presenter*) Nothing to Disclose
Ruimei Chai, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
Dooman Arefan, PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Jules H. Sumkin, DO, Pittsburgh, PA (*Abstract Co-Author*) Research Grant, Hologic, Inc; Research Grant, General Electric Company
Min Sun, MD,PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Shandong Wu, PhD, MSc, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

rmh1995@gmail.com

PURPOSE

The complementary analysis of breast cancer via radiology imaging and molecular pathology approaches has spurred radiogenomics and radioproteomics studies. We performed an investigation of the relationships between quantitative radiomic imaging phenotype data and underlying proteomic expression, with the goal of improving precise breast cancer diagnosis and cancer behavior characterization.

METHOD AND MATERIALS

We identified a retrospective cohort of 40 invasive breast cancer patients from a single medical center. Their integrated protein expression data were obtained from The Cancer Genome Atlas study. The proteomic data was acquired via Reverse Phase Protein Array (RPPA) to measure the expression of 217 breast cancer related proteins and phospho-proteins. Dynamic Contrast Enhanced Magnetic Resonance Imaging (DCE-MRI) data of the 40 patients were collected from clinical archive, all acquired with a 1.5T same-vendor scanner. A set of 30 radiomic imaging features were extracted from automatically-segmented tumor volume in all 40 DCE-MRIs to capture tumor morphological and contrast enhancement characteristics. Multivariate linear regression was used to map the associations between each imaging feature with each of the 217 protein expressions, controlling for patient age and cancer stage. A p value was obtained evaluating the significance of the association and was adjusted for multiple comparisons of the selected radiomic feature against every protein. Adjusted p values less than 0.05 were recorded.

RESULTS

The average patient age at scan was 38.7±12 years, 10 (25%) of which were pre- with the rest post-menopausal. We found a variety of expression of cancer related proteins were significantly associated (positively or negatively) with a subset of morphological and contrast enhancement kinetics related imaging features. For example, ERCC5 (a protein responsible for DNA repair following UV-induced damage) is negatively associated with the tumor brightness and contrast agent uptake rates. The full association map is shown in the attached figure.

CONCLUSION

Our study showed that the expression of several cancer related proteins were found to be linearly associated with quantitative DCE-MRI-derived phenotype features in invasive breast tumors.

CLINICAL RELEVANCE/APPLICATION

Radioproteomic studies of cancer can help to decipher how molecular mechanisms may regulate the development of specific tumor phenotypes.

RC215-07 Prediction of 21-gene Recurrence Score in Patients with Estrogen Receptor-positive Early-Stage Breast Cancer Using MRI-based Radiomics Nomogram

Monday, Nov. 26 9:50AM - 10:00AM Room: Arie Crown Theater

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PURPOSE

To develop a breast MRI-based radiomics nomogram including pathologic factors which can predict low-risk recurrence score (RS) on 21-gene RS assay in patients with estrogen receptor-positive early-stage breast cancer (EBC).

METHOD AND MATERIALS

From 2011 to 2017, a total of 547 tumors in 539 patients with EBC who underwent preoperative breast MRI were retrospectively included in this study. Among them, low-risk was 320 (58.5%), intermediate-risk was 180 (32.9%), and high-risk was 47 (8.6%). We extracted 744 quantitative MR radiomic features from computerized three-dimensional segmentations of each tumor generated computer-extracted image phenotypes (CEIP) within the intratumoral regions of early post-contrast T1-weighted images, percent enhancement (PE) map, signal enhancement ratio (SER) map, and T2-weighted images. We divided 547 cases into a training set (n=365) and a validation set (n=182). Elastic net was used for feature selection and radiomics score building. Multivariate logistic regression analysis was used to develop a prediction model, we incorporated the radiomics score and independent pathologic risk factors and build a radiomics nomogram. Internal validation for an independent validation set (n=182) was performed.

RESULTS

The radiomics score, which consisted of 24 selected CEIPs, was significantly associated with the prediction of recurrence (C-index, 0.769 for training set and 0.745 for validation set). Independent pathologic predictors contained in the nomogram were progesterone receptor status, nuclear grade, histologic grade, extensive intraductal component, lymphovascular invasion, P53, and Ki67 status, and their C-index was 0.858 for training set and 0.774 for validation set. Addition of radiomics score to the pathologic nomogram showed an incremental value of 0.054 and 0.092, respectively. Radiomics nomogram showed good prediction of low-risk RS, with a C-index of 0.912 for training set and 0.866 for validation set.

CONCLUSION

This study shows that a radiomics nomogram which incorporates the MRI-based radiomics score and pathologic features, can be used to help the preoperative individualized prediction of low-risk RS in patients with EBC.

CLINICAL RELEVANCE/APPLICATION

Prediction nomogram using breast MRI-based radiomics score and pathologic predictors can be used to facilitate the preoperative individualized prediction of low-risk RS on 21-gene RS assay in patients with EBC.

RC215-08 Can Histogram Analysis of Dynamic Contrast-Enhanced MRI and Apparent Diffusion Coefficient Map Predict Molecular Subtypes of Invasive Breast Cancers?

Monday, Nov. 26 10:00AM - 10:10AM Room: Arie Crown Theater

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PURPOSE

To evaluate if histogram analysis of dynamic contrast-enhanced (DCE) MRI and apparent diffusion coefficient (ADC) maps with diffusion-weighted imaging (DWI) can predict molecular subtypes of invasive breast cancers.

METHOD AND MATERIALS

In this HIPAA-compliant and IRB-approved study we retrospectively evaluated 91 consecutive patients from January 2011 to January 2013 with invasive ductal carcinoma of the breast who underwent multiparametric MRI with DCE and DWI at our institution. The exclusion criteria were 1) lesion smaller than 1 cm, 2) previous treatment for breast cancer, 3) pathology report unavailable, and 4) poor image quality. One experienced breast radiologist drew a region of interest on DCE MRI and ADC maps on the slice with the largest diameter of the solid portion of the lesion avoiding cystic areas and biopsy markers. The histogram analysis was performed and the mean, variance, kurtosis and skewness were calculated. Molecular breast cancer subtypes were derived by IHC surrogates. Tumors were classified as luminal A if either ER or PR was positive and HER2 was negative, Luminal B if either ER or PR was positive and HER2 positive, HER2-enriched if ER and PR were negative and HER2 positive and triple-negative if ER, PR and HER2 were negative. Nonparametric Mann-Whitney U test and Kruskal-Wallis were used to compare groups of molecular subtypes. P-values <0.05 were accepted to be statistically significant.

RESULTS

The histogram analysis of DCE images and ADC maps of 91 breast cancers demonstrated no significant difference among breast tumor molecular subtypes. Measurements of the mean, variance, kurtosis and skewness were used to compare luminal A/B with HER-2 enriched/triple-negative cancers, without significant results for both DCE (p-value = 0.405, 0.252, 0.667, 0.809) and ADC (0.204, 0.081, 0.941, 0.574), respectively. Histogram measurements were also used to compare luminal A with other subtypes and also demonstrated no significant difference for DCE (0.659, 0.162, 0.516, 0.833) and ADC (0.204, 0.222, 0.495, 0.896).

CONCLUSION

Histogram analysis of DCE MRI and ADC map cannot predict molecular subtypes of invasive breast cancers.

CLINICAL RELEVANCE/APPLICATION

Despite many valuable applications of histogram analysis in diagnostic imaging, it cannot predict molecular subtypes of invasive breast cancers.

RC215-09 CESM Enhancement Pattern and Intensity and Its Correlation to Breast Cancer Immunophenotype: Preliminary Results

Monday, Nov. 26 10:10AM - 10:20AM Room: Arie Crown Theater

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PURPOSE

The differences in the intensity and pattern of enhancement in CESM between breast carcinomas might result from the differences in the amount of contrast that leaked out from the blood vessels and timely arrested in the interstitium. The aim of this paper is to study the expression of podoplanin in cancer stroma and its relation to breast cancer immunophenotype.

METHOD AND MATERIALS

Patients with lesions enhancing on CESM were subjected to biopsy - material obtained during biopsies was histopathologically verified. In the present study we retrospectively investigated 97 invasive breast carcinomas diagnosed in 94 patients. This study was performed in compliance with the Declaration of Helsinki and it received the approval of Ethical Committee at the Regional Medical Chamber. For each tumor enhancing on CESM, the intensity and the pattern of enhancement were evaluated. The enhancement of contrast agent uptake was qualitatively assessed as weak/medium or strong ,while the pattern as heterogenous or homogenous. Lymphatic vessels were defined as strongly podoplanin-stained structures with lymphatic vessel characteristics , clearly distinguishable from other tissue structures and cells. We classified tumor stroma as: podoplanin-sparse and podoplanin-rich.

RESULTS

Strong enhancement on CESM was found more frequently in: large tumors (pT>1), node-positive carcinomas, in tumors with podoplanin-sparse stroma vs. tumors with podoplanin-rich stroma . We found no relationship between enhancement on CESM and: tumor grade, histological type of cancer, breast cancer immunophenotype and Ki-67LI. However, in luminal A tumors strong enhancement on CESM was insignificantly more frequent as compared to neoplasms with non-luminal A subtype .

CONCLUSION

In our study prognostic significance of selected CESM features was found for the first time: strong and heterogenous enhancement on CESM was related to poor patients' outcome. In this study, the aforementioned correlation was additionally confirmed by the relationship between strong enhancement on CESM and nodal involvement or large tumor size.

CLINICAL RELEVANCE/APPLICATION

Our results may suggest that intensity and pattern of enhancement on CESM might bring (together with the results of diagnostic imaging methods) not only the confirmation of presence or absence of tumor, but also prognostic information.

RC215-10 Development of MRI-based Radiomics Nomogram for the Prediction of Recurrence in Patients with Luminal-type Breast Cancer: A Nested Case-Control Study

Monday, Nov. 26 10:20AM - 10:30AM Room: Arie Crown Theater

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PURPOSE

To determine whether breast MRI-based radiomics nomogram including pathologic factors can predict recurrences or distant metastasis in patients with luminal-type breast cancer (LTBC).

METHOD AND MATERIALS

From 2006 to 2012, a total of 348 patients with LTBC who underwent preoperative breast MRI were retrospectively included in this study. Patients with recurrence were 174. Patients without recurrence were matched in terms of age, stage, and type of chemotherapy, and developed 174 nested case-control pairs. We extracted 804 quantitative MR radiomic features of computerized three-dimensional segmentations of each cancer generated computer-extracted image phenotypes (CEIP) within the intratumoral regions of early post-contrast T1-weighted images, percent enhancement (PE) map, signal enhancement ratio (SER) map, and T2-weighted images. We divided 174 case-control matches into a training set (n=232) and a validation set (n=116). Elastic net was used for feature selection and radiomics score building. Multivariate logistic regression analysis was used to develop the prediction model, we incorporated the radiomics score and independent pathologic risk factors and build a radiomics nomogram. Internal validation for an independent validation set (n=76) was performed.

RESULTS

The radiomics score, which consisted of 14 selected CEIPs, was significantly associated with the prediction of recurrence (C-index, 0.864 for training set and 0.815 for validation set). Independent pathologic predictors contained in the nomogram were progesterone receptor status, P53, lymphovascular invasion, Ki67 status, and lymph node ratio, and their C-index was 0.695 for training set and 0.701 for validation set. Addition of radiomics score to the pathologic nomogram showed an incremental value of 0.211 and 0.177, respectively. Radiomics nomogram showed good prediction of recurrence, with a C-index of 0.906 for training set and 0.878 for validation set.

CONCLUSION

This study shows that a radiomics nomogram which incorporates the MRI-based radiomics score and pathologic features, can be used to help the individualized prediction of local or distant recurrence in patients with LTBC.

CLINICAL RELEVANCE/APPLICATION

Nomogram using breast MRI-based radiomics score and pathologic predictors can be used to facilitate the individualized prediction of recurrence in patients with LTBC.

RC215-11 Horizons with Deep Learning

Monday, Nov. 26 10:40AM - 11:00AM Room: Arie Crown Theater

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LEARNING OBJECTIVES

1) To understand the importance implementing deep learning tools into a breast imager's workflow. 2) To understand applications of deep learning outside of detection and characterization of breast lesions.

RC215-12 Incorporating Patient Characteristics in Breast Cancer Screening with Deep Convolutional Neural (DCN) Network

Monday, Nov. 26 11:00AM - 11:10AM Room: Arie Crown Theater

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PURPOSE

To determine if the addition of patient characteristics obtained from the electronic health records may improve the ability of a DCN network to detect and classify lesions on screening mammography.

METHOD AND MATERIALS

This is a retrospective study of a DCN network trained on over 250,000 screening mammograms performed at our institution from 2010-2016. The patients were sorted according to the date of their latest exam and divided into training (first 80%), validation (next 10%), and test (last 10%) sets. In the test phase, only the most recent exam was used for each patient. Patient characteristics including age, family history of breast cancer, and history of prior examinations were extracted from the radiologist reports. The original high-resolution images and extracted side information were utilized as inputs by a multi-column DCN network to classify BI-RADS category. The model was evaluated using area under the receiver operating characteristic curve (AUC) analysis. Analysis was also performed after stratifying patients by age-group and breast density (dense vs non-dense).

RESULTS

The overall performance of the DCN network improved with the addition of patient characteristics in comparison to using images alone (AUC 0.750 vs 0.733). This improvement was especially notable for BI-RADS 0 cases, with an AUC of 0.664 vs 0.618. Performance also generally improved with increasing age, with an average AUC of 0.759 in patients over 70 years of age. Finally, performance of the model is superior in dense breasts vs non-dense breasts (AUC 0.740 vs AUC 0.707).

CONCLUSION

The performance of DCN networks in evaluating screening mammograms increases with the addition of patient characteristics information, especially in the abnormal BI-RADS 0 cases which are the most difficult to evaluate.

CLINICAL RELEVANCE/APPLICATION

End-to-end architectures of DCN networks, like ours, support the incorporation of patient characteristics to increase the accuracy of deep learning algorithms in breast cancer screening.

RC215-13 Detecting Breast Cancer in Mammography: A Deep Learning-Based Computer System versus 101 Radiologists

Monday, Nov. 26 11:10AM - 11:20AM Room: Arie Crown Theater

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PURPOSE

To compare the stand-alone performance of a computer-based detection system to that of radiologists in detecting breast cancer on digital mammography (DM).

METHOD AND MATERIALS

Nine multi-reader multi-case (MRMC) study datasets previously used for different performance evaluation purposes in seven countries were collected. Each dataset consisted of DM exams acquired with systems from four different vendors, multiple radiologists' assessments per exam (BI-RADS or probability-of-malignancy scores), and ground truth: yielding a total of 2,458 exams (608 malignant) and interpretations by 101 radiologists (28,373 independent exam interpretations). A deep learning-based computer system (Transpara, ScreenPoint Medical, Nijmegen, The Netherlands) was used to automatically analyze each exam, resulting in a score for suspiciousness of cancer (1-100). Independently for each dataset, the area under the receiver operating characteristic curve (AUC) and the sensitivity at the radiologists' specificity level (case recall) were compared between the computer and radiologists using MRMC analysis of variance.

RESULTS

The performance of the computer system was not significantly different to that of the average of radiologists in eight of nine datasets (AUC differences ranged between -2.6% and +2.5%, P>0.329) and was significantly better in the ninth (+4.6%, P=0.036). At the average specificity of the radiologists, the computer had an equal or higher sensitivity (+0-9%, P>0.083) in all datasets but one (-13%, P=0.066). Comparing individually, the computer had an AUC and sensitivity higher than 53% and 65% of all radiologists, respectively.

CONCLUSION

A computer system based on deep learning has an equivalent performance to radiologists for detecting breast cancer in mammography.

CLINICAL RELEVANCE/APPLICATION

Whether used for decision support (preventing overlook and interpretation errors that are relatively common in the reading of mammography) or as stand-alone readers, computer systems performing at radiologist-like level might herald a breakthrough in the breast cancer detection workflow with mammography. In some situations, where there is a lack of experienced breast radiologists, it might even allow the development or continuation of screening programs.

RC215-14 Improving Accuracy and Efficiency with Concurrent Use of Artificial Intelligence for Digital Breast Tomosynthesis Screening

Monday, Nov. 26 11:20AM - 11:30AM Room: Arie Crown Theater

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PURPOSE

Screening with Digital Breast Tomosynthesis (DBT) improves accuracy but prolongs reading time when compared to Full-Field Digital Mammography (FFDM) alone. A reader study evaluated concurrent use of Artificial Intelligence (AI) to shorten reading time, while maintaining or improving sensitivity and specificity.

METHOD AND MATERIALS

An AI system based on deep convolutional neural networks was developed to identify suspicious soft tissue and calcific lesions in DBT slices. Findings are outlined in slices, indicating AI's confidence of malignancy with 0-100 scores. A retrospective, fully-crossed, multi-reader, multi-case designed study compared performance of 24 radiologists reading 260 DBT cases both with and without AI. The case set included 65 cancer cases with 66 malignant lesions and 65 cases with biopsy-proven benign lesions. Readings with and without AI occurred in 2 visits separated by a memory washout period of at least 4 weeks. Performance was assessed by measuring Area Under the ROC Curve (AUC) for malignant lesions with AI versus without AI. Reading time, sensitivity, specificity and recall rate were also assessed.

RESULTS

Radiologist performance for detection of malignant lesions, measured by mean AUC, increased 0.057 with use of AI (95% CI: 0.028, 0.087; $p < 0.01$), from 0.795 without AI to 0.852 with AI. Reading time decreased 52.7% with use of AI (95% CI: 41.8%, 61.5%; $p < 0.01$), from 64.1 sec without AI to 30.4 sec with AI, using a normalizing transformation to appropriately assess reading times that

were not normally distributed. Sensitivity increased from 77.0% without AI to 85.0% with AI (8.0%; 95% CI: 2.6%, 13.4%; $p < 0.01$), specificity increased from 62.7% without AI to 69.6% with AI (6.9%; 95% CI: 3.0%, 10.8%; $p < 0.01$), and recall rate for non-cancers decreased from 38.0% without AI to 30.9% with AI (7.2%; 95% CI: 3.1%, 11.2%; $p < 0.01$).

CONCLUSION

Concurrent use of AI improves cancer detection with increases of 0.057 in AUC, 8.0% in sensitivity, and 6.9% in specificity; and decreases of 7.2% in recall rate and 52.7% in reading time.

CLINICAL RELEVANCE/APPLICATION

Radiologist's concurrent use of AI for DBT with certainty of finding scores increases detection of breast cancer with significant reduction in reading time while improving sensitivity and specificity.

RC215-15 Breast Cancer Temporal Risk Prediction by Deep Learning and Longitudinal Digital Mammogram Images

Monday, Nov. 26 11:30AM - 11:40AM Room: Arie Crown Theater

Participants
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PURPOSE

Mammographic breast density is a risk factor and recent studies showed deep learning may identify more predictive imaging risk features than breast density. We performed a study to investigate temporal breast cancer risk prediction by using deep learning models on longitudinal 'normal' screening mammograms acquired prior to diagnosis of breast cancer.

METHOD AND MATERIALS

We conducted a retrospective case-control study on a cohort of 226 patients (1:1 case-control ratio) who underwent standard mammographic screening at our institution during 2006-2013. The unilateral cancer cases (61.3±10.3YO) were all newly diagnosed at 2013 and confirmed by pathology. Asymptomatic cancer-free controls (60.1±10.0 YO) are matched to the cancer cases by age and year of the cancer-diagnosis imaging. All studied women did not have any prior biopsy or recall on mammography. For all cohort, a set of sequential prior 'normal' (negative or benign findings) screening mammogram exams acquired during 2006-2012 were collected (2-8 exams per patient), generating a total of 3263 'normal' images (913 for cancer cases, and 2350 for controls). Those prior images of the cancer-affected breast (for cancer cases) and side-matched breast (for controls) were used to predict the outcome (i.e., case/control status). We compared the prediction in terms of three time periods: (A) all priors from 2006 to 2012, (B) recent priors (1548 images) from 2010 to 2012, and (C) distant priors (1715 images) from 2006 to 2009. The outcome prediction was based on a pre-trained convolutional neural network model (ResNet-50) that was further fine-tuned on our mammograms. 10-fold cross-validation and AUC were used to measure model performance.

RESULTS

81% of cancers and 82% of controls were post- with the rest pre-menopausal, and neither menopausal status nor family history of breast cancer was associated with the outcome. AUC was 0.84 when using all priors, while it was 0.77 or 0.75 when using only the recent or only the distant priors, respectively.

CONCLUSION

Sequential recent or distant prior 'normal' screening mammograms can predict, and their combination is more predictive of, breast cancer development using deep learning models.

CLINICAL RELEVANCE/APPLICATION

Deep learning modeling on longitudinally acquired prior 'normal' screening mammogram images through up to 7 years earlier can enhance temporal prediction of breast cancer development.

RC215-16 Novel Radiomic Descriptor of Tumor Vascular Morphology Identifies Responders to Neo-Adjuvant Chemotherapy on Pre-Treatment Breast MRI

Monday, Nov. 26 11:40AM - 11:50AM Room: Arie Crown Theater

Awards
Trainee Research Prize - Medical Student

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PURPOSE

Despite significant interest in predicting treatment response prior to breast cancer neo-adjuvant chemotherapy (NAC) from DCE-MRI, prior work has focused on textural patterns of the tumor or parenchyma or deep learning-based approaches that lack direct biological interpretability. In this work, we introduce functional radiomic descriptors of vascular network disorder (VND) and evaluate whether differences in the complexity of tumor-associated vasculature on pre-treatment DCE-MRI can discriminate between patients who do and do not respond to NAC.

METHOD AND MATERIALS

1.5 or 3T DCE-MRI scans of 76 NAC recipients, 24 of whom had surgically confirmed pathological complete response (pCR), were retrospectively analyzed. Average pixel width and slice thickness were .77 mm and 1.22 mm, respectively. Patients were randomly divided into training (n=53, 14 pCR) and testing (n=23, 10 pCR) sets. A semi-interactive scheme was employed to segment the tumor and vascular network. Within a sliding window, vessel orientation was computed for a series of 2-dimensional representations of the vasculature relative to the tumor centroid. Statistics (mean, median, st. dev, skewness, and kurtosis) of the distribution of vessel orientations for each representation were computed, yielding 20 VND features total. Top VND features were selected in the training set using the Wilcoxon rank sum test via three-fold cross validation, then used to train a linear discriminant analysis classifier to predict response in the test set. Performance was compared against (1) intra- and peri-tumoral texture features and (2) a 3 layer LeNet convolutional neural network (CNN).

RESULTS

The top 4 VND features distinguished pCR with an AUC=0.75. pCR was characterized by reduced vascular disorder relative to non-pCR. VND performed comparably or better than other state of the art radiomic approaches, including intra- and peri-tumoral texture (AUC=.75) and deep learning (AUC=.67). Combining predictions from VND, texture features, and CNN yielded the best response prediction accuracy (AUC=0.80).

CONCLUSION

VND features, which capture chaotic vessel network architecture, appear to be associated with NAC response and added predictive value to established radiomic and deep learning approaches.

CLINICAL RELEVANCE/APPLICATION

Quantitative assessment of vessel network architecture as a functional radiomic biomarker could provide interpretable NAC response prediction in breast cancer.

RC215-17 Using Machine Learning to Assess Tumor Metastatic Lymph Nodes and Ki-67 Expression Aggressiveness from Breast MRI Using a Large Clinical Dataset of 300 Cancers from China

Monday, Nov. 26 11:50AM - 12:00PM Room: Arie Crown Theater

Participants
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PURPOSE

To evaluate quantitative MRI radiomics in the task of identifying metastatic versus nonmetastatic axillary lymph nodes and Ki-67 expression aggressiveness.

METHOD AND MATERIALS

Our research involved a HIPAA-compliant, DCE-MRI database of 300 breast cancer cases. The average age was 47.2 years with a standard deviation of 9.6 years and a range from 25 to 77 years with a median of 47 years. The clinical cohort included 48 low Ki-67 expression (Ki-67 proliferation index < 14%) and 252 cases with high Ki-67 expression (Ki-67 proliferation index >= 14%), indicating a range of tumor aggressiveness. The cohort also included 93 cases with axillary lymph node metastasis and 201 cases without metastasis. The images had been obtained with a gadodiamide-enhanced T1-weighted spoiled gradient-recalled acquisition in the steady state sequence. Primary lesions underwent computerized radiomic analysis in which tumor segmentation and extraction were automatically conducted on an existing CADx workstation. These computer-extracted features included MRI-based phenotypes from six categories: size, shape, morphology, enhancement texture, kinetics, and enhancement-variance kinetics. Radiomic features were input to a Bayesian artificial neural network classifier (BANN) and underwent leave-one-case-out cross validation. Area under the ROC curve (AUC) served as the figure of merit in the classification tasks.

RESULTS

In the task of identifying Ki-67 expression and lymph node status, the analyses of the various radiomic phenotypes yielded AUCs ranging from 0.50 (se = 0.05) to 0.69 (se = 0.04). The Ki-67 MRI-based tumor signature produced an AUC value of 0.71 (se = 0.04). In the task of assessing the status of axillary lymph nodes, the radiomics tumor signature yielded an AUC value of 0.67 (se = 0.03). Both signatures were found to be statistically different from random guessing.

CONCLUSION

Quantitative MRI radiomics conducted on depicted primary breast tumors can contribute to identifying aggressive tumors, including identifying Ki-67 expression and discriminating between metastatic and nonmetastatic lymph nodes, yielding automatic MRI-based prognostic markers for ultimate use in radiogenomics and patient care.

CLINICAL RELEVANCE/APPLICATION

The ability to assess automatically the potential aggressiveness of tumors may elucidate the characteristics of breast cancers for radiogenomics and for use in helping clinician estimate prognosis.

RC221

Advances in CT: Technologies, Applications, Operations-Special Purpose CT

Monday, Nov. 26 8:30AM - 10:00AM Room: S102CD

BR MK CT IR PH

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Ehsan Samei, PhD, Durham, NC (*Coordinator*) Research Grant, General Electric Company; Research Grant, Siemens AG; Advisory Board, medInt Holdings, LLC; License agreement, 12 Sigma Technologies; License agreement, Gammex, Inc
Lifeng Yu, PhD, Chicago, IL (*Coordinator*) Nothing to Disclose

ABSTRACT

CT has become a leading medical imaging modality, thanks to its superb spatial and temporal resolution to depict anatomical details. New advances have enabled extending the technology to depict physiological information. This has enabled a wide and expanding range of clinical applications. These advances are highlighted in this multi-session course. The course offers a comprehensive and topical depiction of these advances with material covering CT system innovations, CT operation, CT performance characterization, functional and quantitative applications, and CT systems devised for specific anatomical applications. The sessions include advances in CT system hardware and software, CT performance optimization, CT practice management and monitoring, spectral CT techniques, quantitative CT techniques, functional CT methods, and special CT use in breast, musculoskeletal, and interventional applications.

Sub-Events

RC221A Breast CT Applications

Participants
John M. Boone, PhD, Sacramento, CA (*Presenter*) Patent agreement, Isotropic Imaging Corporation Consultant, RadSite

LEARNING OBJECTIVES

1) Introduce the technology of cone beam breast CT to audience. 2) Show both qualitative parameters describing image quality and qualitative images. 3) Demonstrate breast CT performance using metrics such as anatomical noise metrics, computer and human observer studies. 4) Illustrate the future potential of breast CT in diagnostic and screening breast imaging.

RC221B MSK CT Applications

Participants
Wojciech Zbijewski, PhD, Baltimore, MD (*Presenter*) Research Grant, Carestream Health, Inc; Research Grant, Siemens AG

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LEARNING OBJECTIVES

1) Explain the technology of musculoskeletal (MSK) cone-beam CT (CBCT). 2) Identify key differences between MSK CBCT and other orthopedic imaging modalities. 3) Discuss emerging clinical applications of MSK CBCT.

RC221C Interventional CT Applications

Participants
Christopher P. Favazza, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

VW30

A Practical Approach to Breast Magnetic Resonance Imaging (MRI) Interpretation: An Interactive Session: Siemens Healthineers Vendor Workshop

Monday, Nov. 26 10:15AM - 11:25AM Room: Booth 5530

Participants

Susan Weinstein, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Program Information

This interactive session will include both didactic and hands-on case review at workstations equipped with syngo® MR Brevis. A practical approach to breast MRI interpretation will be discussed as well as utilizing the available sequences and techniques to improve interpretive skills.

VW28

Wide-angle Digital Breast Tomosynthesis and Contrast Enhanced Mammography Self-guided Reading Sessions: Siemens Healthineers Vendor Workshop

Monday, Nov. 26 10:30AM - 5:00PM Room: Booth 5530

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 and contrast enhanced mammography cases presented as problem cases with a solution enables you to develop and test your reading skills.

VW29

Automated Breast Volume Scanner (ABVS) Self-guided Reading Sessions: Siemens Healthineers Vendor Workshop

Monday, Nov. 26 10:30AM - 5:00PM Room: Booth 5530

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.

VW04

Introduction to Qview and QVCAD/ABUS Case Review - The AI Deep Learning Radiology Assist in Reviewing GE Invenia ABUS Cases: GE Vendor Workshop

Monday, Nov. 26 11:00AM - 12:00PM Room: Booth 8156

Participants

Doug Whisler, Sunnyvale, CA (*Presenter*)

Program Information

This thirty minute session will cover the latest technological advancements in ABUS design and performance. Attendees will learn how improvements in workflow and image quality have the potential to increase cancer detection in women with dense breast tissue. *Registration is required; adding this session to the RSNA calendar tool alone does not secure your seat in this session. Click the link below to register.*

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2018-/agenda-e57e0b47e9aa4f5ba89b1a0da1e829b9.aspx

VW31

Automated Breast Volume Scanner (ABVS) Physician Training Workshop: An Interactive Learning Experience: Siemens Healthineers Vendor Workshop

Monday, Nov. 26 11:40AM - 12:50PM Room: Booth 5530

Participants

Terri A. Gizienski, MD, Greenwood Village, CO (*Presenter*) Nothing to Disclose

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 unique coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

VW58

Improving Tomosynthesis Read-times, While Maintaining Clinical Performance: Hologic Vendor Workshop

Monday, Nov. 26 12:00PM - 1:00PM Room: Booth 5524

Program Information

Discussion and case review focuses on Hologic's new innovations to improve workflow efficiency, without sacrificing clinical outcomes. (3D Mammography™ Technology, Clarity HD, Smart Mapping, SecurView® Workstations)

Registration

https://hologicrsna.com

BRS-MOA

Breast Monday Poster Discussions

Monday, Nov. 26 12:15PM - 12:45PM Room: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Lars J. Grimm, MD, Durham, NC (*Moderator*) Editorial Advisory Board, Medscape, LLC; Educational program support, Hologic, Inc

Sub-Events

BR229-SD-MOA1 Ultrasound Radiomics in the Differentiation Between Benign and Malignant Breast Masses: Comparison Between Conventional Ultrasonography and Shear-Wave Elastography

Station #1

Participants
Ji Hyun Youk, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jin Young Kwak, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Ju Son, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jeong-Ah Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate whether ultrasound radiomics features can differentiate benign and malignant breast mass, compared conventional ultrasonography (US) with shear-wave elastography (SWE).

METHOD AND MATERIALS

We retrospectively collected 328 pathologically-confirmed breast masses in 296 women who underwent US and SWE before biopsy or surgery from March to November 2014. Their radiomics features were extracted from US and SWE images by texture analysis algorithms in Matlab software. A representative SWE image for measuring elasticity of the index mass was selected for analysis, which had both US and color-coded SWE image displayed in split-screen mode. For a manual lesion segmentation for all masses, an ROI was delineated around the boundary of the index mass on US image from which the same ROI was copied and pasted to SWE image by a dedicated breast radiologist. A total of 730 candidate radiomics features including first order statistics, textural features (GLCM and GLRLM), and wavelet features, were extracted from each image. LASSO regression was used for data dimension reduction and feature selection. Univariate and multivariate logistic regression analysis were performed to identify independent radiomics features of differentiating between benign and malignant masses. The area under the receiver operating characteristic curve (AUC) was calculated.

RESULTS

Of 328 breast masses, 205(62.5%) were benign and 123(37.5%) were malignant. Following radiomics feature selection, 22 features from US and 6 features from SWE remained. On univariate analysis, all 6 radiomics features from SWE ($P<0.0001$) and 21 of 22 radiomics features from US ($P<0.03$) showed significant differences between benign and malignant masses. After multivariate analysis, 3 radiomics features from US and 2 radiomics features from SWE were independently associated with malignant breast masses. The AUC of logistic regression model in differentiating between benign and malignant masses was 0.929 for US and 0.992 for SWE ($P<0.001$).

CONCLUSION

Ultrasound radiomics features can differentiate between benign and malignant breast masses with good performance. SWE showed significantly better performance than US.

CLINICAL RELEVANCE/APPLICATION

Quantitative ultrasound radiomics features can be used to diagnose breast cancer with good diagnostic performance and SWE radiomics show superior performance to conventional ultrasonography radiomics.

BR230-SD-MOA2 Impact of Inflammatory Breast Cancer Heterogeneity for Predicting Survival: Low-Dose Breast CT Texture Analysis

Station #2

Participants
Myoung-Ae Kwon, Ansan, Korea, Republic Of (*Presenter*) Nothing to Disclose
Bo Kyoung Seo, MD, PhD, Ansan, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation; Research Grant, Guerbet SA; Research Grant, Koninklijke Philips NV;
Balaji Ganeshan, PhD, London, United Kingdom (*Abstract Co-Author*) CEO, Feedback plc; Director, Feedback plc; Director, Stone Checker Software Ltd; Director, Prostate Checker Ltd
Eun Kyung Park, MD,PhD, Ansan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ok Hee Woo, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kyu Ran Cho, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Inflammatory breast cancer (iBC) is very aggressive and one of the non-measurable lesions in response evaluation criteria in solid tumors, therefore measuring tumor size is inadequate to assess prognosis. The purpose of this study was to investigate the usefulness of low-dose breast CT texture analysis (CTTA) to predict overall survival in patients with iBC.

METHOD AND MATERIALS

This retrospective study was approved by the institutional review board. From 2006 to 2017, fifty-five patients who had iBC and pre-treatment low-dose breast CT were included. CTTA was performed on pre- and post-contrast CT images using a TexRAD research software (TexRAD Ltd, www.texrad.com, Cambridge, UK). CTTA comprised a filtration-histogram technique where the filtration step extracted and enhanced objects of different sizes corresponding to spatial scale filter (0-without filtration; 2mm-fine texture scale; 3-5mm-medium texture scales; 6mm-coarse texture scale) and variation in density followed by quantification of texture using histogram based analysis (mean-M, standard deviation-SD, entropy-E, mean of positive pixels-MPP, skewness-S, and kurtosis-K). Delta texture i.e. difference between post-contrast and pre-contrast texture was also evaluated. The relationship between CT texture features and overall survival was assessed using Kaplan-Meier survival analysis.

RESULTS

27/55 patients died within a mean follow-up period of 29.7 (0-100) months. Median survival was 32.0 (95% CI: 3.7-60.3) months. A number of CTTA metrics predicted survival. Higher SD and E without filtration and E across fine to medium texture scales on pre-contrast CT were significant predictors of poor prognosis (best - E at fine texture scale >=5.55, p=0.003). Lower M and S without filtration and higher M and E across fine to medium texture scales on post-contrast CT were significant predictors of poor prognosis (best - E at fine texture scale >=5.91, p=0.0004). Delta texture (Lower E and higher K) without filtration and across fine, medium and coarse texture scales were significant predictors of poor prognosis (best - Delta K at fine texture scale >=0.08, p=0.0002).

CONCLUSION

Low dose CTTA can be useful to predict survival in patients with iBC.

CLINICAL RELEVANCE/APPLICATION

Filtration histogram based texture analysis increases the utility of low-dose breast CT by reflecting tumor heterogeneity and demonstrates prognostic potential in inflammatory breast cancer.

BR231-SD-MOA3 Clinical Impact of Second Opinion Radiology Consultation for Patients with Breast Cancer

Station #3

Awards

Student Travel Stipend Award

Participants
Debra S. Whorms, MD, Boston, MA (*Presenter*) Nothing to Disclose
Catherine S. Giess, MD, Wellesley, MA (*Abstract Co-Author*) Nothing to Disclose
Mehra Golshan, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Rachel Freedman, Brookline, MA (*Abstract Co-Author*) Nothing to Disclose
Craig A. Bunnell, MD, MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Emily C. Alper, BA, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Katya Losk, Brookline, MA (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Assess the incidence and clinical significance of:interpretation discrepancies when subspecialty consult review of outside imaging is performed at a National Cancer Institute (NCI)-designated tertiary cancer center, for patients with newly diagnosed breast cancer.

METHOD AND MATERIALS

This Institutional Review Board-approved retrospective observational study included patients presenting 7/2016-3/2017 to an NCI-designated comprehensive cancer center for second opinion after a breast cancer diagnosis. Outside and second-opinion radiology reports of 252 randomly-selected patients were compared by two subspecialty breast radiologists to consensus. A peer review score was assigned using a modification of the American College of Radiology's RADPEER peer review metric: 1-agree; 2-minor discrepancy (unlikely clinically significant); 3-moderate discrepancy (may be clinically significant); 4-major discrepancy (likely clinically significant). Among cases with clinically significant discrepancies, rates of clinical management change (alterations in management including change in follow-up, use of neoadjuvant therapy, and surgical management as a direct result of image review) and detection of additional malignancy were assessed through electronic medical record review.

RESULTS

A significant difference (RADPEER 3 or 4) in interpretation was seen in 41 cases (16%, 95% Confidence Interval [CI], 11.7%-20.8%). The difference led to additional work-up in 38 cases (15%, 95% CI 10.6%-19.5%) and a change in clinical management in 18 cases (7.1%, 95% CI 4.0%-10.2%), including 15 cases with a change in surgical management (6.0%, 95% CI, 3.0%-8.9%) cases. An additional malignancy or larger area of disease was identified in 12 cases (4.8%, 95% CI, 2.1%-7.4%).

CONCLUSION

Discrepancy between outside and second-opinion radiologists frequently results in additional work-up for breast cancer patients, changes in treatment plan, and identification of new malignancies.

CLINICAL RELEVANCE/APPLICATION

Formal second opinion imaging consultation in patients with newly diagnosed breast cancer presenting to a multidisciplinary breast oncology program has significant value in identifying additional malignancy and optimizing treatment approach.

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 EducatorCatherine S. Giess, MD - 2017 Honored Educator

BR232-SD-MOA4 Prediction of 21-Gene Recurrence Score in Patients with Estrogen Receptor-positive Early-Stage Breast Cancer Using MRI-based Radiomics Nomogram

Station #4

Participants
Nam Joo Lee, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hee Jung Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hwa Jung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ki Chang Shin, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jong Won Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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Ga Young Yoon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To develop a breast MRI-based radiomics nomogram including pathologic factors which can predict low-risk recurrence score (RS) on 21-gene RS assay in patients with estrogen receptor-positive early-stage breast cancer (EBC).

METHOD AND MATERIALS

From 2011 to 2017, a total of 547 tumors in 539 patients with EBC who underwent preoperative breast MRI were retrospectively included in this study. Among them, low-risk was 320 (58.5%), intermediate-risk was 180 (32.9%), and high-risk was 47 (8.6%). We extracted 744 quantitative MR radiomic features from computerized three-dimensional segmentations of each tumor generated computer-extracted image phenotypes (CEIP) within the intratumoral regions of early post-contrast T1-weighted images, percent enhancement (PE) map, signal enhancement ratio (SER) map, and T2-weighted images. We divided 547 cases into a training set (n=365) and a validation set (n=182). Elastic net was used for feature selection and radiomics score building. Multivariate logistic regression analysis was used to develop a prediction model, we incorporated the radiomics score and independent pathologic risk factors and build a radiomics nomogram. Internal validation for an independent validation set (n=182) was performed.

RESULTS

The radiomics score, which consisted of 24 selected CEIPs, was significantly associated with the prediction of recurrence (C-index, 0.769 for training set and 0.745 for validation set). Independent pathologic predictors contained in the nomogram were progesterone receptor status, nuclear grade, histologic grade, extensive intraductal component, lymphovascular invasion, P53, and Ki67 status, and their C-index was 0.858 for training set and 0.774 for validation set. Addition of radiomics score to the pathologic nomogram showed an incremental value of 0.054 and 0.092, respectively. Radiomics nomogram showed good prediction of low-risk RS, with a C-index of 0.912 for training set and 0.866 for validation set.

CONCLUSION

This study shows that a radiomics nomogram which incorporates the MRI-based radiomics score and pathologic features, can be used to help the preoperative individualized prediction of low-risk RS in patients with EBC.

CLINICAL RELEVANCE/APPLICATION

Prediction nomogram using breast MRI-based radiomics score and pathologic predictors can be used to facilitate the preoperative individualized prediction of low-risk RS on 21-gene RS assay in patients with EBC.

BR233-SD-MOA5 Volumetric versus Area-based Breast Density Assessment: Comparisons using Fully-Automated Quantitative Measurements in a Large Screening Population

Station #5

Participants
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
Eric A. Cohen, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Yifan Hu, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Emily F. Conant, MD, Philadelphia, PA (*Abstract Co-Author*) Grant, Hologic, Inc; Consultant, Hologic, Inc; Grant, iCAD, Inc; Consultant, iCAD, Inc; Speaker, iiCME
Despina Kontos, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Breast density is an important factor affecting the sensitivity of screening mammography due to the masking of tumors within the dense breast tissue, therefore, substantially influencing supplemental screening recommendations for women. We investigate associations between fully-automated quantitative measures of area-based (ABD) and volumetric (VBD) breast density versus categorical (BI-RADS) density assessment and potential implications for supplemental screening.

METHOD AND MATERIALS

We retrospectively analyzed bilateral digital mammograms (Selenia Dimensions, Hologic Inc.) from an entire one-year screening cohort at our institution (2012-2013; N = 11,107 women). BI-RADS density categories, visually assigned to each study by the reviewing radiologist, were collected from archived screening reports. Fully-automated software (QuantraTM v2.2; Hologic Inc.) was used to extract quantitative measures of ABD, VBD and categorical, BI-RADS-like, density categories. Pair-wise correlation (r) and linear regression were used to investigate the relationship between ABD and VBD measurements, adjusted for age, BMI and race (41% White, 50% Black, 9% Other/Unknown). Analysis of variance (ANOVA) was performed to evaluate ABD and VBD variation by the clinical BI-RADS density categories. Agreement between the radiologist's and the software-assessed density categories was measured via the Cohen's weighted kappa (k).

RESULTS

VBD (12.5% ± 6.9%) and ABD (16.5% ± 16.0%) were strongly correlated (r = 0.95), with VBD being lower than ABD (b = 0.41, 95% CI = [0.40, 0.41]). Both density measures were significantly different across BI-RADS density categories with an increase as BI-RADS density increased (ANOVA, $p < 0.001$). There was moderate agreement between the radiologists' and the software-assessed breast density categories (k = 0.67, SE = 0.01), on par with reported inter-reader variability between radiologists.

CONCLUSION

VBD measurements are strongly correlated to ABD estimates in digital mammography; yet, reported breast density is likely to be lower in the volumetric evaluation. The software-generated breast density scores moderately agree with clinical BI-RADS density readings.

CLINICAL RELEVANCE/APPLICATION

Refinement of density thresholds that prompt supplemental screening is likely to be needed for clinical adoption of automated density measures, adjusting also for area-based vs. volumetric evaluation.

BR234-SD-MOA6 Breast Cancer Risk Assessment at the Time of Screening Mammography: Pathology and BIRADS Outcomes

Station #6

Awards

Student Travel Stipend Award

Participants
Diana Murcia, MD, Burlington, MA (*Presenter*) Nothing to Disclose
Megan E. Mcdevitt, Burlington, MA (*Abstract Co-Author*) Nothing to Disclose
Maryam Shahrzad, MD, Arlington, MA (*Abstract Co-Author*) Nothing to Disclose
Cathleen M. Kim, MD, Burlington, MA (*Abstract Co-Author*) Nothing to Disclose
Jeanette Y. Chun, MD, Burlington, MA (*Abstract Co-Author*) Nothing to Disclose
Michelle R. McSweeney, DO, Burlington, MA (*Abstract Co-Author*) Nothing to Disclose
Meera Sekar, MD, Lexington, MA (*Abstract Co-Author*) Nothing to Disclose
Meaghan Mackesy, MD, Burlington, MA (*Abstract Co-Author*) Nothing to Disclose
Audrey L. Hartman, MD, MS, Burlington, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the early experience with breast cancer risk assessment (CRA) in a multicenter breast screening program, utilizing pathology and BIRADS outcomes for patients stratified into high and low risk groups.

METHOD AND MATERIALS

Patients were offered to complete a commercially available, tablet-based CRA survey at the time of the screening mammogram. The software utilized 3 risk prediction models; BRCAPRO (high risk >=20%), Tyrer-Cuzick v.7 (high risk >=20%), and BRCAMUTATION (high risk >=5%). The patient was identified as high risk (HR) if any of the 3 models predicted high risk. Otherwise, the patient was labeled low risk (LR). A HIPAA compliant and IRB approved retrospective review of all patients offered the survey in a 6 month period was performed. Inclusion criteria: completion of risk prediction survey, BIRADS 0 on screening mammogram, completion of additional imaging (diagnostic mammogram and/or focused ultrasound), resulting in BIRADS 4 or 5, and completion of core biopsy (and surgical biopsy, if indicated).The rate of BIRADS 0, cancer detection rate (CDR), and percentage of invasive cancer were compared for the HR and LR patients, using a chi-square test. CDR and Positive Predictive Value 3 for breast cancer (PPV3) were calculated for both HR and LR groups.

RESULTS

A total of 10394 patients underwent screening mammogram, of which 88.5% (9200) elected to complete the CRA survey, of which 14% (1293) of patients were HR, and 86% (7897) were LR. The percent of BIRADS 0 at screening was higher for HR than LR (11.2% vs 7.7 %, $p<0.001$). The cancer detection rate (per 1000 patients) was higher for HR than LR (7.8 vs 3.8 $p<0.05$). The PPV3 was not statistically different (34.5% for HR, 25.2% for LR, $P=0.37$). The percent of invasive cancers was also not statistically different between the HR and LR patients.

CONCLUSION

Patients identified as high risk by breast cancer risk assessment at the time of screening mammography had a higher cancer detection rate than low risk patients.

CLINICAL RELEVANCE/APPLICATION

Breast cancer risk assessment at screening mammogram may provide information towards personalized screening for breast cancer.

BR176-ED-MOA7 Contrast-Enhanced Mammography: Current Applications and Future Direction

Station #7

Awards
Identified for RadioGraphics

Participants
Kimeya Ghaderi, MD, Boston, MA (*Presenter*) Nothing to Disclose
Jordana Phillips, MD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company; Consultant, General Electric Company
Hannah Perry, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Parisa Lotfi, MD, Newton, MA (*Abstract Co-Author*) Nothing to Disclose
Tejas S. Mehta, MD, MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Contrast-Enhanced Mammography (CEM) employs a dual energy technique to create images that show abnormal morphology and density (similar to conventional mammography) and abnormal enhancement (like MRI). CEM is FDA approved for adjunct use in the diagnostic setting. Diagnostic applications include evaluation of screening callbacks, the symptomatic breast, disease extent in women with known breast cancer, and response to neoadjuvant chemotherapy. Key clinical indication of CEM is as an MRI alterative demonstrating similar sensitivity and positive predictive value. Benefits include reduced patient cost and relative ease of access compared to MRI. Challenges include IV placement, risks associated with contrast in mammography setting, and added time.

TABLE OF CONTENTS/OUTLINE

Background: What is CEM and how are images acquired? FDA approved indications and literature review Screening recall: Architectural distortion, mass, calcifications Follow-up diagnostic imaging Symptomatic breast Evaluation of disease extent Response to neoadjuvant chemotherapy Mammographically occult malignancy Troubleshooting When MRI cannot be performed Supplemental screening Other potential uses: High-risk screening Benefits and Challenges of using CEM for these indications

BR177-ED-MOA8 Factors Affecting MRI Accuracy in Evaluating of Neoadjuvant Therapy Response in Breast Cancer: A Pictorial Review with Radiopathological Correlation

Station #8

Awards
Certificate of Merit

Participants
Gulgun Engin, Istanbul, Turkey (*Presenter*) Nothing to Disclose
Semen Onder, MD, ?stanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose
Inci Kizildag Yirgin, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose
Ekrem Yavuz, MD, ?stanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

To review tumor shrinkage patterns subsequent to NAC To discuss the factors affecting MRI accuracy in evaluating of NAC response To improve the knowledge about the detection accuracy of residual disease after NAC by MRI

TABLE OF CONTENTS/OUTLINE

Preoperative neoadjuvant chemotheraphy (NAC) is widely performed for patients with locally-advanced breast carcinomas in order to control and downstage the primary breast carcinomas. Breast magnetic resonance imaging (MRI) is the most accurate imaging modality for assessment of tumor response to NAC. However, MRI often over- or underestimate the extent and distribution of residual carcinomas following NAC. The accuracy of MRI in evaluating residual tumor size and extent depends on tumor type, morphology, and biomarker status. Cancers with lobular component, non-mass-like enhancement lesions, HR-positive, and HER2-negative cancers had an increased discrepancy between MRI versus pathology tumor size (Figures 1-5). Improved knowledge about the detection accuracy of residual disease after NAC by MRI is crucial to help planning of an optimal surgery to achieve a tumor free margin. This can reduce the re-excision rate and minimize local recurrence. In this pictorial review, the factors affecting MRI accuracy in evaluating of NAC response are analysed and discussed with detailed radiopathological correlation.

BR178-ED-MOA9 Pitfalls, Tricks, and Tips in the Sonographic Evaluation of Breast. What the Radiology Residents Need to Know?

Station #9

Participants
Karina Pesce, Capital Federal, Argentina (*Abstract Co-Author*) Nothing to Disclose
Maria B. Orruma, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

1. Review of the anatomy and the factors contributing to the difficulties in the evaluation in the breast ultrasound. 2. Describe

common artefacts and image quality issues. Discuss common pitfalls and limitations. 3. Illustrate several examples of the technical artefacts, with helpful suggestions to help optimize images and avoid misinterpretation. 4. Learn tips to optimize images techniques and demonstration of some pitfalls.

TABLE OF CONTENTS/OUTLINE

1. Introduction: We present a review of common pitfalls and troubleshooting. Tips for radiology residents who perform and interpret breast ultrasound. 2. Overview of breast ultrasound protocol 3- Classification of pitfalls A) Anatomical B) Sonography physics C) Instrumentation D) Cross-Correlation with mammographic lesions E) Foreign bodies. 4-Sonography Physics: Artefacts in breast ultrasound a-Gray scale ultrasound b- Artefacts in doppler ultrasound color 5- Tips to optimize imaging techniques, relevant pathologic findings and demonstration of some pitfalls. 6-Conclusions

BR179-ED-MOA10 Breast Imaging STAT: A Pictorial Review of Acute Pathology

Station #10

Participants
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TEACHING POINTS

1. Review the types of acute breast pathology commonly seen in the emergency setting. 2. Describe the imaging features of each entity using case-based examples. 3. Discuss current best practice for management and/or treatment.

TABLE OF CONTENTS/OUTLINE

1. Review clinical and imaging features of mastitis and breast abscess. a. Puerperal b. Non-puerperal c. Granulomatous mastitis d. Pitfall: inflammatory breast cancer 2. Summarize evidence-based breast abscess management and treatment algorithms for the radiologist, with emphasis on ultrasound-guided drainage. 3. Present imaging manifestations of accidental breast trauma, including hematoma and fat necrosis. Pitfall: breast cancer presenting after trauma. 4. Illustrate acute post-procedural complications following percutaneous breast biopsy and surgery. 5. Describe additional examples of acute breast pathology including Mondor's disease and inflamed epidermal inclusion cyst.

BR180-ED-MOA11 Primary Breast Tuberculosis: Imaging Findings

Station #11

Participants
Ali H. Baykan, MD, Adiyaman, Turkey (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

The purpose of this exhibit is: 1. To provide general information about breast tuberculosis in order to raise awareness. 2. To review radiologic findings of breast tuberculosis with some sample cases. 3. To discuss difficulties in the diagnosis of breast tuberculosis and multidisciplinary approach in the management of treatment.

TABLE OF CONTENTS/OUTLINE

1. General information about breast tuberculosis 2. Review of imaging findings with sample cases 3. The role of radiology in the multidisciplinary approach 4.Summary

BR181-ED-MOA12 Probably Benign Assessment on Breast MRI: Appropriate and Inappropriate Utilization

Station #12

Participants
Mirelys Barrios, MD , Boston, MA (*Presenter*) Nothing to Disclose
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TEACHING POINTS

ACR BI-RADS Category 3 ('probably benign') should carry <= 2% likelihood of malignancy and was initially defined for a normal risk screening mammography population. The ACR BI-RADS Lexicon states that probably benign lesions should have a very high probability of being benign and many approaches for assessment are intuitive. The objectives of this exhibit are: 1. To review the evolving criteria for findings to be placed in probably benign category on breast MRI, with emphasis on challenges in daily practice.

2. To understand various clinical and patient factors that may affect management and assessment, including high risk patient populations, younger patient population, and baseline studies.

TABLE OF CONTENTS/OUTLINE

1. To review the published literature on probably benign (BI-RADS 3) lesions on breast MRI. 2. To provide an overview on breast MRI findings currently accepted as probably benign. 3. To present a pictorial review of upgraded BIRADS 3 lesions, benign and malignant, with assessment and management lessons. 4. To review appropriate and inappropriate uses of probably benign category in breast MRI, with emphasis on challenging clinical and patient factors that may affect management.

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 EducatorCatherine S. Giess, MD - 2017 Honored Educator

VW07

Application of ABUS in Diagnosis of Breast Cancer: A Multi-Center Study in China: GE Vendor Workshop

Monday, Nov. 26 12:30PM - 1:00PM Room: Booth 8156

Participants

You-Lin Qiao, Beijing, China (*Presenter*) Nothing to Disclose

Program Information

In this presentation, Dr. Qiao will discuss his experience as Principal Investigator of a multi-center study in China aimed at evaluating the diagnosis accuracy of Automated Breast Ultrasound to traditional ultrasound and mammography. *Registration is required; adding this session to the RSNA calendar tool alone does not secure your seat in this session. Click the link below to register.*

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2018-/agenda-e57e0b47e9aa4f5ba89b1a0da1e829b9.aspx

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

BRS-MOB

Breast Monday Poster Discussions

Monday, Nov. 26 12:45PM - 1:15PM Room: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Lars J. Grimm, MD, Durham, NC (*Moderator*) Editorial Advisory Board, Medscape, LLC; Educational program support, Hologic, Inc

Sub-Events

BR235-SD-MOB1 Does the Tumor Stiffness of Shear Wave Elastography Correlate with Tumor Hypoxia or Fibrosis of Breast Cancer?

Station #1

Participants
Myoung-Ae Kwon, Ansan, Korea, Republic Of (*Presenter*) Nothing to Disclose
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PURPOSE

Hypoxic and stiff microenvironments of breast cancer promote metastasis and resistance to therapy. The purpose of this study was to investigate whether the tumor stiffness parameters of shear wave elastography (SWE) are related with tumor hypoxia or fibrosis in invasive breast cancer.

METHOD AND MATERIALS

This retrospective study was approved by the institutional review board. From June 2016 to January 2018, eighty-two women with invasive breast cancers who underwent SWE before treatment were enrolled. We used Aplio 500 US equipment (Toshiba Medical Systems Corporation, Japan). On the SWE features, average tumor elasticity (Eaverage) and tumor-to-fat elasticity ratio (Eratio) were extracted. Glucose transporter 1 (GLUT1) for evaluation of tumor hypoxia and Masson's trichrome staining (MT) for fibrosis were used. Immunostaining and automated digital image analysis were performed for assessment of GLUT1 and MT activities. Correlations analysis was performed between SWE parameters (Eaverage and Eratio) and GLUT1 or MT activities using spearman's correlation. Correlations with biomarkers according to molecular subtype, tumor grade, lymph node, hormone receptor, HER2, and Ki67 were compared using t-test, Mann-Whitney test, and Kruskal-Wallis test with Bonferroni correction.

RESULTS

SWE parameters including Eaverage (r=0.676) and Eratio (r=0.411) were significantly correlated with GLUT1 activities (P<0.001 for all). On the other hand, SWE parameters were not related with MT activities (P>0.05 for all). Eaverage values were significantly higher in breast cancers with positive lymph node, negative hormone receptor, high Ki67, and high grade (P<0.03 for all). Eratio values were higher in breast cancers with high Ki67 and high grade (P<0.05 for all). Eaverage values were different according to molecular subtypes of breast cancer (P=0.009). Eaverage values were significantly higher in triple negative cancers than those in luminal A cancers (P=0.03).

CONCLUSION

Tumor stiffness measured by SWE is associated with tumor hypoxia and biomarkers that affect tumor prognosis and it not related to fibrous components.

CLINICAL RELEVANCE/APPLICATION

Tumor stiffness parameters as measured by SWE is significantly correlated with tumor hypoxia and histologic biomarkers and can be used to predict prognosis of invasive breast cancer.

BR236-SD-MOB2 Therapeutic Nipple Sparing Mastectomy (NSM): Tumor-To-Nipple Distance (TND) on Preoperative MRI as Useful Variable in Surgical Patient Selection and Outcomes

Station #2

Participants
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PURPOSE

Newer surgical oncological nipple-sparing mastectomy (NSM) enables nipple-areola complex (NAC) preservation. Patient selection criteria and oncologic outcomes data are being established. We evaluated tumor-to-nipple distance (TND) on preop MR in NSM patients to help determine cancer recurrence risk factors.

METHOD AND MATERIALS

Retrospective institutional review of 2/2006- 7/2017 yielded 496 therapeutic NSMs in 312 women (mean f/u 48.25 m). Demographics, outcomes, trends, and cancer recurrences were reviewed. TND was measured on available preop MRIs using axial, sagittal, or multiplanar reconstruction images. Univariate analysis identified independent risk factors for cancer recurrence. p-values <0.05 significant.

RESULTS

Mean patient age was 48.66 yo (23-65 y). 74.2% of NSMs were part of bilateral surgery. Most common were: IDC (52.4%) and DCIS (50.4%); and stage IA (42.5%) and stage 0 (31.3%) disease. Mean tumor size was 1.48 cm. 25.2% of NSMs had multifocal disease, 11.5% had LVI; 59.9% were ER+, 56.3% were PR+, and 42.5% were HER 2-neu +. SLN biopsy performed in 79.8% of cases. Positive subareolar biopsy on 6.4% frozen section and 6.7% permanent biopsy. Per NSM, the rate of local in-breast recurrence was 1.6% (N=8) and regional was 0.6% (N=3). Per patient, rates were 2.6% local, 1.0% regional, and 1.3% (N=4) distant mets. One local recurrence (12.5%) had positive permanent subareolar biopsy treated with NAC resection. Preop MRI in 171 NSMs showed mean TND 4.78 cm. TND did not signif differ between NSMs with and w/o locoregional recurrence (4.62 vs 4.78 cm; p=0.8758). However, NSMs with TND <=1 cm (25.0% vs 2.4%, p=0.0031) and <=2 cm (8.7% vs 2.0%; p=0.0218) were signif associated with locoregional recurrence. In univariate analysis, TND <=1 cm was the only signif risk factor (OR=13.5833, p=0.0385). Age <50 years (p=0.0503) and multifocal disease (p=0.0820), TND <=2 cm (p=0.1052), and positive permanent subareolar biopsy (p=0.1094) trended towards association with higher recurrence risk.

CONCLUSION

NSM had locoregional recurrence of 2.0%. TND of <=1 cm and <=2 cm were significantly associated with recurrence risk. TND <=1 cm was significant predictor of locoregional recurrence on univariate analysis.

CLINICAL RELEVANCE/APPLICATION

NSM is oncologically safe with low locoregional recurrence of 2.0% in appropriately selected patients. TND of <=1 cm and <=2 cm on preoperative MRI can be useful variables in predicting recurrence.

BR237-SD-MOB3 Determining the Appropriateness of Second Look Targeted Sonography Recommendation Following Detection of Suspicious Non-Mass Enhancement (NME) Detected on Breast Magnetic Resonance Imaging (MRI)

Station #3

Participants
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PURPOSE

There are currently no evidence-based guidelines detailing the appropriateness of recommending targeted sonography versus proceeding directly to MRI-guided biopsy for suspicious non-mass enhancement (NME) detected on breast MRI. The purpose of this study is to determine if characteristics of suspicious NME are associated with detection of appropriate sonographic correlates on second look ultrasound.

METHOD AND MATERIALS

IRB approved, retrospective review of 4,292 contrast enhanced screening and diagnostic bilateral breast MRI examinations performed on female patients (ranging in age from 20 to 87 years old) at our institution between January 1, 2012 and December 31, 2015 was performed, focusing on the subset of 134 studies in which targeted sonography was recommended and subsequently performed for suspicious NME detected on MRI. Multivariate linear regression analysis ($p > 0.05$) was employed to analyze patient demographics as well as imaging study findings and characteristics in order to determine the likelihood of identifying an appropriate sonographic correlate on targeted sonography performed for suspicious NME.

RESULTS

Sonographic correlates were detected in 26% (35/134) of targeted ultrasounds performed for suspicious NME (all subtypes). Multivariate linear regression analysis demonstrating that suspicious linear NME seen on screening MRI was significantly associated with negative targeted sonography, coefficient -0.0787454 ($p = 0.05$, CI [-0.1576416, 0.0001507]), while segmentally distributed NME was significantly associated with detection of a sonographic correlate, coefficient 0.6343792 ($p < 0.0001$, CI [0.5294839,

0.7392745]). NME seen in the same quadrant as an enhancing mass on MRI was also significantly associated with detection of a sonographic correlate, coefficient 0.7905429 (p < 0.0001, CI [0.6914279, 0.889658]).

CONCLUSION

This study demonstrates that specific characteristics of suspicious NME are differentially associated with detection of sonographic correlates on second look ultrasound, findings that can be further studied to guide appropriateness criteria for targeted sonography after detection of suspicious NME on breast MRI.

CLINICAL RELEVANCE/APPLICATION

Developing appropriateness criteria for targeted sonography for suspicious NME detected on MRI aides patient care by reducing unnecessary second look ultrasound examinations, health care costs, and delay in time to diagnosis.

BR238-SD-MOB4 Prediction of Neoadjuvant Chemotherapy Response using Radiogenomics of MR Imaging in Breast Cancer: Correlation of Quantitative and Qualitative MR findings with Results of Multi-Gene Classifier

Station #4

Participants
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PURPOSE

To examine the correlation of magnetic resonance imaging (MRI) features with results of multi-gene classifier for predicting neoadjuvant chemotherapy (NAC) response of breast cancer.

METHOD AND MATERIALS

This study included 120 patients with breast cancer who were classified into response (R) group (n=46) and non-response (NR) group (n=74) by using the immune-related 23-gene signature for NAC (IRSN23) for NAC sensitivity prediction. All patients had undergone a dynamic contrast-enhanced breast MRI (DCE-MRI). For quantitative data, the following DCE-MRI features were measured: volume ratio of each fast, medium and slow to whole mass in the initial phase; volume ratio of each washout, plateau and persistent to whole mass in the delayed phase; and both kurtosis and skewness of intensity histogram in whole mass on each phase. Mass size and volume were measured. For qualitative data, two breast radiologists independently interpreted and decided the findings by consensus reading. The value in examining associations with R- and NR-group were analyzed using univariate logistic regression (ULR). Significant parameters identified by the URL analysis were included in the multiple logistic regression (MLR) analysis. Each binary group of quantitative data was designated by a cutoff value decided by receiver-operating characteristic analysis.

RESULTS

ULR analysis revealed that volume ratio of slow, medium, washout, persistent, medium-washout, medium-plateau, and slow-persistent volume ratio, volume of the whole mass, skewness in the delayed phase, mass shape, mass margin, and multiple masses were significant indicators to divide into R- and NR- group. MLR analysis revealed that volume ratio of slow in the initial phase>34.4% and medium-washout<=4.5%, and round/oval shape were significant indicators associated with R-group (Odds ratio, 3.76, 4.16, and 4.35; 95% confidence interval, 1.44 to 9.86, 1.78 to 9.76, and 1.72 to 11.03; p=0.007, p=0.001, and 0.002, respectively).

CONCLUSION

Volume ratio of slow >34.4% in the initial phase and medium-washout <=4.5% to the mass, and round/oval shape were found to be independent indicators associated with R-group.

CLINICAL RELEVANCE/APPLICATION

Both quantitative and qualitative data of dynamic contrast-enhanced breast MRI might contribute to the prediction of neoadjuvant chemotherapy response of breast cancer using multi-gene classifier.

BR239-SD-MOB5 Breast Cancer and Breast Imaging Malpractice Litigation: A 10-Year Analysis and Update in Trends

Station #5

Awards
Student Travel Stipend Award

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PURPOSE

The purpose of this study is to evaluate factors contributing to breast cancer and breast imaging-related medical malpractice cases.

METHOD AND MATERIALS

A retrospective analysis of jury verdict and settlement reports in US state and federal courts on the Westlaw legal database was performed. The database was searched for 'malpractice' and 'breast cancer' related terms from 2005 to 2015. 253 cases were evaluated for factors including outcome, award amount, alleged causes of malpractice, patient demographics, defendant specialities, and other alleged factors claimed in the litigation. Data were summarized using descriptive statistics. Logistic regression was used to evaluate associations between factors and plaintiff award.

RESULTS

Median plaintiff age was 46 (IQR 39, 56). In cases that resulted in plaintiff payment, award amount was $978,858±2,308,598. Delay in diagnosis was cited as a reason for claimed negligence in 82% of cases. Mean length of delay was 17±13 months. Named defendants were radiologists (43%), surgeons (27%), obstetrician/gynecologists (26%), and internal medicine/family practice (15%). Age, defendant type, and cancer stage were not significant predictors of case outcome. Failure to refer to a surgeon was two-fold (OR [95% CI]: 2.44 [1.085, 5.489]) more likely to be resolved with payment. Cases with a delay in diagnosis of >12 months were two-fold (OR [95% CI]: 2.129 [1.086, 4.175]) more likely to be resolved with payment compared to a delay <12 mos. Patients who failed to follow up as recommended were two-fold (OR [95% CI]: 2.31 [1.05, 5.10]) less likely to have their case be resolved with payment.

CONCLUSION

Plaintiffs involved in breast cancer imaging-related malpractice cases tend to be younger than the median age of diagnosis of breast cancer for US women (62 per NCI Surveillance, Epidemiology and End Results data). Breast cancer-related suits involve physicians from multiple specialties, radiology being the most common. Delay in diagnosis, lack of surgeon referral, and lack of recommended follow-up are related to plaintiff payments and may be areas of professional practice to target to prevent over- and misuse of the medical malpractice system.

CLINICAL RELEVANCE/APPLICATION

Breast cancer imaging-releated medical malpractice remains prevalent and costly for all involved. A better understanding of factors and trends in malpractice litigation can lead to medical malpractice system improvement.

BR240-SD-MOB6 Measurement of Breast Density Using Bioimpedance

Station #6

Participants
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PURPOSE

Breast density is associated with both risk of developing breast cancer and the effectiveness of mammography as a screening tool. An accurate and practical measurement method is crucial for personalising screening programmes and assessing the efficacy of preventive interventions. We evaluate the relationship between breast bioimpedance and volumetric breast density measured from mammograms. If mammographic density can be estimated using bioimpedance, this would provide a non-invasive, inexpensive and safe method of assessment.

METHOD AND MATERIALS

Volumetric breast density (VBD) measured by Volpara from mammograms and bioimpedance measurements using a custom Electrical Impedance (EI) data acquisition device were measured in 211 women commencing a chemoprevention trial. Bioimpedance measurements at 3.2-102.4 kHz were made with the woman reclining at an angle of approximately 30°. Eight paediatric ECG electrodes were placed around and equidistant to the nipple. Bioimpedance was recorded from eight combinations of four electrodes (two delivering current and two measuring potential difference). The bioimpedance recorded from these eight combinations is averaged for each breast and compared to VBD. Data from women with missing VBD or bioimpedance signatures and those with poor electrode contact were excluded from the analysis.

RESULTS

EI and VBD data were available for 106 women. As expected, VBD is inversely related to bioimpedance; low VBD breasts with a greater adipose content have higher impedance than more glandular breasts. Weighted least squares regression analysis suggests the relationship between EI and VBD is of the form y=AxB, where A=582.926±6.062 Ω-1, B=-1.008±0.0204, and has a X_{red}^2 value of 14.05.

CONCLUSION

EI has the potential to identify women with high breast density who are at increased risk of cancer or require supplemental screening, and those with low breast density who could potentially be screened less frequently. Further development of the

technology is necessary to improve reliability.

CLINICAL RELEVANCE/APPLICATION

A safe, practical and inexpensive method of assessing breast density is needed for personalising screening by risk of cancer and masking, and for assessing the efficacy of preventive interventions.

BR182-ED-MOB7 Advances in Radiology Education: Development of Subspecialty Specific Entrustable Professional Activities Using a Double Delphi Technique

Station #7

Participants
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TEACHING POINTS

1. EPAs provide practicality to our current means of assessing trainee readiness for clinical practice by representing an essential skill or task performed in daily clinical practice. 2. The developed breast imaging specific EPAs support the General Radiology EPAs published in 2016 while providing a more refined scope of practice specific to the subspecialty. 3. The Delphi technique is a methodologically approved consensus driven process used to synthesize and validate expert opinion when evidence is not available.

TABLE OF CONTENTS/OUTLINE

*Introduction: Background; development of EPAs to bridge gap between competency based training and clinical practice by framing competencies into clinical context; 5 Levels of entrustment; Alignment with ACGME competencies, subcompetencies and milestones; extension of general radiology EPAs; Need for subspecialty specific EPAs *Methods: Development of EPA list; Validation via Double Delphi Technique; Refinement by educational theorists; role of facilitator in entire process *Outcome: 8 EPAs specific to breast Imaging *Challenges *Next Steps: EPA-based online curriculum development and assessments; providing guidance for other subspecialties in radiology to develop their own EPAs

BR183-ED-MOB8 Two Faces Breast Cancer: Shooting the Enemy More Than One Time with Biopsy Gun to Unmask It

Station #8

Awards
Cum Laude

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TEACHING POINTS

Molecular subtypes classification is important to guide treatment, including primary chemotherapy, and developing new therapies. The purposes of this Education Exhibit are: 1. To discuss about molecular subtypes of breast cancer. 2. To demonstrate an association between the molecular subtype and ultrasound images. 3.To discuss some cases that we chose to do the biopsy in more than one location because ultrasound characteristics showed different patterns in the same patient and the histopathology confirmed different results.

TABLE OF CONTENTS/OUTLINE

1.Introduction. 2. Molecular subtypes of breast cancer. 3. Radiopathological characteristics of molecular subtypes. 4. Show cases that we chose to do the biopsy in more than one location because the image characteristics showed different patterns in the same patient. 5. To discuss about possibility of choosing biopsy in two different locations and whether these radiological changes showed different histopathological characteristics in our cases. 5. To emphasize how the decision in making biopsy in more than one location can alter the patient's prognosis and treatment.

BR184-ED-MOB9 Don't Forget the Breast: Incidental Breast Findings on CT

Station #9

Participants
Ayushi Singh, DO, New York, NY (*Presenter*) Nothing to Disclose
Priyanka Kadaba, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Mary M. Salvatore, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Richard H. Stern, PHD, Englewood, NJ (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Evaluation of the breast parenchyma on CT can lead to earlier diagnosis of breast cancer Demonstrate malignant and benign lesions in the breast on CT and which lesions warrant further work-up Demonstrate the appearance of the breast on CT in the postoperative setting Provide guidelines for interpretation of breast lesions on CT on the basis of the breast imaging lexicon

TABLE OF CONTENTS/OUTLINE

1. Introduction a. Incidence and outcome of breast findings on CT imaging b. Advantages of imaging the breast on CT i. Improved contrast resolution ii. Larger field of view/cross-sectional capability iii. Better lesions located near the chest wall and medially 2. Breast Findings a. Malignant i. Invasive ductal carcinoma ii. Invasive lobular carcinoma iii. Invasive ductal and lobular carcinoma iv. Secondary lymphoma of the Breast v. Inflammatory Carcinoma b. Benign i. Fibroadenoma ii. Benign Calcifications iii. Hamartoma iv. Lactating breast c. Postoperative findings i. Hematoma/Seroma ii. Fibrous Scar 3. Breast Imaging Lexicon for CT a. Rule of Thumb: Always include shape, density, pattern of enhancement and associated findings

BR185-ED-MOB10 You Sow What You Reap: Tumoral Needle Tract Seeding After Percutaneous Breast Biopsy

Station #10

Awards

Certificate of Merit

Participants
Heni D. Skaf, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Rafael L. Macedo, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Caio D. Pinheiro, MBBS, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Cecilia S. Goldman, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Matheus V. Paulino, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Su J. Kim, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Carlos Shimizu, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Juliana H. Catani, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Tatiana C. Tucunduva, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Vera Christina C. Ferreira, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Erica Endo, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Luciano F. Chala, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Nestor Barros, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The purposes of this exhibit are: 1- Review our institution's cases of tumoral needle tract seeding after percutaneous breast biopsy. 2- Review the prevalence of tumoral needle tract seeding after percutaneous breast biopsy. 3 - Review which tumors are more susceptible to this complication. 4 - Evaluate the factors that aggravate this phenomenon. 5 - Identify the best ways to prevent this complication.

TABLE OF CONTENTS/OUTLINE

1 - Review breast tumoral needle tract seeding cases at our radiology department, documented in multiple methods (MRI, ultrasound and mammography). 2 - Background: epidemiology and clinical aspects of needle tract tumoral seeding after percutaneous biopsy. 3 - Histopathological and imaging features of the most involved tumors. 4 - Imaging aspects of tumoral local recurrence. 5 - Identify factors that increase the risk of this complication and how to minimize it.

BR186-ED-MOB11 Increased Unnaturally? What Lies Beneath Markedly Enlarged Breast

Station #11

Participants
Sungmin Moon, Gwangju, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hyo Soon Lim, MD, Jeollanam-Do, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
So Yeon Ki, Gwangju, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

To aid approach for evaluation of enlarged breast : diffuse breast enlargement or presence of huge mass or other unusual cause of enlarged breast Provide pictorial review of diseases using multimodality image and discuss clinicopathological findings and management To know enlarged breast can be associated with benign as well as malignant condition in peripuberty, adult women and men

TABLE OF CONTENTS/OUTLINE

1. Normal breast development stage 2. Categorization for evaluation of enlarged breast 3. Case based review of diseases (A) Diffuse breast enlargement Infection - Mastitis Hormonal disturbance - Gynecomastia Other cause - Edema caused by extramammary origin - Edema caused by mammary procedure (B) Neoplasm Benign - Hamartoma - Fibroadenoma - Giant juvenile fibroadenoma - Fibrocystic disease - Benign phyllodes tumor Malignant - Invasive ductal cancer - Inflammatory breast cancer - Malignant phyllodes tumor (C) Extrammamary location of mass: Chest wall - Lipoma - Malignant fibrous histiocytoma 4. Differential diagnosis: mastitis vs. inflammatory breast cancer 5. Conclusion

BR187-ED-MOB12 2018 New Trends! Axillary Ultrasound

Station #12

Participants

Karina Pesce, Capital Federal, Argentina (*Abstract Co-Author*) Nothing to Disclose
Maria Jose Chico, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose
Carolina Hadad, Capital Federal, Argentina (*Abstract Co-Author*) Nothing to Disclose
Roberto Secco, Capital Federal, Argentina (*Abstract Co-Author*) Nothing to Disclose
Griselda Choque Leniz, MEd,MEd, Longchamps, Argentina (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1-Analyze the role of axillary ultrasound in the patient with breast cancer 2-Discuss the role of axillary ultrasound in the evaluation of newly diagnosed breast cancer patients given recent changes in the surgical management of the axilla. 3- Emphasize the common sonographic features of axillary metastasis

TABLE OF CONTENTS/OUTLINE

1-Introduction: Axillary staging in the context of breast cancer is a contentious topic. Ultrasound is the most commonly used modality for axillary evaluation given its wide availability. Current debate questions whether there is a benefit to diagnosing metastasis with ultrasound-guided needle biopsy as this may lead to more axillary node dissections in an era of its decreasing role. 2- What is the future of axillary ultrasound in the axillary management of breast cancer? 3- An updated literature review 4- Future Developments 5-Conclusion

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

VW32

Wide-angle Digital Breast Tomosynthesis Reading Session: Siemens Healthineers Vendor Workshop

Monday, Nov. 26 1:05PM - 2:15PM Room: Booth 5530

Participants

Paula M. Grabler, MD, Oak Park, IL (*Presenter*) Nothing to Disclose
Brandie L. Fagin, MD, Glenview, IL (*Presenter*) Nothing to Disclose

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 challenge you! All cases have been acquired with Siemens Mammomat Inspiration and are displayed on our syngo® Breast Care workstations so you will become familiar with the quality of our HD Tomo images and ease of use of our systems.

MSRO27

BOOST: Breast-Science Session with Keynote

Monday, Nov. 26 1:30PM - 2:30PM Room: S103CD

BR RO OI

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Kathleen Horst, MD, Stanford, CA (*Moderator*) Nothing to Disclose
Anna Shapiro, MD, Syracuse, NY (*Moderator*) Nothing to Disclose

Sub-Events

MSRO27-01 Invited Speaker:

Monday, Nov. 26 1:30PM - 1:50PM Room: S103CD

Participants
Jianling Yuan, MD, PhD, Minneapolis, MN (*Presenter*) Nothing to Disclose

MSRO27-03 Where Are the RCTs? Analysis of the 2018 American Society for Radiation Oncology (ASTRO) Evidence-Based Guidelines for Radiation Therapy to the Whole Breast as Treatment for Breast Cancer

Monday, Nov. 26 1:50PM - 2:00PM Room: S103CD

Participants
Norman R. Williams, PhD, London, United Kingdom (*Presenter*) Travel support, Carl Zeiss AG

For information about this presentation, contact:

norman.williams@ucl.ac.uk

PURPOSE

Early in 2018, the American Society for Radiation Oncology (ASTRO) produced evidence-based guidelines on five key questions for radiation therapy to the whole breast as treatment for breast cancer [Smith et al PMID: 29545124]. An analysis was made of the publications supporting these guidelines to determine how many reported level-1 evidence from randomised clinical trials (RCTs), as this is the standard applied to chemotherapy and adjuvant hormonal therapy.

METHOD AND MATERIALS

All 112 references were scrutinized, and tabulated according to level of evidence (RCT or not), year of publication, country of lead author, and which of the statements (grouped into five key questions) they addressed.

RESULTS

Of the 33 statements, 12 are not supported by evidence from RCTs. In a further 9 statements, data from RCTs only partly support the consensus. Therefore, 21/33 (64%) of the statements are not directly supported by evidence from RCTs. There is no evidence from RCTs to support any of the statements regarding avoiding exposure of cardiac and other normal tissue (key questions 4 and 5). Such exposure has been linked to death from ischemic heart disease [Darby et al PMID: 23484825] and lung cancer [Taylor et al PMID: 28319436]. There is evidence that the effects of a course of whole breast radiation therapy induces early ECG changes [Tuohinen et al PMID: 29599341]; biological effects can be detected after a single fraction [Woolf et al PMID: 25045612]. Such measures could be used in the design of RCTs, particularly of patients with low-risk breast cancer in whom de-escalation of breast radiation therapy (using accelerated partial breast, intra-operative, etc.) may be warranted to reduce an imbalance in the efficacy/safety profile [Franco et al PMID: 29616366].

CONCLUSION

The majority of the 2018 ASTRO evidence-based guidelines for use of radiation therapy in breast cancer are not based on level-1 evidence from RCTs. Trials using techniques that minimize exposure to normal tissues are urgently required.

CLINICAL RELEVANCE/APPLICATION

Clinicians and patients should be aware that current guidelines for treatment of breast cancer using radiation therapy are mostly based on sub-optimal evidence.

MSRO27-04 Clinical Outcomes and Toxicity of Proton Beam Radiation Therapy for Re-Irradiation of Locally Recurrent Breast Cancer

Monday, Nov. 26 2:00PM - 2:10PM Room: S103CD

Awards
Student Travel Stipend Award

Participants

Prashant Gabani, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Maria A. Thomas, MD, PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Beth Bottani, CMD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Jeffrey D. Bradley, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Laura Ochoa, RN,PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Imran Zoberi, MD, St. Louis, MO (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

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PURPOSE

Repeat radiation therapy (RT) using x-rays for locally recurrent breast cancer results in increased short and long-term toxicity. Proton beam RT (PBRT) can minimize dose to surrounding organs thereby reducing toxicity. Here, we report the toxicity and outcomes for women who underwent re-irradiation to the chest wall for locally recurrent breast cancer using PBRT.

METHOD AND MATERIALS

A total of 16 patients with locally recurrent breast cancer who underwent re-irradiation to the chest wall with PBRT between 2014-2018 were retrospectively analyzed. For their recurrences, 6 patients underwent salvage mastectomy, 8 patients had wide local excision, and 2 patients had biopsy only. The median dose for the first RT course was 50 Gy, and for the second course, 50.4 Cobalt Gy Equivalent. The target for re-irradiation was chest wall alone in 12 patients and chest wall plus regional nodes in 4 patients. A boost was delivered in 3 (18.8%) patients. Concurrent hyperthermia was used in 10 (62.5%) patients. For systemic therapy, 4 (25%) patients received chemotherapy and 8 (50%) patients received hormone therapy. Follow up was calculated from the start of second RT course. Toxicities were based on CTCAE 4.0.

RESULTS

The median age at diagnosis and at recurrence was 49.8 years and 60.2 years respectively. The median time between the two RT courses was 10.2 (0.7-20.2) years. The median follow up time was 10.6 (1.5-29.1) months. There were no local failures observed after re-irradiation. Only one patient developed distant metastasis and ultimately died. Grade 3-4 acute skin toxicity was observed in 5 (31.2%) patients. There were 4 (25%) patients who developed chest wall infections during or shortly (2 weeks) after re-irradiation. Grade 3-4 fibrosis was observed in only 3 (18.8%) patients. Grade 5 toxicities were not observed. Hyperpigmentation was seen in 12 (75%) patients. Other RT related toxicities such as pneumonitis, telangiectasia, rib fracture, and lymphedema occurred in 2 (12.5%), 4 (25%), 1 (6.3%), and 1 (6.3%) patients respectively.

CONCLUSION

Re-irradiation with PBRT for recurrent breast cancer has acceptable toxicities. There was a high incidence of grade 3-4 skin toxicity and infections, however, they resolved with skin care and antibiotics. Further follow up is needed to determine long-term clinical outcomes.

CLINICAL RELEVANCE/APPLICATION

PBRT can be safely used for re-irradiation of the chest wall for locally recurrent breast cancer.

MSRO27-05 Carcinosarcoma of the Breast: Treatment Patterns and Survival Outcomes

Monday, Nov. 26 2:10PM - 2:20PM Room: S103CD

Awards
Trainee Research Prize - Resident

Participants
William R. Kennedy, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Prashant Gabani, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Sahaja Acharya, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Maria A. Thomas, MD, PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Imran Zoberi, MD, St. Louis, MO (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Carcinosarcoma of the breast is a rare yet highly-aggressive tumor accounting for less than 1% of all breast cancers, for which guidance on optimal management and prognosis are sparse. The purpose of this study is to investigate population-based treatment patterns and overall survival (OS) outcomes in patients with this diagnosis.

METHOD AND MATERIALS

We queried the National Cancer Database for patients diagnosed with carcinosarcoma (Histology 8980) of the breast. All patients included were treated with surgery, with or without chemotherapy and/or radiation therapy. Patients with metastatic disease were excluded. Kaplan-Meier analysis was used to estimate OS. Univariate and multivariate cox analyses were used to determine predictive factors of OS.

RESULTS

A total of 329 patients from 2004-2012 were identified. Median age at diagnosis was 58 years (range, 24-90). Patients had T1 (21%), T2 (44%), T3 (25%), or T4 disease (10%). Most patients were node-negative at diagnosis (77%). Breast conservation surgery was utilized in 33% of patients. Chemotherapy was used in 66% of patients. Less than half (44%) of patients received radiation therapy to a median dose of 50.4Gy (range 35-56 Gy), with a median 10Gy boost used in 76%. With median follow-up of 39.9 months, 3-year overall survival was 74%. Multivariate analysis revealed that T-stage, margin status, and chemotherapy use all significantly influenced OS. There was a trend towards improved survival with the use of RT (HR 0.66, 95% CI 0.43-1.01, p =0.053). The 3-yr OS was 80% in patients receiving chemotherapy vs 59% without chemotherapy. The 3-yr OS was 82% in patients receiving RT vs 66% without RT.

CONCLUSION

Carcinosarcoma of the breast is associated with relatively poor rates of OS. The use of chemotherapy was associated with improved OS, with a trend towards improved OS with the use of RT.

CLINICAL RELEVANCE/APPLICATION

In the largest study to date investigating outcomes in carcinosarcoma of the breast, adding chemotherapy to surgery improved OS. A trend toward improved OS was also seen with adjuvant RT.

MSRO27-06 Quantitative Ultrasound Characterization of Radiation-Induced Acute Skin Toxicity in Breast Cancer Patients Receiving Radiation Therapy: A Feasibility Study

Monday, Nov. 26 2:20PM - 2:30PM Room: S103CD

Participants
Sylvia D. Tang, Johns Creek, GA (*Presenter*) Nothing to Disclose
Jiwoong Jason Jeong, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Xiaofeng Yang, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Mylin A. Torres, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Arif N. Ali, MD, MS, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Tian Liu, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Despite technological advances in radiotherapy, high dose of radiation may induce acute skin toxicity in the majority of women receiving breast-cancer radiotherapy. In current clinical practice, the severity of skin toxicity is often rated by clinicians through visual inspection and physics examination, which is subjective. The purpose of this study is to investigate the feasibility of quantitative characterization of radiation-induced acute skin toxicity via ultrasound morphological and texture analysis.

METHOD AND MATERIALS

Twelve patients receiving standard breast radiotherapy were enrolled in the longitudinal ultrasound study. Ultrasound B-mode images are acquired at various time points: prior to, weekly during, as well as 6 weeks and 3 months post radiotherapy. At each time point, 4 images (12, 3, 6 and 9 o'clock) were acquired on the irradiated breast and 4 mirror images were acquitted on the contralateral normal breast. To evaluate radiation-induced skin changes, we performed both morphological (area, height, perimeter and averaged skin thickness) and textural (contrast, angular second moment (ASM) and inverse difference moment (IDM)) analyses using ImageJ. Clinical assessment of skin toxicity was performed at each time point.

RESULTS

Changes in skin thickness and texture were observed in 5 patients as early as 1 week during treatment. In 2 cases with most severe acute toxicity, the average skin thickness of irradiated breast increases more than 175% and 188% at the end of fractionated therapy in comparison to the untreated contralateral breast, while their slopes in linear regression are 0.87 and 0.70, respectively. Acute skin toxicity was observed in differences in 5 cases in the angular second moment measurements and in 4 cases of entropy analysis over the patient's temporal treatment course.

CONCLUSION

Radiation-induced skin toxicity in breast cancer patients can be quantitatively assessed by ultrasound-based morphologic and textural characterization.

CLINICAL RELEVANCE/APPLICATION

Quantitative ultrasound characterization of radiation-induced acute skin toxicity in breast cancer patients receiving radiation therapy may be of clinical relevance for the optimization of treatment protocols and potential early intervention to prevent long-term breast toxicity.

VW08

Global Perspectives on Risk-based Screening: Panel Discussion: GE Vendor Workshop

Monday, Nov. 26 1:30PM - 2:30PM Room: Booth 8156

Participants

Jack Cuzick, London, United Kingdom (*Presenter*) Nothing to Disclose

Program Information

A global panel of experts will discuss barriers and opportunities that contribute to the ability to institute risk based breast screening including workflow impact, risk assessment tools, balance of screening benefits and risks, cost-effectiveness, patient management, technology needs and more. *Registration is required; adding this session to the RSNA calendar tool alone does not secure your seat in this session. Click the link below to register.*

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2018-/agenda-e57e0b47e9aa4f5ba89b1a0da1e829b9.aspx

VW59

Tomosynthesis Guided Prone Breast Biopsy Solutions: Hologic Vendor Workshop

Monday, Nov. 26 1:30PM - 2:30PM Room: Booth 5524

Participants

Daniel E. Lehrer, MD, CABA, Argentina (*Presenter*) Speaker, Hologic, Inc; Institutional research agreement, Siemens AG

Program Information

Clinical benefits of tomosynthesis guided biopsy which includes a hands-on demonstration of the Affirm® Prone Biopsy System and the Brevera® Breast Biopsy System (Affirm® Prone Biopsy System and Brevera® Breast Biopsy System)

Registration

https://hologicrsna.com

VW33

Automated Breast Volume Scanner (ABVS) Physician Training Workshop: An Interactive Learning Experience: Siemens Healthineers Vendor Workshop

Monday, Nov. 26 2:30PM - 3:40PM Room: Booth 5530

Participants

Terri A. Gizienski, MD, Greenwood Village, CO (*Presenter*) Nothing to Disclose

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 unique coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

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MSRO28

BOOST: Breast-Case-based Multidisciplinary Review (Interactive Session)

Monday, Nov. 26 3:00PM - 4:15PM Room: S103CD

BR OI RO

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants
Nora M. Hansen, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Bethany L. Niell, MD,PhD, Tampa, FL (*Presenter*) Nothing to Disclose
Jean L. Wright, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Cesar A. Santa-Maria, MD, Baltimore, MD (*Presenter*) Research funded, AstraZeneca PLC; Research funded, Pfizer Inc; Advisory Board, Polyphor

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LEARNING OBJECTIVES

1) Describe the latest advances in breast cancer imaging before, during, and after treatment. 2) Facilitate a multidisciplinary approach to the diagnosis, management, and treatment of breast cancer.

SSE01

Breast Imaging (Breast Density and Risk Assessment)

Monday, Nov. 26 3:00PM - 4:00PM Room: E451B

BQ BR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Jennifer A. Harvey, MD, Charlottesville, VA (*Moderator*) Stockholder, Hologic, Inc; Research Grant, Volpara Health Technologies Limited; Stockholder, Volpara Health Technologies Limited;
Ioannis Sechopoulos, PhD, Atlanta, GA (*Moderator*) Research Grant, Siemens AG; Research Grant, Canon Medical Systems Corporation; Speakers Bureau, Siemens AG; Scientific Advisory Board, Fischer Medical

Sub-Events

SSE01-01 Surrounding Regions of Tumor in FFDM are Associated with Breast Cancer Prognostic and Proliferation Markers

Monday, Nov. 26 3:00PM - 3:10PM Room: E451B

Awards
Student Travel Stipend Award

Participants
Dooman Arefan, PhD, Pittsburgh, PA (*Presenter*) Nothing to Disclose
Bingjie Zheng, MD, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose
Ruimei Chai, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
Margarita L. Zuley, MD, Pittsburgh, PA (*Abstract Co-Author*) Investigator, Hologic, Inc
Jules H. Sumkin, DO, Pittsburgh, PA (*Abstract Co-Author*) Research Grant, Hologic, Inc; Research Grant, General Electric Company
Shandong Wu, PhD, MSc, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

wus3@upmc.edu

PURPOSE

Radiomic information of segmented tumors in breast images have been shown to be correlated with prediction of certain markers/surrogates for prognosis. Surrounding regions of tumor may have been affected by tumor development but its effects remain unclear for similar prediction purposes. We performed an investigation on the radiomic imaging features extracted from both tumor and surrounding regions in relation to prediction of breast cancer distant recurrence risk and tumor proliferation markers.

METHOD AND MATERIALS

We performed an IRB-approved retrospective study on 119 ER-positive and node-negative invasive breast cancer patients diagnosed (confirmed by pathology) during 2011-2016. All patients had FFDM scans (including MLO and CC views), Oncotype DX recurrence risk scores, and proliferation markers (Ki-67) available. Breast tumor was segmented by an expert breast imaging radiologist, and a varying size (diameter) of surrounding regions outside the segmented tumor were automatically separated using automated image processing techniques. A total of 23 radiomic features were extracted respectively from tumor and its surrounding region. The logistic least absolute shrinkage and selection operator (LASSO) regression model was used to estimate the Oncotype DX risk score and Ki-67 rate, respectively, using the same set of 23 features. AUC and Pearson's correlation coefficient (r) are performance metrics.

RESULTS

For features extracted from tumor alone, r was 27% ($p < 0.05$) and 35% ($p<0.05$) for estimating Oncotype DX and Ki67, respectively, while the corresponding AUC was 0.77 (High Oncotype DX vs Intermediate and low) and 0.58 (High Ki-67 vs low Ki-67). When imaging features from the surrounding regions (6 mm outer from tumor boundary) were incorporated additionally, r increased to 34% ($p<0.05$) and 47% ($p<0.05$) for estimating Oncotype DX and Ki-67, respectively, while the AUC was 0.78 and 0.63. The LASSO-selected features included the tumor solidity, surrounding region's skewness and intensity contrast.

CONCLUSION

Inclusion of the surrounding regions of breast tumor in FFDM increased the performance of predicting Oncotype DX recurrence risk scores and Ki-67 proliferation rate.

CLINICAL RELEVANCE/APPLICATION

Surrounding regions of breast tumor in FFDM may provide additional quantitative information over tumors to enhance prognosis and proliferation estimation

SSE01-02 Developing a Deep Learning Algorithm to Automatically Classify Breast Density According to 5th

Edition of ACR BI-RADS in Mammography

Monday, Nov. 26 3:10PM - 3:20PM Room: E451B

Participants
Yiming Ding, Berkeley, CA (*Presenter*) Nothing to Disclose
Mian Zhong, Berkeley, CA (*Abstract Co-Author*) Nothing to Disclose
Youngho Seo, PhD, San Francisco, CA (*Abstract Co-Author*) Consultant, BioLaurus, Inc
Thienkhai H. Vu, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Hari Trivedi, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Dmytro Lituiev, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Amie Y. Lee, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Dexter Hadley, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Bonnie N. Joe, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Jae Ho Sohn, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

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sohn87@gmail.com

PURPOSE

The current edition of BI-RADS assigns breast density qualitatively based on potential for obscuring breast cancer, rather than a simple quantitative summation of image intensities. The aim of this study is to develop a deep learning algorithm for breast density classification based on the new BI-RADS system and then retrospectively apply them to a separate set of digital mammograms to automatically classify breast density according to BI-RADS 5th Edition.

METHOD AND MATERIALS

A convolutional neural network with ResNet50 architecture was trained on 94,562 screening mammograms performed from 2014 to 2018 from a single institution following the current 5th edition of BI-RADS for mammography. Optimal neural network hyperparameters were selected via validation accuracy monitoring. The trained model was then applied to a hold-out test set of size 9,547 from the same institution. We then manually inspected all 13 cases in which the predicted label differed by more than 2 density labels from the ground truth. This algorithm was applied to 433,760 screening mammograms in large scale.

RESULTS

Our deep learning model achieved high sensitivity and specificity in assigning breast density category. Breast density distribution for the training data was 7,752 (A: 8.20%), 35,656 (B: 37.71%), 40,943 (C: 43.30%), and 10,211 (D: 10.79%). The AUCs of ROC curves on the test set were 0.97, 0.93, 0.92, and 0.96, respectively for each breast density category. Error analysis revealed that among the 13 cases where breast density differed by more than 2 classes between actual and predicted labels, 7 were due to breast implants, 4 were due to incorrect ground truth labels, and 2 remained equivocal. After the model was applied to the 433,760 screening mammograms, the model-predicted breast density distribution came to be 40,109 (A, 9.25%), 151,893 (B, 35.02%), 193,283 (C, 44.56%), and 48,475 (D, 11.17%).

CONCLUSION

Our deep learning algorithm successfully modeled the breast density classification scheme in the 5th edition BI-RADS system. This was retrospectively applied in large scale to 433,760 mammograms for further inspection.

CLINICAL RELEVANCE/APPLICATION

Qualitative breast density assessment by radiologists is subject to variability. Given widespread adoption of breast density notification laws in the U.S., automated breast density assessment based on masking can improve consistency of breast density assignment particularly between categories B & C.

SSE01-03 Using Quantitative Breast Density Analysis to Predict Interval Cancers and Node Positive Cancers in Pursuit of Improved Screening Protocols

Monday, Nov. 26 3:20PM - 3:30PM Room: E451B

Participants
Elizabeth S. Burnside, MD,MPH, Madison, WI (*Presenter*) Dr. Burnside has a research grant from Hologic
Lucy M. Warren, PhD, Guildford, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Louise S. Wilkinson, MBBCh,FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Kenneth C. Young, PhD, Guildford, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Jonathan Myles, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Stephen W. Duffy, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study investigates whether quantitative breast density can predict interval cancers and node positive screen detected cancers in order to serve as a biomarker to consider more aggressive screening to improve early detection.

METHOD AND MATERIALS

We conducted a case-control study of 1204 women drawn from the U.K. NHS Breast Screening Program aged 50-74 including 599 cases (comprising 302 screen detected cancers, 297 interval cancers; 239 node positive, 360 node negative) and 605 controls. Each woman had prior digital mammograms and 70% had unprocessed images. A radiologist assessed breast density using a visual analog scale (VAS) from 0 to 100 and BI-RADS 5th Edition density categories. Volpara software (V1.5.1) calculated fibroglandular volume (FGV) and volumetric density grade (VDG) on unprocessed images. Logistic regression determined whether the breast density measures could predict mode of detection (screen detected or interval); node-negative cancers; and node-positive cancers, all vs. controls.

RESULTS

FGV predicted both screen-detected ($p<0.01$) and interval cancers ($p<0.01$) compared to controls. VDG, VAS and BI-RADS

FGV predicted both screen-detected (p<0.01) and interval cancers (p<0.01) compared to controls. VDG, VAS and BI-RADS predicted interval cancers (all p<0.01) but not screen-detected cancers (p=0.16, p=0.18, p=0.46 resp.). FGV demonstrated impressive risk stratification with an age-adjusted relative risk (RR) of the 4th quartile compared to the 1st quartile of 3.7 overall, 2.8 for screen detected, and 5.3 for interval cancers. VDG also had notable risk stratification with an age-adjusted RR of 3.6 for interval cancers (Table). FGV predicted node-negative cancers as compared to controls (p<0.01) while BI-RADS, VAS, and VDG did not (p=0.07, p=0.09, and p=0.47 resp.). FGV, BI-RADS, and VDG predicted node-positive cancers (all p<0.01) while VAS did not (p=0.14).

CONCLUSION

FGV predicts interval, screen detected, node-positive and node-negative cancers compared to controls and provides remarkable stratification the RR of interval cancers. BI-RADS and VDG predict interval and node positive cancers. VAS only predicts interval cancers. The quantitative and automated nature of FGV and VDG and notable risk stratification based on RR indicates that these variables may be promising biomarkers.

CLINICAL RELEVANCE/APPLICATION

By predicting mode of detection and nodal status, FGV may be a biomarker for more intensive screening. By predicting interval cancers, BI-RADS, VAS, and VDG may act as supplementary biomarkers.

SSE01-04 Fully-Automated Volumetric Breast Density Estimation from Digital Breast Tomosynthesis: A Case-Control Comparison to Area-Based Density Measures from Digital Mammography

Monday, Nov. 26 3:30PM - 3:40PM Room: E451B

Participants
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
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Despina Kontos, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate associations between breast cancer and fully-automated volumetric density measures extracted with digital breast tomosynthesis (DBT), while also comparing to area-based density measures from digital mammography (DM).

METHOD AND MATERIALS

We retrospectively analyzed contralateral combo DM-DBT studies (Selenia Dimensions, Hologic Inc.) from 174 women with unilateral breast cancer and 696 controls matched to cases on age, ethnicity and screening exam date at a 4:1 ratio. The publicly available 'LIBRA' software (v1.0.4) was adapted and used to estimate absolute dense volume (DV) and volumetric percent density (VPD) from DBT, and absolute dense area (DA) and area percent density (APD) from DM images. Quantra (v2.2; Hologic Inc.) was also applied to DM images, allowing to evaluate APD as well as to infer DV and VPD via physics-based models. Associations between the different density measures and breast cancer were evaluated via logistic regression after adjustment for age, ethnicity and body mass index (BMI). Area under the curve (AUC) of the receiver operating characteristic was used to assess case-control discriminatory capacity, where model performance was compared using the DeLong's test, and odds ratios (ORs) for each of the density measures were estimated.

RESULTS

All density measures had a significant association with breast cancer (OR = 1.24-2.40) after adjustment for age, ethnicity and BMI. Models based on volumetric density measures had significantly ($p < 0.05$) larger case-control discriminatory capacity (AUC = 0.59-0.63) than models considering area density (AUC = 0.57-0.59). Maximum breast cancer association was observed for DV with slightly ($p = 0.440$) improved performance when extracted with DBT (AUC = 0.63) relative to DV inferred from DM (AUC = 0.61).

CONCLUSION

Fully-automated, quantitative, volumetric evaluation of breast density from DBT is feasible and can result in larger case-control discriminatory capacity than area-based density measures from conventional planar mammography. Associations with breast cancer can potentially further improve when volumetric density evaluation is performed with the DBT reconstructed breast volume compared to physics-based models applied to DM.

CLINICAL RELEVANCE/APPLICATION

Our results further elaborate important clinical implications of breast density measures estimated with DBT, which may result in improved measures of breast density in breast cancer risk assessment.

SSE01-05 Predicting Masking Risk in Mammography

Monday, Nov. 26 3:40PM - 3:50PM Room: E451B

Participants
James G. Mainprize, PhD, Toronto, ON (*Presenter*) Institutional research agreement, General Electric Company
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PURPOSE

Masking in mammography is the reduction of lesion conspicuity by surrounding and overlying dense tissue. Masking risk is increased in dense breasts, leading to reduced sensitivity of breast screening. We have developed a masking index that can predict the likelihood of a masked or missed cancer and could be used in a screening program to stratify women at greatest risk of masking to alternative or supplementary imaging modalities to mammography.

METHOD AND MATERIALS

The study population were cancer cases collected (2003-2013) a case-control study used to develop a breast cancer risk model incorporating density measures. Cancers were classified as screen-detected cancers (SDC) found on a screening mammogram and non-screen detected cancers (NSDC) found by clinical symptoms or other imaging. The study had ethics board approval with informed consent All SDC found on baseline images were excluded. Inclusion as NSDC required at least one prior negative screening exam within two years of diagnosis. Images were analyzed with in-house algorithms and by volumetric breast density (VBD) software. The aim in this study was to create an index that differentiated mammograms which allowed for detection (SDC) from those for causing masking or missed lesions (NSDC). To avoid the influence of the lesion itself, only the contra-lateral breast images were used.

RESULTS

The study included 90 NSDC cases and 186 SDC controls. Univariate masking indices based on BMI, age, BI-RADS density, VBD or mean detectability yielded areas under ROC (AUC) of 0.61, 0.65, 0.67, 0.72 and 0.75 (±0.06 95% confidence) respectively. For cancers found within one year, the detectability AUC improved to 0.81.

CONCLUSION

Age and BMI are relatively weak predictors of masking risk whereas VBD and detectability measures have better performance. Further, adding textural measures improve predictions slightly, suggesting that the masking effects of anatomic noise and texture are informative. In future, we will validate the model in an independent population and test the result on normal mammograms to predict impact on a stratified screening program.

CLINICAL RELEVANCE/APPLICATION

A reliable masking index to predict when mammography will underperform would be a valuable tool in a stratified screening program which could be used to redirect women with highly masked mammograms to alternative or adjunct screening strategies such as tomosynthesis, MR or ultrasound.

SSE01-06 Quantitative MRI Background Parenchymal Enhancement and Contralateral Breast Cancer Risk

Monday, Nov. 26 3:50PM - 4:00PM Room: E451B

Participants
Lei Zhang, PhD, Pittsburgh, PA (*Presenter*) Nothing to Disclose
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PURPOSE

MRI background parenchymal enhancement (BPE) has been shown to be correlated with the risk of developing breast cancer in breast-cancer free women. History of breast cancer is a significant risk factor of contralateral breast cancer. We investigated the association between quantitative MRI BPE measures and risk of contralateral breast cancer development in a case-control setting

METHOD AND MATERIALS

A retrospective case-control (1:2 case-control ratio) study was performed using breast DCE-MRI scans from 135 newly diagnosed unilateral breast cancer patients (confirmed by pathology) from 2010-2016: 35 women had future contralateral breast cancer development after the initial breast cancer diagnosis and 70 were age- and year-of-MRI matched controls that remained breast cancer-free in the contralateral breasts after at least 1-year follow-up. The MRIs acquired at the initial diagnosis of the unilateral breast cancer were analyzed using published automated computer algorithms, generating two quantitative BPE measures computed from the first post-contrast series: the absolute BPE volume (|BPE|) and its relative amount over the whole breast volume (BPE%). Volumetric amounts of fibroglandular (dense) tissue (|FGT| and FGT%) were also automatically quantified from the MRI. Conditional logistic regression was performed to assess these BPE and FGT measures as predictors of the contralateral breast cancer development.

RESULTS

Average age was 52.2±13.1 (range 28-81) for cancers and 52.8±12.9 (range 28-80) for controls. 51% (or 49%) are post-menopause for cancers (or controls). Invasive other-cancer history was found in less than 10% of the patients for both cancer cases and controls. None of the |FGT|, FGT%, |BPE|, BPE% measures is statistically significant (all $p>0.05$) in terms of the difference between the cancer group and control group. Logistic regression showed that odds ratios of these four measures are very close to 1 with no statistical significance.

CONCLUSION

This pilot study showed that MRI BPE quantified in the contralateral breast of unilateral breast cancer patients is not associated with the future development of the contralateral breast cancers.

CLINICAL RELEVANCE/APPLICATION

BPE may be affected bilaterally even in unilateral breast cancer patients. Contralateral breast cancer risk markers can guide

treatment selection and risk reduction, meriting further investigation.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
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SSE02

Breast Imaging (Patient-Centric Care)

Monday, Nov. 26 3:00PM - 4:00PM Room: E450B

BR HP

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Rachel F. Brem, MD, Washington, DC (*Moderator*) Board of Directors, iCAD, Inc; Board of Directors, Dilon Technologies, Inc ; Stock options, iCAD, Inc ; Stockholder, Dilon Technologies, Inc; Consultant, Dilon Technologies, Inc; Consultant, ClearCut Medical Ltd ; Consultant, Delphinus Medical Technologies, Inc
Priscilla J. Slanetz, MD, MPH, Belmont, MA (*Moderator*) Nothing to Disclose

Sub-Events

SSE02-01 Communicating Mammography Results: What Method and How Quickly Do Women Want Their Screening Mammogram Results?

Monday, Nov. 26 3:00PM - 3:10PM Room: E450B

Participants
Julia Staschen, BS, Richmond, VA (*Abstract Co-Author*) Nothing to Disclose
Nghiem Pham, BA, Midlothian, VA (*Presenter*) Nothing to Disclose
Alicia Johns, Richmond, VA (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Expectations for when and how to receive results for mammograms are uncertain and the goal of this study is to explore expectations for patient care with regards to receiving mammogram results. The purpose of the study was to understand the majority preference with regards to the wait time for screening mammogram results, whether prompt communication of mammogram results was of importance to patients, whether the time frame to schedule an additional imaging follow-up appointment after an abnormal screening mammogram was of importance to patients, and how patients preferred to be given their screening mammogram results. From the survey, investigators wanted to determine whether any quality practice improvements are necessary at their academic breast imaging centers in order to improve the communication of screening mammogram results.

RESULTS

There were 2,245 patients who participated in the survey. A majority of patients preferred to receive results on Friday (N=1,868, 85.4%). Most individuals preferred to schedule their follow up appointments soon after their initial appointment, preferring either the next day or within 1-2 days. Finally, over half of the sample preferred to be contacted via a phone call, with letter and text messaging being the next most preferred methods. The preference for receiving results on Friday was evaluated by each of the patient characteristics. The responses by the patients for preference for receiving results on Friday were significantly different by ethnicity, education, and clinic. In particular, patients of other ethnicities besides African Americans and Caucasians responded with the highest percent to receiving results on Friday and Caucasians were the least inclined to prefer to receive results on Friday. Individuals with some college and college degrees were more likely to not prefer receiving results on Friday than those with no formal education or high school graduates. The preferred time for scheduling a follow up was assessed by each of the patient characteristics. Across all the patient characteristics, patients preferred to schedule their follow up appointment the next day. Lastly, first choice of contact was examined across each of the patient characteristics. Phone call was the overwhelming choice for method of contact for all patient characteristics.

CONCLUSION

The findings suggest that the patient population surveyed have a preference for their wait time, which is either to wait or receive them within 24 hours. Patients preferred to receive results on Friday, and the most frequent choice for scheduling a follow up appointment was the next day. A phone call was the preferred first choice for method of contact with e-mail being the least preferred. These suggestions can help clinics and providers make changes to how they communicate their results. These findings may help to streamline results for patients who prefer a shorter wait time, and highlight the overwhelming patient preference to receive their abnormal screening mammogram results on a Friday. The findings may also suggest how to contact patients in a different way, as phone calls were the preferred method of contact. The strong preference of patients receiving their screening mammogram results more promptly should help trigger alternative methods toward improving communication between the radiologist and the patient.

METHODS

Patients The study population was patients aged 18 or older, who completed an anonymous paper survey consisting of eight questions when coming in for a routine mammogram screening. The study period lasted from September to November 2017 at two academic breast-imaging centers. *Measures* The primary objective of the study was to summarize the results from a survey examining the communication of mammography results from the patient population. The association between patient demographics

and four outcomes, preferred wait time, preferred scheduling time for a follow-up appointment, preference for receiving screening results on Friday, and preferred methods of contact was investigated. Parameters of the survey are summarized in attached Table 1. *Statistical Methods* Frequencies and percentages for clinic site, age, ethnicity, education, and insurance were calculated. Pearson chi-square analyses were conducted to determine the association between wait time preference and each patient demographic, between preferred scheduling time for follow-up appointment and each patient demographic, between preference for receiving screening results on Friday and each patient demographic, and between the first choice of method of contact and each patient demographics. SAS version 9.4 was used for all analyses.

PDF UPLOAD

http://abstract.rsna.org/uploads/2018/18003961/18003961_3t99.pdf

SSE02-02 City Patterns of Screening Mammography Uptake and Disparity Across the United States

Monday, Nov. 26 3:10PM - 3:20PM Room: E450B

Awards
Trainee Research Prize - Resident

Participants
Eric Kim, MD, 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
C. A. Hartwell, BS, New York, NY (*Abstract Co-Author*) Nothing to Disclose
James S. Babb, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Samantha L. Heller, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Rural disparities in screening utilization are known to be affected by lack of access to care providers; city-level screening mammography disparity has been less well evaluated, although over 30 million adult women live in the 500 largest cities. Our purpose is therefore to evaluate disparities in screening in US cities.

METHOD AND MATERIALS

This descriptive study used public data from the 500 Cities project--500 largest cities, 103,020,808 individuals--which includes self-reported screening uptake (127,298 women ages 50-74) from the Behavioral Risk Factor Surveillance System (BRFSS). Uptake was matched with BRFSS and American Community Survey national population/economic census data variables expected to impact screening: geographic region, health insurance, median household income, obesity, race, combined preventive care services (flu, pneumococcal shots, colorectal screening), and pap smear use. Cities with incomplete data were excluded, yielding 490 cities, 34,629,163 women. Univariable and multivariable analyses were performed. All statistical tests were conducted at the two-sided 5% significance level using SAS 9.3 software (SAS Institute, Cary, NC).

RESULTS

Mean city screening mammography utilization was 77.7% (62.8%-88.9%). Utilization was highest in New England cities ($p<0.002$), significantly positively correlated with pap smear ($r=0.75$), other preventive services ($r=0.3$), household income ($r=0.44$), %Asian race ($r=0.36$), weakly with %Black race ($r=0.10$); significantly negatively correlated with obesity ($r=-0.36$), poverty ($r=-0.30$), %White race ($r=-0.29$), no insurance ($r=-0.27$), ($p<0.05$ for all); not significantly correlated with population size ($p=0.651$). Multivariable analysis demonstrated Pap smear use, Asian race, private insurance, and geographic region to be significant independent predictors of utilization.

CONCLUSION

Screening mammography utilization varies across large cities in the U.S. with highest uptake in New England. Although the literature focuses on rural screening disparities, disparities also exist even across large cities without physical barriers to screening.

CLINICAL RELEVANCE/APPLICATION

Mammographic screening disparities exist at the city level; identifying predictors of uptake may aid in targeting areas and populations for screening education and intervention.

SSE02-03 Aligning Insurance Benefit Design with Patient Preference for Out-of-Pocket Cost Payments

Monday, Nov. 26 3:20PM - 3:30PM Room: E450B

Participants
Paniz Charkhchi, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
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Angela Fagerlin, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose
A. Mark Fendrick, MD, Ann Arbor, MI (*Abstract Co-Author*) Consultant, Abbott Laboratories; Consultant, AstraZeneca PLC; Consultant, sanofi-aventis Group; Consultant, F. Hoffmann-La Roche Ltd; Consultant, GlaxoSmithKline plc; Consultant, Merck & Co, Inc; Consultant, Neocure Group LLC; Consultant, Pfizer Inc; Consultant, POZEN Inc; Consultant, Precision Health Economics LLC; Consultant, The TriZetto Group, Inc; Consultant, Zanzors; Speakers Bureau, Merck & Co, Inc; Speakers Bureau, Pfizer Inc; Researcher, Abbott Laboratories; Researcher, AstraZeneca PLC; Researcher, sanofi-aventis Group; Researcher, Eli Lilly and Company; Researcher, F. Hoffmann-La Roche Ltd; Researcher, GlaxoSmithKline plc; Researcher, Merck & Co, Inc; Researcher, Novartis AG ; Researcher, Pfizer Inc
Ruth C. Carlos, MD, MS, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Alternative payment models encourage physicians to accept payment bundles. Their patients continue to pay fee-for-service (FFS) out of pocket costs, contrary to their preference for predictable out of pocket costs for a care episode. Using a hypothetical screening mammography diagnostic episode of care, we assessed patient preference for FFS vs bundled copayments (copays).

METHOD AND MATERIALS

After IRB approval, we recruited a population-based cross-sectional survey of women 40-75 years old through Survey Sampling International. Participants read a hypothetical scenario describing a screening mammography episode of care where 12% of women undergoing screening needed a follow-up breast ultrasound and 2% a breast biopsy. Estimated out-of-pocket (OOP) costs for these services and the characteristics of OOP payment types (FFS and a hypothetical bundled copay) were also described. We assessed OOP payment type preference and knowledge (7 true/false items, see Fig. 1), additional test cost worry (7-point scale from not at all to very worried), likelihood of mammogram use by OOP payment type and willingness to pay (WTP) for a breast screening episode bundle.

RESULTS

Participant (n=1,236) characteristics are described in Fig. 1. 82.9%preferred bundled copays over FFS and 70.8% answered at least half of the knowledge questions correctly. While most participants (74.5%) indicated they would get screened regardless of OOP payment type, 13.8%said they would only get screened with bundled copays and 3.4% with FFS. Sizeable percentages of participants were worried about costs associated with the ultrasound (42.0%) and biopsy (67.7%). Median WTP was $81 (25-75IQ=$34-$215) for a bundle to avoid paying additional OOP for possible ultrasound or biopsy.

CONCLUSION

Given worry over the cost over potential additional tests, participants preferred a predictable OOP cost for a breast screening episode, despite the low likelihood of additional testing. Although most participants would not defer mammography based on OOP payment type, a significant minority were more likely to screen if bundled copays were available. Insurers should consider incorporating these preferences in future benefits.

CLINICAL RELEVANCE/APPLICATION

Designing insurance plans to include bundled copays may decrease financial barriers to breast cancer work-up and diagnosis after screening mammography.

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/ Ruth C. Carlos, MD, MS - 2015 Honored EducatorRuth C. Carlos, MD, MS - 2018 Honored Educator

SSE02-04 Patient, Radiologist, and Examination Characteristics Affecting Screening Mammography Recall Rates in a Large Academic Practice

Monday, Nov. 26 3:30PM - 3:40PM Room: E450B

Participants
Catherine S. Giess, MD, Wellesley, MA (*Presenter*) Nothing to Disclose
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PURPOSE

To evaluate patient, radiologist, and examination characteristics affecting individual screening mammography recall rates in a large academic breast imaging practice.

METHOD AND MATERIALS

This Institutional Review Board approved retrospective study included all screening mammography examinations in female patients interpreted by thirteen breast imaging specialists at an urban academic center and two outpatient imaging centers from 10/1/2012-5/31/2015. Patient demographics were extracted via electronic medical record. A natural language processing algorithm captured breast density, BI-RADS assessment, and current and prior screening examination findings. Radiologists' annual screening volumes, years of clinical experience, and percentage of time doing breast imaging were calculated. Risk aversion, stress from uncertainty, and malpractice concerns were derived via online survey. Univariate and multivariate analyses assessed patient, radiologist, and examination characteristics associated with likelihood of mammography recall. Pearson product-moment correlation coefficient assessed relationship between cancer detection rate and recall rate.

RESULTS

Overall, 5,678 (9.3%) of 61,198 screening examinations were recalled. In multi-variate analysis, patient and radiologist characteristics associated with higher odds of recall included patient's age < 50 years ($p<0.0001$); calcification ($p<0.0001$), mass ($p<0.0001$), and higher density category ($p<0.0001$) on prior mammogram; baseline examination ($p<0.0001$); annual reading volume < 1250 screening exams ($p=0.0282$); and <10 years experience ($p=0.0036$). Radiologist's risk aversion, stress from uncertainty, malpractice concerns, or cancer detection rates were not associated with higher recall rates ($r=-0.36$, $p=0.23$).

CONCLUSION

In addition to patient and examination factors, screening recall variations were explained by radiologist's annual reading volume and experience. Interventions targeting radiologist factors may reduce unwarranted variation in screening recall and improve patient's care experience.

CLINICAL RELEVANCE/APPLICATION

Efforts to reduce screening recall rate variability and false positive recalls might include increasing annual screening interpretive volumes and review of uncertain screening findings for less experienced radiologists by more experienced breast imaging specialists.

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 EducatorCatherine S. Giess, MD - 2017 Honored Educator

SSE02-05 Preventive Care: How Comorbidities Affect Mammography Screening Rates

Monday, Nov. 26 3:40PM - 3:50PM Room: E450B

Awards
Student Travel Stipend Award

Participants
Cindy Yuan, MD,PhD, Chicago, IL (*Presenter*) Nothing to Disclose
Kirti M. Kulkarni, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Brittany Z. Dashevsky, MD,DPhil, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Here we evaluate the impact of comorbid conditions and age on screening mammography utilization.

METHOD AND MATERIALS

Data was retrospectively drawn from the 2011-2015 Medical Expenditure Panel Survey, which contained 40,752 women over the age of 40. Utilization was defined as a screening mammogram within the previous one or two years, analyzed separately. A logit model was employed to evaluate correlation of comorbidities with utilization. Statistical significance was defined by a p-value <0.05 by two-sided test.

RESULTS

Of the 36,575 women in the final sample, 45.9%, 43.6%, 3.9%, and 5.7% reported a history of hypertension (HTN), hyperlipidemia (HLD), prior heart attack (MI) and prior stroke (CVA), respectively. Among women without a comorbid condition, baseline annual mammography utilization was 47.3%. HTN and HLD were correlated with increased annual utilization [2.5 and 6.8 percentage points (pp)]. In comparison, prior MI and CVA were correlated with decreased annual utilization (-8.2 and -1.5 pp, not statistically significant in the latter). Results were similar for biennial utilization (3.0 and 7.6 pp increased utilization with HTN and HLD, respectively, and -6.5, and 0.1 pp decreased utilization for MI and CVA, respectively).

CONCLUSION

Screening utilization was increased in patients with HTN and HLD, and decreased in patients with prior MI and CVA. An understanding of how comorbid conditions influence screening may help better target specific populations and improve overall utilization of preventive care.

CLINICAL RELEVANCE/APPLICATION

HTN and HLD, comorbidities that require regular physician visits, are correlated with increased screening. However, prior MI or CVA, are correlated with decreased screening, possibly reflecting the effect of decreased life expectancy and increased morbidity. This is especially relevant as age-based guidelines fail to take into account individual comorbidities and life expectancy.

SSE02-06 Contrast-Enhanced Spectral Mammography (CESM) in the Screening Setting: Patient Preferences and Attitudes

Monday, Nov. 26 3:50PM - 4:00PM Room: E450B

Participants
Matthew M. Miller, MD, PhD, Charlottesville, VA (*Presenter*) Nothing to Disclose
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PURPOSE

Contrast-enhanced spectral mammography (CESM) is an emerging imaging tool that has been shown to have greater sensitivity than conventional mammography and equal sensitivity with improved specificity relative to breast MRI in the diagnostic setting. Ongoing studies are evaluating CESM performance in the screening setting, but little is known regarding whether patients would agree to its use and the associated risks in screening. Our study aims to evaluate the attitudes and concerns of patients regarding

the use of CESM in a screening setting.

METHOD AND MATERIALS

In this IRB-approved HIPAA-compliant prospective study, patients with prior mammograms demonstrating heterogeneous or extremely dense breasts presenting for screening mammography were invited to complete a survey. Patients were asked to rate their perception of personal breast cancer risk compared to peers and their level of concern related to screening callbacks, radiation exposure, and contrast allergies, and then identify which factors might deter them from getting adjunct screening exams such as CESM.

RESULTS

512 patients with dense breasts undergoing screening mammography completed surveys. While 27% of surveyed patients reported previously having been called back from screening for a diagnostic workup, a majority (63%) expressed little or no concern for callbacks leading to additional imaging or biopsy. Most patients (63%) felt it was likely or very likely that cancer could be missed on their mammogram, but only 9% had undergone adjunct screening exams in the past 3 years. The most commonly cited deterrents to undergoing adjunct screening were cost (69%), pain (35%), and concern for an increased likelihood of having a biopsy or surgery recommended (32%). When asked to select from several hypothetical adjunct screening modality choices, patients reported a strong preference (63%) for a test that is most likely to detect their cancer, even if this would require IV-line placement. Only 5% preferred a common but less sensitive test that did not require IV-line placement.

CONCLUSION

Our study suggests that women with dense breasts may accept CESM as an adjunct screening exam and may actually prefer it over screening MRI or US given its relatively high sensitivity and low cost.

CLINICAL RELEVANCE/APPLICATION

Women with dense breasts may accept CESM as an adjunct screening exam given its sensitivity and low cost.

SSE23

Physics (Breast X-Ray Imaging)

Monday, Nov. 26 3:00PM - 4:00PM Room: S502AB

AI BR PH SQ

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Srinivasan Vedantham, PhD, Tucson, AZ (*Moderator*) Research collaboration, Koning Corporation
Hilde Bosmans, PhD, Leuven, Belgium (*Moderator*) Co-founder, Qaelum NV Research Grant, Siemens AG

Sub-Events

SSE23-01 Radiation Dose Reduction in Digital Breast Tomosynthesis (DBT) by Means of Neural Network Convolution (NNC) Deep Learning

Monday, Nov. 26 3:00PM - 3:10PM Room: S502AB

Participants
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Kenji Suzuki, PhD, Chicago, IL (*Presenter*) Royalties, General Electric Company; Royalties, Hologic, Inc; Royalties, MEDIAN Technologies; Royalties, Riverain Technologies, LLC; Royalties, Canon Medical Systems Corporation; Royalties, Mitsubishi Corporation; Royalties, AlgoMedica, Inc

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PURPOSE

To reduce cumulative radiation exposure and lifetime risks for radiation-induced cancer from breast cancer screening, we developed novel NNC deep learning for radiation dose reduction in DBT.

METHOD AND MATERIALS

Our original NNC deep learning employed patched-based neural network regression in a convolutional manner to convert lower-dose (LD) to higher-dose (HD) tomosynthesis images. We trained NNC with quarter-dose (25% of the standard dose: 12mAs at 32kVp) raw-projection images and corresponding "teaching" higher-dose (HD) images (200% of the standard dose: 99mAs at 32kVp) of a breast cadaver phantom acquired with a DBT system (Selenia Dimensions, Hologic). Once trained, NNC no longer requires HD images. It converts new LD images to images that look like HD images; thus the term "virtual" HD (VHD) images. We reconstructed tomosynthesis slices on a research DBT system. To determine a dose reduction rate, we acquired 4 studies of another test phantom at 4 different doses (1.35, 2.7, 4.04, and 5.39mGy entrance dose). Structural SIMilarity(SSIM) index was used to evaluate the image quality. For further testing, we collected half-dose (50% of the standard dose: 32±14 mAs at 33±5 kVp) and full-dose (100% of the standard dose: 68±23mAs at 33±5kvp) images of 51 clinical cases with the DBT system at Univ. of Iowa Hospitals & Clinics. We evaluated resulting images in a blinded observer study with 35 breast radiologists to rate and distinguish blinded VHD and real full-dose DBT images.

RESULTS

NNC converted quarter-dose images (1.35mGy; SSIM: 0.88) of the testing cadaver phantom to VHD images with image quality (SSIM:0.97) equivalent to 119% dose images (6.41mGy), achieving 79% dose reduction. In our blinded observer study, 21(60%) of 35 breast radiologists either preferred VHD images over real full-dose images or could not distinguish between the two. The difference in image quality between the two was not statistically significant (P=0.37). The time required to process each study was 0.48 sec. on a GPU (GTX Titan Z, Nvidia).

CONCLUSION

Blinded observer study with 35 radiologists demonstrated that VHD images converted by our deep-learning technology were equivalent to full-dose DBT images. Our cadaver phantom experiment demonstrated 79% dose reduction.

CLINICAL RELEVANCE/APPLICATION

Substantial radiation dose reduction would benefit patients by reducing the lifetime risk of radiation-induced cancer from DBT screening.

SSE23-02 Centralized Physics QC Program for the ECOG-ACRIN TMIST Trial of Breast Tomosynthesis

Monday, Nov. 26 3:10PM - 3:20PM Room: S502AB

Participants
Martin J. Yaffe, PhD, Toronto, ON (*Presenter*) Research collaboration, General Electric Company; Shareholder, Volpara Health Technologies Limited; Co-founder, Mammographic Physics Inc; Research Consultant, BHR Pharma LLC
Etta D. Pisano, MD, Charleston, SC (*Abstract Co-Author*) Researcher, Freenome Holdings Inc; Researcher, Real Imaging Ltd; Researcher, Therapixel; Researcher, DeepHealth, Inc; Researcher, ToDos
Aili K. Maki, BEng, Toronto, ON (*Abstract Co-Author*) Research collaboration, General Electric Company; Contractor, Mammographic Physics, Inc
James G. Mainprize, PhD, Toronto, ON (*Abstract Co-Author*) Institutional research agreement, General Electric Company
Gordon Mawdsley, BS, Toronto, ON (*Abstract Co-Author*) Director, Medical Physics Incorporated Research collaboration, General Electric Company
Sam Shen, Toronto, ON (*Abstract Co-Author*) Employee, Mammographic Physics Inc; Research collaboration, General Electric Company
Ruth C. Carlos, MD, MS, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Kathy D. Miller, MD, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose
Christopher E. Comstock, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To describe and provide preliminary results from a remote-monitoring QC program developed to provide assessment of quality and rapid feedback in a screening trial. The program is being used in the randomized TMIST trial of screening with breast tomosynthesis versus digital mammography. TMIST is expected to include 125 sites in the US and Canada and will recruit 164,986 women who will be imaged up to 5 times over 4 years.

METHOD AND MATERIALS

The QC program is based on imaging of phantoms by the technologist at each site and digital transmission to a central analysis server. Phantoms assess signal and noise properties, artifacts, spatial resolution and geometric fidelity of the imaging system. The analysis is performed automatically with results made available to technologists on a password protected web site. Technical information from the DICOM header, stripped of personal identifiers, from every clinical image is available for analysis of doses, exposure factors and compression parameters..

RESULTS

As of April 2018, initial QC data from 87 units at the first 29 TMIST sites were available, including de-identified screening mammogram header data from 60 units at the first 25 sites. The most frequent technical problems were due to electronic interference, dustlike artifacts and the compression force being reported in the header as '0. Problems were also noted due to duplication of image submission from the same individual as separate cases and noncompliance with the QC protocol. In addition, it was noted that digital detectors were occasionally replaced without technical documentation. This was accompanied by changes in signal-to-noise performance. Based on 881 examinations, the mean dose (CC + MLO) was 4.2 mGy for 2D digital mammograms and 8.2 mGy for tomosynthesis. The presentation will report on results up to November, 2018.

CONCLUSION

Use of a centralized remote data collection QC system reduces technologist labor at the site and reduces subjectivity in testing. This approach enables consistent analysis and rapid reporting of QC results.

CLINICAL RELEVANCE/APPLICATION

Sensitivity and specificity of breast cancer detection depend critically on the technical image quality. The credibility of the results from the TMIST trial requires that the image quality of both modalities is verified. In addition, experience from this trial will provide data to help define the essential elements of the standard QC program for tomosynthesis.

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/ Ruth C. Carlos, MD, MS - 2015 Honored EducatorRuth C. Carlos, MD, MS - 2018 Honored Educator

SSE23-03 Visual Grading Characteristics Analysis of Propagation-Based X-Ray Phase Contrast Mammography

Monday, Nov. 26 3:20PM - 3:30PM Room: S502AB

Participants
Seyedamir Tavakoli Taba, Sydney, Australia (*Abstract Co-Author*) Nothing to Disclose
Sarah J. Lewis, PhD,MEd, Sydney, Australia (*Abstract Co-Author*) Nothing to Disclose
Patrycja Baran, Parkville, Australia (*Abstract Co-Author*) Nothing to Disclose
Matthew Dimmock, Clayton, Australia (*Abstract Co-Author*) Nothing to Disclose
Mikkaela McCormack, Heidelberg, Australia (*Abstract Co-Author*) Nothing to Disclose
Sheridan Mayo, Clayton, Australia (*Abstract Co-Author*) Nothing to Disclose
Yakov Nesterets, Clayton, Australia (*Abstract Co-Author*) Nothing to Disclose
Christopher Hall, Clayton, Australia (*Abstract Co-Author*) Nothing to Disclose
Jane Fox, Clayton, Australia (*Abstract Co-Author*) Nothing to Disclose
Zdenka Prodanovic, Clayton, Australia (*Abstract Co-Author*) Nothing to Disclose
Darren Lockie, FRANZCR, Southbank, Australia (*Abstract Co-Author*) Software support, Hologic, Inc
Harry Quiney, Parkville, Australia (*Abstract Co-Author*) Nothing to Disclose
Daniel Hausermann, Clayton, Australia (*Abstract Co-Author*) Nothing to Disclose
Giuliana Tromba, PhD, Trieste, Italy (*Abstract Co-Author*) Nothing to Disclose

Andrew Peele, Clayton, Australia (*Abstract Co-Author*) Nothing to Disclose
Timur Gureyev, Parkville, Australia (*Abstract Co-Author*) Nothing to Disclose
Patrick C. Brennan, PhD, Lidcombe, Australia (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

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PURPOSE

While all current x-ray based breast imaging modalities rely on minimal differences in soft tissue x-ray attenuation (absorption contrast), phase-contrast imaging has the capacity to also visualise variations in x-ray refraction (phase contrast). For x-ray energies typically used in breast imaging, the phase contrast can be substantially larger than the absorption contrast, presenting an opportunity to improve soft tissue visualisation especially in mammographically dense breasts. The goal of this study was to evaluate the radiological quality of images produced by the x-ray propagation-based phase-contrast computed tomography (PB-CT) technique at two different x-ray energies in comparison to absorption-based CT images collected at the same radiation dose (4 mGy).

METHOD AND MATERIALS

Twenty-seven synchrotron-based CT images of a full-size breast mastectomy specimen were reconstructed. Nine images were absorption-based CT at 32 KeV, nine images were PB-CT at 32 KeV and nine were PB-CT at 38 KeV. A group of breast specialist radiologists and medical imaging experts compared the radiological quality of the three sets of images based on various image quality criteria. Visual grading characteristics (VGC) analysis was conducted and VGC curves were obtained. The area under the VGC curve (0<=AUCVGC<=1) was calculated as the measure of the difference in image quality between two compared sets of images.

RESULTS

The results show that the radiological quality ratings of PB-CT 32 KeV images were significantly higher than absorption-based CT images (AUCVGC=0.879, p<=.001) and PB-CT 38 KeV images (AUCVGC=0.795, p<=.001). The image quality ratings were not significantly different between PB-CT 38 KeV images and absorption-based CT images (AUCVGC=0.567, p=.076).

CONCLUSION

Phase-contrast PB-CT mammography can be used to produce images with substantially higher radiological quality compared to conventional absorption-based images, but this advantage appears to be dependent on beam energy. The results from this study should provide a strong basis for future experimental and clinical protocols for further optimisation of this novel and promising approach to breast imaging.

CLINICAL RELEVANCE/APPLICATION

PB-CT of the breast is expected to deliver improved image quality compared to current x-ray modalities and become a viable method for early diagnosis of breast cancer in the future.

SSE23-04 Evaluation of American College of Radiology (ACR) Mammography Accreditation Phantom Image Quality of a Grid-Less and Software-Based Scatter Correction Technology

Monday, Nov. 26 3:30PM - 3:40PM Room: S502AB

Participants
Anzi Zhao, MS, Cleveland, OH (*Presenter*) Nothing to Disclose
Katie Hulme, MS, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the quality of ACR mammography accreditation phantom images acquired with a grid-less and software-based scatter correction technology - Progressive Reconstruction Intelligently Minimizing Exposure (PRIME).

METHOD AND MATERIALS

3 Siemens Mammomat Inspiration units with PRIME were utilized in this study. The same ACR phantom was imaged on all units. 20 2D phantom images were acquired on each unit using a phototimed technique (W/Rh, 28kVp, AEC segmentation off, dose level 'normal', exam tag 'QC RAW'), of which 10 were acquired with grid in position and 10 were acquired with PRIME. Mode of acquisition was varied in a random order. 10 additional PRIME images were acquired on one unit with a resolution test pattern to assess spatial resolution. Contrast-to-noise ratio (CNR), signal-to-noise ratio (SNR), and standard deviation (SD) of phantom images were evaluated using the method in Siemens quality control manual. Incident air kerma and average glandular dose (AGD) were measured and calculated for each exposure. A total of 60 phantom images were scored by 4 qualified medical physicists and 2 experienced mammography technologists on a diagnostic workstation in clinical viewing conditions, and using ACR phantom evaluation guidelines with demographics hidden.

RESULTS

With PRIME, all images failed CNR criteria (>=2) with significantly lower CNR and higher SD than grid-based images by as much as 43% and 23%, respectively; SNR was reduced by 2-4%; spatial resolution was unaffected at 7 mm/lp; AGD was reduced by up to 16%. Visual scoring by 6 viewers resulted in no significant difference between the two types of images. Minor degradation on average score of masses on PRIME images compared to grid-based images (4.1 vs 4.2) was noted on one unit. All viewers agreed on the notable difference in image appearance and noise texture when PRIME was employed.

CONCLUSION

PRIME didn't penalize ACR phantom scoring, although there was a significant degradation of CNR on PRIME images because of the increased noise. The clinical implications of differences in noise texture warrant further investigation. Although PRIME offers moderate dose savings, clinicians should still be aware of potential effects on image appearance.

CLINICAL RELEVANCE/APPLICATION

PRIME technology corrects scatter radiation and enables grid-less full-field digital mammography at lower patient average glandular

PRIME technology corrects scatter radiation and enables grid-less full field digital mammography at lower patient average glandular dose, with comparable image quality.

SSE23-05 Mammographic Compression Variability Increased after Removing Real-Time Pressure Indicator

Monday, Nov. 26 3:40PM - 3:50PM Room: S502AB

Participants
Monique G. van Lier, MSc, Amsterdam, Netherlands (*Presenter*) Employee, SigmaScreening BV
Jerry E. De Groot, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Employee, SigmaScreening BV
Woutjan Branderhorst, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Employee, SigmaScreening BV
Laura J. Schijf, MD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Cornelis A. Grimbergen, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Founder, SigmaScreening BV Employee, SigmaScreening BV Board Member, SigmaScreening BV Patent holder, SigmaScreening BV
Gerard J. den Heeten, MD,PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Founder, SigmaScreening BV; Scientific Advisor, SigmaScreening BV; Patent Holder, SigmaScreening BV; Stock options, Volpara Health Technologies Limited; Medical Advisory Board, Volpara Health Technologies Limited

For information about this presentation, contact:

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CONCLUSION

When replacing a paddle with a pressure indicator, in a group of technicians familiar with the indicator, by a conventional paddle, the variability increased significantly leading to more unfavorable over- and under-compression.

Background

A certain level of breast flattening in mammography is needed to obtain a high quality image. Generally accepted and quantifiable standards do not exists. Recent studies show that the level of compression pressure at exposure influences screening performance. Attempts are made to standardize the compression procedure by introducing pressure-based compression using a paddle equipped with a real-time pressure indicator. We aimed to study the impact on compression practice when replacing the pressure-based paddle with a conventional paddle without pressure indication in group experienced technicians.

Evaluation

Mammographic compression pressure was retrospectively obtained from mammographic images (VolparaAnalytics) and evaluated in two datasets from the same radiology department with the same technician team. The first dataset (4 years, n=11.561 compressions) was collected when using a compression paddle equipped with a real-time pressure indicator aiming for a 10kPa (75mmHg) compression pressure. The second dataset (3 months, n=1331 compressions) was collected 4 months after the mammography system with pressure indicator was replaced by a system without pressure indicator. The average compression pressure and variance significantly ($P<0.001$) increased from 11.23 ± 0.04 kPa to 11.60 ± 0.14 kPa (mean ± SEM) after removal of the pressure indicator. The proportion of compressions in the pressure range 5-15 kPa decreased from 87.4% to 77.9%. The proportion of high pressures (>15kPa) almost doubled (11.0% to 18.8%) and low pressures (<5kPa) more than doubled (1.6% to 3.3%).

Discussion

When removing the pressure indicator, the initially low variability is increasing rapidly, indicating that an indicator is needed to remain high compression reproducibility. An increase in over- and under-compression can ultimately lead to decreased mammographic performance.

SSE23-06 Development of Low Dose Digital Mammography Platform by Image Reconstruction Using Deep Learning Algorithm: A Preliminary Study

Monday, Nov. 26 3:50PM - 4:00PM Room: S502AB

Participants
Su Min Ha, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Eunhee Kang, Daejon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jong Chul Ye, PhD, Daejon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hak Hee Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate whether low dose mammography can be reconstructed to standard dose mammography using the new deep learning algorithm.

METHOD AND MATERIALS

14 specimens from 14 patients who underwent total mastectomy for primary breast cancer were included. Specimen mammograms were obtained with standard routine dose and reduced sequential doses; 80% of routine dose, 60%, 40%, 20% and 10%. The proposed de-noising method is designed based on semi-supervised learning with cycle consistency loss. Most of the mammography has Automatic Exposure Control (AEC) system which chooses an appropriate current X-ray source. The routine dose and 20% dose level images were selected as training dataset. Since the noise levels between two images are different and unavoidable slight mismatch due to potential deformation between multiple acquisitions, we developed the semi-supervised learning using cyclic consistency. We trained two generators (network G and F) and two discriminators (network Dx and Dy). Since we had 14 datasets, we performed cross-validation. Last, image quality of reconstructed low dose image was compared with the standard full dose image and was qualitatively rates as follows; 1= poor, 2= fair, 3= equal, 4=better.

RESULTS

As more radiation dose was decreased, noise was increased and contrast resolution was decreased accordingly. However, in the reconstructed images, noise was decreased and contrast resolution was rather improved. Overall, when we evaluated the lesions according to Breast imaging-reporting and data system lexicon, and with consideration of underlying breast parenchyma density,

the reduced dose of 20% cut-off of standard full dose showed no significant difference in image quality compared with standard dose mammography.

CONCLUSION

The image quality of reconstructed low dose mammography using the new deep learning algorithm is comparable with standard dose mammography until dose reduction cut-off 20% of standard full dose. Therefore, the radiation dose of mammography could be considerably reduced using this deep learning algorithm.

CLINICAL RELEVANCE/APPLICATION

Image reconstruction using the new deep learning algorithm is effective in dose reduction of mammography, especially in young women with high risk who are routinely examined with mammography for screening.

VW09

Invenia ABUS 2.0 - Live Scanning Demo: GE Vendor Workshop

Monday, Nov. 26 3:00PM - 3:30PM Room: Booth 8156

Participants
Doug Whisler, Sunnyvale, CA (*Presenter*)

Program Information

This thirty minute session will cover the latest technological advancements in ABUS design and performance. Attendees will learn how improvements in workflow and image quality have the potential to increase cancer detection in women with dense breast tissue. *Registration is required; adding this session to the RSNA calendar tool alone does not secure your seat in this session. Click the link below to register.*

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2018-/agenda-e57e0b47e9aa4f5ba89b1a0da1e829b9.aspx

VW60

The Clinical Benefits of Tomosynthesis Guided Breast Biopsy: Hologic Vendor Workshop

Monday, Nov. 26 3:00PM - 4:00PM Room: Booth 5524

Participants

Lars J. Grimm, MD, Durham, NC (*Presenter*) Editorial Advisory Board, Medscape, LLC; Educational program support, Hologic, Inc

Program Information

Clinical experience of the 3D prone biopsy system and the benefits to the patient followed by hands on demonstration of the Affirm® Prone Biopsy System (Affirm® Prone Biopsy System)

Registration

https://hologicrsna.com

VW34

Wide-angle Digital Breast Tomosynthesis and Contrast Enhanced Mammography Reading Sessions: Siemens Healthineers Vendor Workshop

Monday, Nov. 26 3:50PM - 5:00PM Room: Booth 5530

Participants

Luis Pina, MD, PhD, San Sebastian, Spain (*Presenter*) Nothing to Disclose

Program Information

Learn about the value of wide-angle Digital Breast Tomosynthesis (DBT) and Contrast Enhanced Mammography (CEM) in the daily routine from one of our most experienced clinical experts. The differences and respective advantages of the morphological (DBT) and functional (CEM) breast imaging methods will be discussed. This, all with the flexible assistance of our multi-modality reading solution syngo.via and the syngo® Breast Care applications.

VW10

3D ABUS: Hands-on Workshop: GE Vendor Workshop

Monday, Nov. 26 4:00PM - 5:00PM Room: Booth 8156

Program Information

Peer educator led workshop includes a live Invenia ABUS 2.0 scan station acquisition and hands-on review of clinical cases using the Invenia ABUS Viewer. Learn about the importance of the coronal view and how 3D ABUS screening helps increase cancer detection in women with dense breast tissue. *Registration is required; adding this session to the RSNA calendar tool alone does not secure your seat in this session. Click the link below to register.*

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2018-/agenda-e57e0b47e9aa4f5ba89b1a0da1e829b9.aspx

VW61

Advancements in Real-time Breast Specimen Imaging: Hologic Vendor Workshop

Monday, Nov. 26 4:30PM - 5:00PM Room: Booth 5524

Program Information

Learn how real-time breast specimen imaging can streamline workflow efficiency through specimen verification and automated post-biopsy specimen handling with the Brevera® Breast Biopsy System. (Brevera® Breast Biopsy System)

Registration

https://hologicrsna.com

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

ED001-TU

Breast Tuesday Case of the Day

Tuesday, Nov. 27 7:00AM - 11:59PM Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Jessica H. Porembka, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Amy M. Fowler, MD, PhD, Madison, WI (*Abstract Co-Author*) Research support, General Electric Company
Susan O. Holley, MD, PhD, Raleigh, NC (*Abstract Co-Author*) Nothing to Disclose
Alexander B. Sevrukov, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Chandni Bhimani, DO, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Catherine A. Young, MD, JD, Saint Louis, MO (*Abstract Co-Author*) Research support, Hologic, Inc
Cheryl R. Herman, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Michelle V. Lee, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Mai A. Elezaby, MD, Madison, WI (*Abstract Co-Author*) Research Grant, Exact Sciences Corporation
Lonie R. Salkowski, MD,PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Roberta M. Strigel, MD, Madison, WI (*Abstract Co-Author*) Research support, General Electric Company
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Urvi A. Tailor, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Lindsay Compton, MD, Dallas, TX (*Abstract Co-Author*) Researcher, QT Ultrasound, LLC
Ramapriya Ganti, MD, Dallas, TX (*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.

SPSH30

Hot Topic Session: Management of DCIS and Minimal Risk Lesions

Tuesday, Nov. 27 7:15AM - 8:15AM Room: E450B

BR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Linda Moy, MD, New York, NY (*Moderator*) Nothing to Disclose

Sub-Events

SPSH30A LORIS Trial-Will it Address the Overtreatment of Low Grade DCIS?

Participants
Matthew G. Wallis, MD, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) To learn about the risk of overdiagnosis and overtreatment. 2) To become familiar with the risk of avoiding surgery. 3) To appreciate the prospective for the future.

ABSTRACT

Breast screening has led to an inexorable rise in the number of women living with a diagnosis of DCIS predominantly but not exclusively as a result of the detection of micro-calcification. It is clear from long term follow up that conventional treatment fails the 15 to 20% who develop invasive disease a few of whom then die from breast cancer. There is larger group that never progress with in their life time which means we have either cured them or just over treated them. Traditional pathology and genetics suggest that there is a low risk group that either never progress or if they do they develop 'low risk' invasive disease. I will describe the 4 international trials LORIS (The LOw RISk DCIS trial), LORD (LOw Risk DCIS) , COMET (Comparison of Operative versus Medical Endocrine Therapy for Low Risk DCIS) and LORETTA (Low Risk Tamoxifen Treatment And surveillance) . In particular commenting on their differences. Using LORIS as my main example I will discuss how we have attempted to resolve the hurdles of setting up a 'no treatment trial' and talk about some of the lessons learnt from successfully steering LORIS from feasibility to full trial. Anecdotally patient views have been more entrenched than those of surgeons

SPSH30B Pathologic Interpretation of Borderline Breast Lesions

Participants
Laura C. Collins, MD, Boston, MA (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) To have a greater level of understanding of the nuances of interpreting atypical ductal proliferations. 2) To have a greater level of understanding of the quantitative criteria for a diagnosis of low grade ductal carcinoma in situ. 3) Learners will have a greater level of understanding of the limitations of providing definitive diagnosis of some atypical ductal proliferations on core needle biopsy samples.

ABSTRACT

This presentation will cover the nuances of pathologic interpretation of borderline atypical ductal proliferations of the breast, particularly in the setting of core needle biopsy samples. Features that favor a diagnosis of atypical ductal hyperplasia versus low nuclear grade ductal carcinoma in situ will be discussed. Finally, the ramifications of definitive distinctions rendered on borderline lesions will be reviewed.

SPSH30C High Risk DCIS and What are We Prepared To Do About it

Participants
Brian J. Czerniecki, MD, PhD, Tampa, FL (*Presenter*) Advisory Board, ImmunoRestoration

LEARNING OBJECTIVES

1. Understand that there are subgroups of women with DCIS in whom there is an increased risk of subsequent breast cancer deaths and they include women under 40, African American females and those with hormone receptor negative breats cancer. 2. Disseminated cancer cells may seed even from very early DCIS lesions 3. Surgery and Radiation do not appear to reduce the risk of death from breast cancer in high risk groups

ABSTRACT

Controversy exists concerning whether all ductal carcinoma in situ (DCIS) lesions represent premalignant precursors destined to become invasive breast cancer (IBC). There is also evidence that cancer cells can disseminate very early during the process of tumorigenesis even prior to invasive breast cancer developing. There is a also evidence that certain groups of patients with DCIS have increased risk of mortality from DCIS and they include those diagnosed under 40, African American females and those that are hormone receptor negative. Local therapy with surgery and radiation does not decrease risk of mortality from DCIS. Many of these high risk lesions have expression of HER2 which is associated with both invasion and dissemintation of cancer cells (DCC). Targeting HER2 maybe benficial for eliminating both DCC and reducing risk of subsequent IBC. Dendritic cell (DC) vaccines administered in a neoadjuvant trials to patients with HER2 expressing DCIS has resulted in complete regression of disease in about 30% of DCIS patients. Vaccines drive anti-HER2 CD4 Th1 cells especially in sentinel nodes. Complete regression of DCIS is associated with diminshed breast cancer events. Combinations of other immune therapies with DC vaccines may result in greater numbers of complete responses. In summary, high grade and HER2 expressing DCIS in young women, African American females requires novel approaches to reduce mortlaity and subsequent breast cancer events.

RC315

Breast Series: MRI

Tuesday, Nov. 27 8:30AM - 12:00PM Room: Arie Crown Theater

BR MR

AMA PRA Category 1 Credits ™: 3.50
ARRT Category A+ Credits: 4.00

FDA Discussions may include off-label uses.

Participants
Bonnie N. Joe, MD, PhD, San Francisco, CA (*Moderator*) Nothing to Disclose
Hiroyuki Abe, MD, Chicago, IL (*Moderator*) Nothing to Disclose

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Sub-Events

RC315-01 Outcome Data: Does MRI Help?

Tuesday, Nov. 27 8:30AM - 8:50AM Room: Arie Crown Theater

Participants
Francesco Sardanelli, MD, San Donato Milanese, Italy (*Presenter*) Speakers Bureau, Bracco Group; Advisory Board, Bracco Group; Research Grant, Bayer AG; Advisory Board, General Electric Company; Reserach Grant, General Electric Company; Speakers Bureau, Siemens AG; Reserach Grant, Real Imaging Ltd;

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LEARNING OBJECTIVES

1) Know the current debate about the need of outcome data for an appropriate use of breast MRI in clinical practice. 2) Understand why the acceptance of breast MRI has a large variability by other clinicians depending on indication, from screening of BRCA1/2 or P53 mutated women to the preoperative setting. 3) Appraise the high complexity of the current debate on the evidence in favor or against preoperative breast MRI. 4) Identify those applications where more research is needed for an increased use of breast MRI, also considering the perspective of prognostic breast MRI.

RC315-02 Comparison of Diagnostic Performance of DBT and MRI Added to Mammography for Preoperative Staging of Screening-Detected Breast Cancer: Which Method Is More Appropriate Depending On the Mammographic Density?

Tuesday, Nov. 27 8:50AM - 9:00AM Room: Arie Crown Theater

Participants
So Yeon Yang, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Ji Soo Choi, 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
Boo-Kyung Han, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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Mi-Ri Kwon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
E-Ryung Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Surin Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To compare the diagnostic performance of digital breast tomosynthesis (DBT) and magnetic resonance imaging (MRI) added to mammography for preoperative staging of screening-detected breast cancer depending on mammographic density.

METHOD AND MATERIALS

This retrospective study enrolled 281 patients with 332 screening-detected breast cancers recruited from Jan to Dec 2013. Three radiologists independently reviewed three image sets of (mammography alone, DBT plus mammography and MRI plus mammography) of the patients, and they recored final BI-RADS categories of detected lesions. BI-RADS categories 4-5 defined positive results and BI-RADS category 1-3 defined negative results. Readers' sensitivities and positive predictive values (PPVs) were analyzed for each reading mode. Readers' performances with the three reading modes were compared for dense breast (heterogeneously or extremely

dense, n=263) and non-dense breast (entirely fatty or scattered areas of fibroglandular density, n=120) groups, respectively.

RESULTS

In non-dense breast group, readers' sensitivities with DBT plus mammography (92.5-94.4%) were lower than MRI plus mammography (96.3-98.1%), but higher than mammography alone (88.8-92.5%). Readers' PPVs with DBT plus mammography (97.1-100%) were higher than those with MRI plus mammography (94.7-100%) and mammography alone (94.7-97.0%). However, there was no statistically significant difference in both readers' sensitivities and PPVs between DBT plus mammography and MRI plus mammography (p>0.05). In dense breast group, sensitivities with MRI plus mammography (93.3-98.2%) were significantly higher than those with DBT plus mammography (87.6-92.0%) or mammography alone (84.9-87.6%) (p<0.05), but PPVs with MRI plus mammography (92.1-97.5%) were lower than those with DBT plus mammography (96.1-97.6%) or mammography alone (96.1-97.5%) without a statistical significance.

CONCLUSION

In non-dense breast group, diagnostic performances of DBT and MRI for preoperative staging of screening-detected breast cancer were not significantly different when using as an adjunctive to mammography. In dense breast group, however, DBT had lower sensitivitiy than MRI.

CLINICAL RELEVANCE/APPLICATION

In non-dense breast group, DBT plus mammography may provide similar diagnostic performance to MRI plus mammography for preoperative staging of screening-detected breast cancer.

RC315-03 Pre-Chemotherapy Morphology and ADC Characteristics of Primary Breast Cancers Vary By Hormone-Receptor and HER2 Subtype

Tuesday, Nov. 27 9:00AM - 9:10AM Room: Arie Crown Theater

Participants
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Nola M. Hylton, PhD, San Francisco, CA (*Abstract Co-Author*) Research support, General Electric Company

PURPOSE

To evaluate the hormone-receptor (HR) and HER2 subtype dependence of pre-treatment MRI morphology and apparent diffusion coefficient (ADC) characteristics of primary breast cancers.

METHOD AND MATERIALS

A retrospective analysis of DCE-MRI, DW-MRI and T2WI was performed on pre-treatment MRI studies of 220 breast cancer patients who were enrolled in a neoadjuvant breast cancer trial. DCE-MRI and T2WI were reviewed according to the BI-RADS lexicon, and MRI morphologic pattern was categorized using a 1-5 scale for tumor containment. Extent of necrosis and presence of peritumoral edema were also ranked. ADC values at 5, 15, 25, 50, 75 and 95 percentile were computed from the DW-MRI based on an ROI encompassing the entire tumor volume. Fisher's exact test was used to compare the morphologic features and one-way ANOVA and Scheffe post hoc test were used to compare ADC measurements among all breast cancer subtypes.

RESULTS

The triple negative (TN) subtype exhibited mass more frequently than non-mass enhancement (NME) (p=0.004), with masses showing irregular versus spiculated margin (p=0.034). HR-/HER2+ subtype had NME more frequently than mass (p=0.027). HR+/HER2+ showed heterogeneous enhancement rather than rim enhancement (p<0.001). There was no specific pattern observed in NME among subtypes. In the MRI morphologic pattern, TN showed a well-defined pattern with more than 10% necrosis versus other subtypes. The difference in ADC values at the lower 5 and 15 percentiles was found to be statistically significant between TN vs. HR-/HER2+ (p=0.007 in 5 percentile and p=0.014 in 15 percentile), HR-/HER2+ vs. HR+/HER2- (p=0.002 in 5 percentile and p=0.004 in 15 percentile), and HR+/HER2- vs. HR+/HER2+ (p=0.028 in 5 percentile and p=0.014 in 15 percentile).

CONCLUSION

The BI-RADS lexicon (lesion classification, internal enhancement pattern and margin of the mass), MR morphologic pattern, and the amount of necrosis may be useful for distinguishing breast cancer subtypes. Among the variable measurements, the lower 5 or 15 percentiles of the ADC distributions showed potential to distinguish breast cancer subtypes.

CLINICAL RELEVANCE/APPLICATION

Adding the lower 5 or 15 percentile ADC with MR morphologic patterns may help refine MRI methods for distinguishing breast cancer subtypes prior to neoadjuvant chemotherapy.

RC315-04 Pre-Operative Breast Magnetic Resonance Imaging: Relationship Between Magnetic Resonance-Detected Additional Cancer and Survival Outcomes

Tuesday, Nov. 27 9:10AM - 9:20AM Room: Arie Crown Theater

Participants
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PURPOSE

To determine the additional cancer detection yield of pre-operative MRI in women with invasive breast cancer that was occult on

mammogrpahy and ultrasonography (US), to identify a subgroup of women who are likely to have additional cancer, and to investigate whether the presence of MRI-detected additional cancer (MDAC) affects patients' long-term survival outcomes.

METHOD AND MATERIALS

The pre-operative MRI examinations of 1,843 women who had undergone surgery for invasive breast cancer were reviewed for the presence of additional multifocal/multicentric /contralateral disease that was occult on mammgoraphy and US. Clinicopathological findings and mammographic breast density were compared between patients with MDAC and those without. Logistic regression analysis was conducted to find factors associated with MDACs. A Cox proportional hazards model was used to analyze the effects of MDACs or other variables on disease-free survival (DFS) or overall survival (OS). Kaplan-Meier curves and log-rank tests were used to analyze survival between the two groups.

RESULTS

Of 1,843 patients, 178 (9.7%) had an MDAC. Multivariate analysis showed that invasive lobular cancer (odds ratio: 1.151, 95% confidence interval [CI]: 1.080, 1.239; P = 0.0002) and extensive intraductal component (odds ratio: 1.113, 95% CI: 1.080, 1.148; P < 0.0001) were independently associated with a higher probability of MDAC. Kaplan-Meier curves did not show that MDACs affected DFS (P = 0.343) or OS (P = 0.991).

CONCLUSION

MDACs had no significant impact on survival outcomes.

CLINICAL RELEVANCE/APPLICATION

No studies have focused on survival outcomes in MRI-detected additional cancers (MDACs) that were occult at mammography and ultrasonography (US).

RC315-06 Long-Term Survival Outcomes in Invasive Lobular Carcinoma Patients with and Without Preoperative MR Imaging: A Matched Cohort Study

Tuesday, Nov. 27 9:30AM - 9:40AM Room: Arie Crown Theater

Participants
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PURPOSE

To investigate and compare the effect of preoperative breast magnetic resonance (MR) imaging on recurrence-free survival (RFS) and overall survival (OS) outcomes among patients with invasive lobular carcinoma (ILC).

METHOD AND MATERIALS

A total of 287 ILC patients (age range, 31-82 years; mean age, 49.8 years) between January 2005 and December 2012 were included in the analysis. Of these patients, 120 (41.8%) had undergone preoperative breast MR imaging (MR group) and the remaining 167 (58.2%) had not (no MR group). These two study groups were matched for 21 covariates in term of patient demographics, tumor characteristics, and various clinical features. The RFS and OS outcomes were compared using Kaplan-Meier estimates. MR effects were estimated after adjusting for significant potential confounders of specific outcomes in the multivariate modeling.

RESULTS

In the matched cohort, no statistically significant association was observed between MR imaging and total recurrence (hazard ratio [HR], 1.096; 95% CI: 0.497-2.416; P=0.821), loco-regional recurrence (HR, 1.204; 95% CI: 0.294-4.924; P=0.796), contralateral breast recurrence (HR, 0.945; 95% CI: 0.147-6.061; P=0.952), or distant recurrence (HR, 1.020; 95% CI: 0.339-3.070; P=0.973). MR imaging was associated with an improved OS with 51% reduction, but not significantly (HR, 0.485; 95% CI: 0.149-1.585; P=0.231). Analysis with a multivariate Cox regression model indicated that MR imaging was not a significant independent factor for better RFS (HR, 0.823; 95% CI: 0.409-1.658; P=0.586) or improved OS (HR, 0.478; 95% CI: 0.167-1.366; P=0.168).

CONCLUSION

Preoperative MR imaging is not a prognostic factor and produces no recurrence or survival outcome benefits in ILC patients.

RC315-07 Preoperative Breast MRI: Multicenter Prospective Study

Tuesday, Nov. 27 9:40AM - 9:50AM Room: Arie Crown Theater

Participants
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PURPOSE

To investigate the effect of breast MRI for preoperative staging on clinical evaluation and treatment plan in women diagnosed with breast cancer.

METHOD AND MATERIALS

In the prospective, multicenter study, the institutional ethics committee approval was obtained for all centers. Conventional imaging (mammography and ultrasonography) findings, preoperative breast MRI findings, treatment plan and histopathology results were evaluated in 432 consecutive breast cancer patients at nine centers. Cases that were scheduled to receive neoadjuvant chemotherapy were excluded. The effect of preoperative breast MRI added to conventional breast imaging on clinical-radiological evaluation and on surgical treatment plan was investigated. Chi-square and McNemar tests were used for statistical analysis.

RESULTS

Two-hundred thirty-four cases (54.2%) were premenopausal and 198 cases (45.8%) were postmenopausal. Cancer was detected in 134 women (31%) at the time of screening, and cancer was found in 298 (69%) women who had undergone diagnostic radiological evaluation due to complaints or physical examination. Physical examination was positive in 248 (57%) women and negative in 184 (43%) women. 23 women had bilateral breast cancer. The frequencies of multifocal and multicentric tumor detection were 9-7%, 16-11%, 17-28% for MG, US and MRI, respectively. Breast-conserving surgery (BCS) was performed on a total of 210 cancers and modified radical mastectomy (MRM) on 255 cancers. A total of 8 cases required re-excision surgery due to positive surgical margin. MRI changed the surgical treatment plan in 14% of patients for whom BCS was planned based on conventional imaging. The difference between the conventional imaging and MRI in the preoperative evaluation was considered statistically significant (p=0.001).

CONCLUSION

Breast MRI added to conventional breast imaging in the preoperative evaluation of patients with breast cancer contributes to an accurate treatment plan by lower need for re-excision surgery and providing accurate treatment of the 14% cases.

CLINICAL RELEVANCE/APPLICATION

This study showed that breast MRI contributes to the preoperative evaluation and treatment plan in women who were diagnosed with breast cancer.

RC315-08 Ongoing Trials Update

Tuesday, Nov. 27 9:50AM - 10:10AM Room: Arie Crown Theater

Participants
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LEARNING OBJECTIVES

To list the current studies published on the use of MRI for screening To list cancer detection rates and predictive values of abbreviated MRI for screening in comparison to those of digital breast tomosynthesis and breast ultrasound.

RC315-09 Breast MRI-based Radiomics Nomogram for the Prediction of Recurrence in Patients with Triple-negative Breast Cancer: A Nested Case-Control Matched Study

Tuesday, Nov. 27 10:10AM - 10:20AM Room: Arie Crown Theater

Participants
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PURPOSE

To develop a breast MRI-based radiomics nomogram including clinicopathologic factors for individualized prediction of local or distant recurrences in patients with triple-negative breast cancers (TNBC).

METHOD AND MATERIALS

From 2006 to 2013, a total of 2604 patients were diagnosed as TNBC and 836 patients underwent preoperative breast MRI. Among them, patients with recurrence and without recurrence were matched in terms of age, stage, and type of chemotherapy, and developed 115 nested case-control pairs. Within the intratumor and peritumoral regions on early post-contrast T1-weighted images, percent enhancement (PE) map, signal enhancement ratio (SER) map, and T2-weighted images, a total of 1029 quantitative MR radiomic features, each referred to as a computer-extracted image phenotypes (CEIP), were calculated based on the semiautomatically derived three-dimensional tumor segmentations. Elastic Net was used for feature selection and radiomics score building. A radiomics nomogram was constructed from a multivariable logistic regression prediction model with the radiomics score and independent pathologic predictors. We divided 115 case-control pairs into a training set (n=154) and a validation set (n=76), and the internal validation for the validation set was performed.

RESULTS

The radiomics score, consisted of 20 selected CEIPs, was significantly associated with the prediction of recurrence (C-index of 0.867 for training set and 0.778 for validation set). Independent pathologic factors in the nomogram were lymphovascular invasion, Ki-67 status, and lymph node ratio (C-index of 0.665 for training set and 0.668 for validation set). Radiomics nomogram showed better prediction of recurrence (C-index of 0.879 for training set and 0.802 for validation set) due to incremental value of 0.214 and 0.134, respectively, by addition of radiomics score to the pathologic predictors.

CONCLUSION

Our results indicate that the radiomics nomogram which incorporates the MRI-based radiomics score and pathologic features, show promise for the individualized prediction of local or distant recurrence in patients with TNBC.

CLINICAL RELEVANCE/APPLICATION

Nomogram using breast MRI-based radiomics score and pathologic predictors can facilitate the individualized prediction of recurrence in patients with TNBC.

RC315-11 Advanced Sequences

Tuesday, Nov. 27 10:40AM - 11:00AM Room: Arie Crown Theater

Participants
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LEARNING OBJECTIVES

1) Review the standard dynamic contrast-enhanced MRI (DCE-MRI) and quantitative MRI using two compartment model. 2) Understand the current status of abbreviated breast MRI. 3) Explore the clinical value of ultrafast DCE-MRI.

ABSTRACT

Breast dynamic contrast-enhanced (DCE)-MRI refers to MR imaging techniques with temporal resolution of 2 minutes or less to assess the changes of contrast uptake and washout in tumors. Recent technological advances realize various combinations of spatial and temporal resolution of breast MRI. Refined quantification (Ktrans, Ve, Kep) of exchange of contrast agent between vascular space and interstitial space provide sophisticated hemodynamic information. Pre-contrast with only one post-contrast image makes MRI screening more feasible by reducing time and cost while maintaining diagnostic performance. DCE-MRI with a 4 to 7-second temporal resolution during the first minute before a standard image acquisition shows the potential to improve lesion conspicuity and characterization. This session will focus on the review of variations of breast DCE-MRI.

RC315-12 Agreement between Radiologist-Assigned Categories and Quantitative Measures of Background Parenchymal Enhancement on Breast MRI

Tuesday, Nov. 27 11:00AM - 11:10AM Room: Arie Crown Theater

Participants
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PURPOSE

Because background parenchymal enhancement (BPE) on breast magnetic resonance imaging (MRI) reflects the volume and intensity of contrast uptake, quantitative values of enhancement can be measured by 1) averaging the voxels of enhancement (PE = percent enhancement) above a pre-defined threshold, 2) computing the total volume of FGT that enhances above the threshold value (absolute volume of BPE), and 3) estimating the percentage of breast tissue that enhances above the threshold value relative to the total breast volume (BPE%). We developed a semi-automated segmentation algorithm to extract these quantitative measures of BPE. In this study, we investigated the agreement of computed measures of BPE with radiologist-assigned categories.

METHOD AND MATERIALS

In this IRB approved HIPAA compliant retrospective study, we identified 123 patients with breast MRI performed for screening indications. As previously described, the breast segmentation algorithm co-registers pre- and post-contrast T1-weighted fat-suppressed and non-fat-suppressed sequences. Active contours method merged chest components and non-fat voxels were clustered using Otsu's method to identify fibroglandular tissue (FGT) voxels. Within the segmented FGT on the first post-contrast phase, we computed median and inter-quartile ranges for absolute volume of BPE and BPE% using a PE=30% threshold. Student's t-test evaluated BPE volume and BPE% by radiologist-assigned categories.

RESULTS

Using the previously described 30% threshold, median and inter-quartile ranges for the volume of BPE by radiologist-assigned category were as follows (cm3): minimal (57.2, 24.4-100.1), mild (41.8, 30.7-65.4), moderate (70.6, 43.5-111.1), marked (67.1, 54.3-137.9). BPE% median and inter-quartile ranges were as follows (%): minimal (3.5, 1.7-5.5), mild (3.2, 1.7-4.6), moderate (4.7, 2.7-7.4), marked (5.7, 4.0-10.0). BPE volume and BPE% differed significantly between minimal/mild and moderate/marked radiologist-assigned categories (p=0.030 and 0.004, respectively) (Figure: Box plot of BPE% by BPE category).

CONCLUSION

Quantified BPE volume and BPE% were significantly different between minimal/mild and moderate/marked radiologist-assigned categories.

CLINICAL RELEVANCE/APPLICATION

Given the inter-reader variability in BPE categorical assessments, the development and validation of quantitative measures is a necessary step towards incorporation of BPE into future risk prediction models.

RC315-13 Correlation between 3T Multi-Parametric MRI and Molecular Subtypes of Breast Cancer

Tuesday, Nov. 27 11:10AM - 11:20AM Room: Arie Crown Theater

Participants
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PURPOSE

To test whether 3T multi-parametric magnetic resonance imaging (mp-MRI) provides information related to molecular subtypes of breast cancer.

METHOD AND MATERIALS

Women with mammographic or US findings of breast lesions (BI-RADS 4-5) underwent 3T mp-MRI (DCE, DWI and MR spectroscopy). DCE-MRI was evaluated by classifying the wash-in/wash-out curve in three classes (I-III). DWI was used to calculate the mean ADC value within a region of interest centered on the tumor. MR spectroscopy (MRS) was evaluated by means of the signal-to-noise ratio (SNR) of the total choline peak (tCho). The histological type of breast cancer was assessed. Estrogen-receptor (ER), progesterone-receptor (PgR), Ki-67 status and HER-2 expression, assessed by immunohistochemistry (IHC), were used to identify four molecular subtypes: Luminal-A, Luminal-B, HER2-enriched and triple-negative tumors. Non-parametric tests (Kruskal-Wallis, k-sample equality of medians, and Mann-Whitney) and logistic regression were performed to investigate correlations between mp-MRI features (lesion volume, margins, ADC, type of DCE curve, and tCho SNR) and molecular subtypes.

RESULTS

483 patients (505 lesions) were included in the study. Volume was smaller in Luminal-B and larger in triple-negative tumors (non-parametric tests, $p<0.03$ and $p<0.004$, respectively). A prevalence of irregular margins was observed in triple negative tumors ($p<0.01$). The type of DCE curve was significantly different in Luminal-A (lack of type III curves compared to average, $p<0.03$). ADC values were higher in Luminal-A ($p<0.04$ and $p<0.016$ in non-parametric tests and logistic regression, respectively). tCho SNR was higher in triple-negative tumours ($p<0.05$ and $p<0.01$).

CONCLUSION

A significant correlation was found between some MRI features and molecular subtypes of breast tumors. The strongest correlations were observed between Luminal A tumors and ADC, Luminal A tumors and DCE-MRI findings, Triple negative tumors and tCho SNR. These results warrant further research to improve the prognostic value of multi-parametric MRI.

CLINICAL RELEVANCE/APPLICATION

Significant correlations were observed between multi-parametric MRI features and molecular subtypes of breast tumors. Further research is needed to improve the prognostic value of mp-MRI.

RC315-14 Apparent Diffusion Coefficient Difference Value on Diffusion-Weighted Imaging: Association with Distant Metastasis-Free Survival of Patients with Invasive Breast Cancer

Tuesday, Nov. 27 11:20AM - 11:30AM Room: Arie Crown Theater

Participants
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PURPOSE

To investigate whether apparent diffusion coefficient (ADC) parameters on diffusion-weighted imaging (DWI) are associated with distant metastasis (DM)-free survival in patients with invasive breast cancer.

METHOD AND MATERIALS

This retrospective study was approved by the institutional review board. The requirement to obtain informed consent was waived. Between June 2013 and June 2014, 258 consecutive women (mean age, 50.9 years; age range, 23-85 years) with newly diagnosed invasive breast cancer who underwent preoperative breast MR imaging with DWI were evaluated. All DWI were retrospectively reviewed by two radiologists blinded to the clinical information. The mean, minimum, and maximum ADC values were measured by

manually placing regions of interest within the lesions and the ADC difference value (which is the difference between minimum and maximum ADC) was calculated to evaluate intratumoral heterogeneity. Cox proportional hazards models were used to reveal the associations between ADC parameters and DM-free survival after adjusting for clinicopathological factors.

RESULTS

In 25 (9.7%) patients, DM developed without prior locoregional recurrence at a mean follow-up of 48.7 months. The mean of ADC difference value was significantly higher in patients with DM than in those without DM (0.781 × 10-3mm2/s vs. 0.620 × 10-3mm2/s, P = .007). Kaplan-Meier survival analysis showed that patients with high ADC difference value (>0.793 × 10-3mm2/s) had shorter DM-free survival times compared with those with low ADC difference value (<=0.793 × 10-3mm2/s) (log-rank test; P < .001). Furthermore, multivariate Cox proportional hazards analysis showed that a high ADC difference value (>0.793 × 10-3mm2/s) (hazard ratio [HR] = 3.448; 95% confidence interval [CI]: 1.567, 7.586; P = .002), presence of axillary node metastasis (HR = 5.101; 95% CI: 2.127, 12.234; P < .001), and estrogen receptor negativity (HR = 2.429; 95% CI: 1.104, 5.343; P = .027) were associated with worse DM-free survival.

CONCLUSION

High ADC difference value on DWI was significantly associated with worse DM-free survival of patients with invasive breast cancer.

CLINICAL RELEVANCE/APPLICATION

Quantitative analysis of ADC difference value as a biomarker of intratumoral heterogeneity can be used to identify a subgroup of breast cancer patients at higher risk of developing distant metastasis.

RC315-15 Bradiomics (Breast Radiomics) Can Improve Breast Cancer Detection: Preliminary Clinical Results Using Multivariate Magnetic Resonance Tensor Modeling Fitting

Tuesday, Nov. 27 11:30AM - 11:40AM Room: Arie Crown Theater

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PURPOSE

To evaluate performance measurements of a radiomics model breast lesions extracted from 30 directions fitting of MR images without gadolinium enhancement.

METHOD AND MATERIALS

Research ethics board approved this prospective study including data of 269 MR studies from patients of 3 institutions. All consented women presented with clinically/imaging suspicious or a biopsy proven breast cancer and an indication for dynamic contrast-enhanced (DCE) breast MRI. Before gadolinium injection, diffusion MR imaging (b values, 0, 800 sec/mm2) was performed using a dedicated 3.0T scanner with 16-channel breast coil. A total of 7 readers independently assessed DCE where BPE, lesion size and BIRADS category for each breast were recorded. Two readers blind to DCE results in consensus assessed the 11 features extracted from pixel-by-pixel fitting modeling optimized to lambda-1 values. Histopathology was used as the gold standard. Adequate statistical tests were used to compare the diagnostic values

RESULTS

There were 248 malignant and 37 benign lesions in 229 patients. 7 patients presented with bilateral cancers. The bradiomics feature tensor model reduced false-positive results from 57 to 29 (specificity 88.9% [95% IC 0.843-0.923]) and diffusion imaging alone was less sensitive 89.9% (95% CI 0.855-0.931) than the conventional reading of DCE that provided sensitivity of 95.1% (95% CI 0.916-0.973) and specificity of 78.2% (95% CI 0.727-0.83) at the threshold including in situ disease. Diagnostic accuracy was 89.41% (95% CI 0.8941-0.9190) for tensor modeling and 86.77% (95% CI 0.8358-0.8954) for DCE.

CONCLUSION

The bradiomics model based on diffusion tensor allowed for similar diagnostic accuracy of obtained using clinical set reading DCE. This may translate to less recalls and improve clinical outcomes.

CLINICAL RELEVANCE/APPLICATION

The use of MR techniques that lead to high diagnostic accuracy without IV contrast may play a role in the clinical set.

RC315-16 Computer-Aided Diagnosis (CAD)-assessed Kinetic Features of Invasive Breast Cancers: Correlation with Clinical-pathologic Prognostic Factors

Tuesday, Nov. 27 11:40AM - 11:50AM Room: Arie Crown Theater

Participants
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PURPOSE

To investigate the association of kinetic features with clinical-pathologic factors in breast cancer patients using computer-aided diagnosis (CAD).

METHOD AND MATERIALS

Between July 2016 and March 2017, 85 patients with invasive breast cancers (mean, 1.8cm; range, 0.8-4.8cm) who had undergone preoperative 3.0T MR imaging and surgery were retrospectively enrolled. All MR image were processed using CAD, and kinetic features of tumors were acquired: peak enhancement, angio-volume, early and delayed enhancement profiles. The relationships between kinetic features and clinical-pathologic factors were assessed. Mann-Whitney test, Spearman's correlation test and binary logistic regression analysis were used for statistical analysis.

RESULTS

In correlation tests, CAD-assessed peak enhancement and angio-volume were significantly correlated with histologic grade, Ki-67 index, and tumor size: r = 0.355 (P = .001), r = 0.330 (P = .002), and r = 0.231 (P = .033) for peak enhancement, r = 0.410 (P = .005), r = 0.341 (P < .001), and r= 0.505 (P < .001) for angio-volume. Plateau compoment at delayed phase was significanly correlated with Ki-67 index (r = 0.255 [P = .019]), but correlated coefficient between rapid component at early phase and Ki-67 index did not reach statistical significance (r = 0.202 [P = .063]). In binary logistic regression analysis, higher peak enhancement was a significant independent predictor of higher histologic grade (odds radio [OR] = 1.004; 95% CI: 1.001,1.008; P = .024), larger angio-colume was a predictor of larger tumor size (OR = 1.384; 95%CI: 1.141, 1.679; P = .001), higher plateau component was a predictor of negative estrogen receptor status (OR = 0.928; 95%CI: 0.877, 0.982; P = .010), and both higher plateau component and angio-volume were predictors of higher Ki-67 index (OR = 1.051; 95%CI: 1.011, 1094; P = .013 for plateau component. OR = 1.178; 95%CI:1.023;1.356; P = .023 for angio-volume).

CONCLUSION

Of the CAD-assessed preoperative breast MRI kinetic features, higher peak enhancement may predict higher histologic grade, larger angio-volume may predict larger tumor size, higher plateau component may predict negative estrogen receptor status, and both higher plateau component and angio-volume may predict higher Ki-67 index.

CLINICAL RELEVANCE/APPLICATION

CAD-assessed preoperative breast MRI kinetic features can be considered as a useful imaging biomarker reflecting clinical-pathologic prognostic factors.

RC315-17 Correlation of MRI Texture Features With Tumor Infiltrating Lymphocytes and Pathologic Complete Response in HER2 Positive and Triple Negative Subtypes of Breast Cancer

Tuesday, Nov. 27 11:50AM - 12:00PM Room: Arie Crown Theater

Participants
Gaiane M. Rauch, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose
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PURPOSE

To evaluate associations of quantitative MRI texture features and tumor infiltrating lymphocytes (TIL) levels in HER2+ and triple negative (TN) subtypes of breast cancer (BC) receiving neoadjuvant chemotherapy (NAC), as potential prognostic non-invasive imaging markers for pathologic complete response prediction (pCR).

METHOD AND MATERIALS

Retrospective review of BC patients who had MRI at staging, neoadjuvant chemotherapy and surgery from January 1, 2008 through December 31, 2015 was performed. Demographic, imaging, and pathologic data including TIL levels were documented. Quantitative MRI texture analysis was performed using 3 types of textural features (TF): local binary patterns (LBP), gray-level co-occurrence matrix (GLCM), and threshold adjacency statistics (TAS). Associations between MRI quantitative TF, TIL levels, and pCR were evaluated by Pearson correlation and logistic regression.

RESULTS

There were 50 HER2+ and 38 TN patients (median age 51 years, range 29-59) with pretreatment MRI and TIL status for analysis; 27 HER2+ patients and 15 TN patients had pCR at surgery. For HER 2+ patients 9 TF significantly correlated with pCR ($p<0.05$): f1 (angular 2nd moment), l3 (75 percentile), l4 (standard deviation), t1-t6 (adjacency 0-5). Four TF were significantly associated with high TIL levels ($p<0.05$): texture l4 (standard deviation), t2 and t3 (adjacency 1 and 2). Additional 4 TF had weak association with TIL ($p<0.1$): feature f8 (sum entropy), t1, t3 and t4 (adjacency 0, 3 and 4). Three TF were significantly associated with both, pCR and TIL ($p<0.05$): texture l3 (75 percentile), l4 (standard deviation), t9 (adjacency 8). For TN patients 4 TF f2 (contrast), t1,t3 and t4 (adjacency 0 ,2,3) were significantly associated with pCR ($p < 0.005$). No TF were significantly associated with TIL levels for TNBC, only t3 and t4 (adjacency 4 and 5) showed weak association with TIL levels ($p<0.1$).

CONCLUSION

Quantitative tumor MRI texture analysis in HER2+ BC showed 9 TF associated with pCR, 8 TF with TIL and 3 TF with both pCR and TIL; for TNBC 4 TF were associated with pCR, and 2 TF weakly associated with TIL.

CLINICAL RELEVANCE/APPLICATION

Analysis of associations of MRI quantitative TF with pCR and TIL in HER2+ and TNBC may help to develop prognostic non-invasive imaging markers for treatment response prediction.

RC320

Role of MR Imaging in Cancer Staging and Treatment

Tuesday, Nov. 27 8:30AM - 10:00AM Room: S403B

BR GI MR RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Kathryn J. Fowler, MD, San Diego, CA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Overview of MRI use in cancer staging, treatment delivery, and response assessment. -Understand the imaging approach to staging rectal cancer -Review pertinent anatomy -Discuss reporting of stage -Understand response indicators and how to report

Sub-Events

RC320A Role of MR Imaging in GI Cancer Staging

Participants
Kathryn J. Fowler, MD, San Diego, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review basic MRI approach to staging gastrointestinal malignancies (pancreatic and rectal). 2) Understand the application of MR/imaging features for assessing response to therapy.

RC320B MR-guided Radiotherapy for GI Cancers

Participants
Michael F. Bassetti, MD, Madison, WI (*Presenter*) Research Grant, Merck KGaA; Research Grant, AstraZeneca PLC;

LEARNING OBJECTIVES

1) Identify the clinical sites where MR-guided radiation may have the highest impact. 2) Understand the unique sources of uncertainty of MR-guided radiation that differ from conventional LINAC radiation. 3) Identify the most common indications for on-line MR -guided adaptive radiotherapy observed in clinical practice.

RC320C Role of MR Imaging in Breast Cancer Staging

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

LEARNING OBJECTIVES

1) Identify evidence-based indications for MR imaging in breast cancer staging. 2) Describe the frequencies of ipsilateral multifocal or multicentric disease and contralateral breast cancer detected on breast MRI. 3) Explain potential pitfalls and limitations of breast MRI performed for staging.

RC320D MR-guided Radiotherapy for Breast Cancer

Participants
Maria A. Thomas, MD, PhD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Michael F. Bassetti, MD, Madison, WI (*Presenter*) Research Grant, Merck KGaA; Research Grant, AstraZeneca PLC;

LEARNING OBJECTIVES

1) Identify potential applications of MR-guided radiotherapy for breast cancer. 2) Describe the advantages and disadvantages of MR-guided radiotherapy for breast cancer.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

VW37

Wide-angle Digital Breast Tomosynthesis and Contrast Enhanced Mammography Reading Sessions: Siemens Healthineers Vendor Workshop

Tuesday, Nov. 27 10:15AM - 11:25AM Room: Booth 5530

Participants

Luis Pina, MD, PhD, San Sebastian, Spain (*Presenter*) Nothing to Disclose

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 challenge you! All cases have been acquired with Siemens Mammomat Inspiration and are displayed on our syngo® Breast Care workstations so you will become familiar with the quality of our HD Tomo images and ease of use of our systems.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

SSG01

Breast Imaging (Ultrasound Screening and Diagnostic Indications)

Tuesday, Nov. 27 10:30AM - 12:00PM Room: S406A

BR US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Donna M. Plecha, MD, Strongsville, OH (*Moderator*) Research Grant, Hologic, Inc
Jessica W. Leung, MD, Houston, TX (*Moderator*) Scientific Advisory Board, Hologic, Inc; Speakers Bureau, Hologic, Inc; Speakers Bureau, FUJIFILM Holdings Corporation

Sub-Events

SSG01-01 Performance of Screening Breast Ultrasound Over 5-Year Period

Tuesday, Nov. 27 10:30AM - 10:40AM Room: S406A

Participants
Stamatia V. Destounis, MD, Scottsville, NY (*Presenter*) Research Grant, Hologic, Inc; Research Grant, Delphinus Medical Technologies, Inc
Amanda Santacroce, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Andrea L. Arieno, BS, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To review and compare performance of screening ultrasound in women with dense breast tissue post adoption of state breast density mandate.

METHOD AND MATERIALS

Through a retrospective chart review, data was collected on 23,878 screening ultrasound exams performed from 2013-2017 in patients with heterogeneously dense or extremely dense breast tissue. We stratified the data by year to compare screening ultrasound performance over time. Cancer detection rate (CDR), PPV and biopsy rate were calculated for US only findings (mammographically normal). Data was collected on patient demographics, number of DBT exams performed, BI-RADS score, pathology, tumor size, and lymph node status.

RESULTS

A total of 23,878 screening ultrasound exams were performed; 691 (2.9%) in 2013, 1700 (7.1%) in 2014, 4767 (20.0%) in 2015, 7389 (30.9%) in 2016, 9339 (39.1%) in 2017. Use of BI-RADS 1 and 2 remained stable; ranging from 95.0% in 2013 to 97.1% in 2017. The use of DBT increased in the population increased, from 18.7% in 2013 to 99.3% in 2017. Cancer detection rate increased in the first 3 years, from 1.4/1000 (2013) to 3.6/1000 (2015) then decreased in 2016 to 2.4/1000, and again in 2017 to 2.2/1000. Biopsy rate steadily decreased since 2013, from 2.9% to 1.0% in 2017. PPV for biopsy initially increased substantially (5% in 2013 to 20% in 2014) and then slightly declined; 18.8% in 2015, 16.2% in 2016, and increased again to 22.3% in 2017. The assignment of BIRADS 3 decreased over time; from 2.5% of exams in 2013, to .76% in 2017.

CONCLUSION

Screening ultrasound continues to detect mammographically occult malignancy, though the rate can vary substantially, as we saw an initial increase, followed by a decrease to 2.2/1000 in 2017. This decrease could be due to the increase in use of DBT, which increases the visibility of malignancies on mammography. The biopsy rate consistently decreased, from 2.9% to 1.0%, as did assignment of BI-RADS category 3. PPV varied over time, with the highest rate over the period in 2017 (22.3%), potentially suggesting more appropriate use of biopsy in this population.

CLINICAL RELEVANCE/APPLICATION

There are 30 states with breast density legislation. As policies continue to change and center around individualized medicine, understanding the performance and value of US will be helpful for facilities as they continue to adopt improved screening practices and modalities for women with dense breast tissue.

SSG01-02 Non-Mass Lesion Detected by Breast US: Stratification of Cancer Risk for Clinical Management

Tuesday, Nov. 27 10:40AM - 10:50AM Room: S406A

Participants
Ko Woon Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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Surin Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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E-Ryung Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To develop a practical diagnostic prediction model by using imaging features of breast non-mass lesion (NML) detected by B-mode ultrasonography (US).

METHOD AND MATERIALS

From Dec 2011 to March 2016, B-mode US was performed in 777 NMLs in consecutive 828 patients. This retrospective study consecutively included 669 breast NMLs in 669 patients for which final diagnoses were established and mammographies obtained at the time of US examination. For each lesion, radiologists assessed BI-RADS category. For developing a diagnostic prediction model to estimate malignant risk of NMLs using a scoring, univariate and multivariate logistic regression analyses were performed to find US or mammographic features associated with malignancy in a developmental dataset (n=460). A score for each significant imaging feature was assigned and multiplied by the regression coefficient, and the risk score of malignancy for each NML was defined as the sum of individual scores. Based on area under the receiver operating characteristic curve (AUC), diagnostic performance of the prediction model was compared to the radiologist's BI-RADS classification. Later, we verified the usefulness of developed scoring model by applying into the remaining validation dataset (n=209).

RESULTS

Among 669 NMLs, 354 (52.9%) were benign and 315 (47.1%) were malignant. In the developmental dataset, the following US features, within or around the main lesion, showed significant association with malignancy: the presence of calcifications, architectural distortion, posterior acoustic shadowing or abnormal ductal change, and absence of microcysts. The following mammographic features also showed significant association with malignancy: the presence of calcifications or focal asymmetry. The predictive model's AUC was higher than the radiologist's BI-RADS classification (0.952 vs. 0.930). In the validation dataset, AUC of our prediction model was 0.961.

CONCLUSION

The prediction model using features of US and mammography may be useful in stratification of cancer risk of breast non-mass lesions.

CLINICAL RELEVANCE/APPLICATION

Cancer risk stratification for breast non-mass lesions using features of US and mammography may be useful in managing breast non-mass lesions detected by US.

SSG01-03 Decreasing Short-Term Follow-Up and Biopsies by Following BI-RADS 3 Lesions at 1 Year: A Prospective Study

Tuesday, Nov. 27 10:50AM - 11:00AM Room: S406A

Participants
Richard G. Barr, MD, PhD, Campbell, 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, Canon Medical Systems Corporation; Research Grant, Esaote SpA; Research Grant, BK Ultrasound; Research Grant, Hitachi, Ltd
Carmine Tinelli, MD, MSC, Pavia, Italy (*Abstract Co-Author*) Nothing to Disclose
Annalisa DeSilvestri, PhD, Pavia, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Supplemental US is know to detect node negative cancers not identified on screening mammography. However the large number of short-term follow-ups and low positive biopsy rate make this technique not cost effective. The majority of these are due to BI-RADS 3 lesions (B3), with an incidence of cancer in < 1%. This prospective study evaluates the effect of following B3 detected on supplemental ultrasound at 1 year.

METHOD AND MATERIALS

This HIPPA compliant, IRB approved with written informed consent study invited patients receiving a B1 or B2 screening mammogram with density 3 or 4 breast of any risk to receive a free automated volume whole breast (ABVS) ultrasound. The ABVS was performed on a Siemens S2000 using a 15cm L14-5 transducer. ABVS were read by radiologist with 20 year experience as BI-RADS category 1, 2, 3, or 0. Category 0 patients received a hand held ultrasound (HH). Patients were followed for 2 years.

RESULTS

Of 23426 screening patients, 8542(36.5%) had density 3 or 4 and were asked to participate. 2257 (26.4%) agreed to participate (50 yo mean age, range 31 to 90) (<10% high risk). The ABVS was interpreted as B1 in 1186 (52.5%), B2 in 591 (26.2%), B3 in 395 (17.5%) and B0 in 85 (3.8%). Of the 395 B3 patients, 310 had 1-year follow-up and were cancer free, 0%, 254 had 2-year follow-up and were cancer free, 0%. Of the 85 B0 patients, (recall rate of 3.8%) on HH 8 (11.3%) were B1, 51 (71.8%) were B2, 2 (2.8%) were B3, 6 (8.5%) were B4, and 4(5.6%) were B5. The B4 and 5 lesions were 2 B4A lesions were fibroadenomas,2 B4A were fibrocystic change, 2 category 4C lesions were IDC, and 4 category 5 lesions were IDC. The biopsy rate was 0.4% (10/2257) with a positive biopsy rate (PPV3) of 60.0% (6/10). The supplemental ultrasound detected 2.8/1000 additional cancers (4/1412). 5 cancers (0.28%, 5/1777) were detected in 3 yr f/u in B1 and B2 and 1 IDC (0.25%, 1/395) was identified in B3 in the contralateral breast.

CONCLUSION

Following B3 at 1 year interval 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 60.0% (6/10))(p=0.001) without substantial node positive cancer misses. With these improved screening characteristic, supplemental ultrasound could be cost effective.

CLINICAL RELEVANCE/APPLICATION

Following B3 at 1 year markedly reduces the recall rate and increases the PPV3 making supplemental screening more cost effective.

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/ Richard G. Barr, MD, PhD - 2017 Honored Educator

SSG01-04 A Preliminary Study of Predicting Molecular Subtypes of Breast Cancer by the Radiomics Features of Contrast-Enhanced Ultrasound

Tuesday, Nov. 27 11:00AM - 11:10AM Room: S406A

Participants
Lei Tang, Shanghai, China (*Presenter*) Nothing to Disclose
Man Chen, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim was to analyze the quantitative features of contrast-enhanced ultrasound(CEUS) imaging of breast cancer through computer image extraction, and to explore the preoperative prognosis of the different molecular subtypes of breast cancer.

METHOD AND MATERIALS

CEUS images of 189 patients were collected from our hospital. Everyone signed informed consent before CEUS. Surgical pathology and molecular typing results were obtained in all patients. Through mapping the borders of breast cancers on the images, the entire internal area of the tumor was determined. The lesions were divided into four quadrants(Fig 1). The high perfusion within the lesion area was defined as a high brightness area. The temporal and special features of the images in different areas were extracted by the computer in a dynamic CEUS file and the time intensity curves(TIC) were drawn. From the TIC curve, the features were extracted such as wash in rate(WiR), wash out rate(WoR), rise time(RT), base intensity(BI) and peak intensity(PI) and EI(=PI-BI), so on. The parameters of the curve in each area were calculated in different molecular typing groups.

RESULTS

The patient' numbers of Luminal A, Luminal B, HER2+, and triple negative breast cancer (TNBC) of each molecular subtypes were 46, 75, 37, and 31, respectively. The extracted effective features included EI of the internal bright area, WoR of internal bright area, WoR of the internal overall area, RT of the internal overall area, and so on. The cutoff value 1.566 of WoR in the internal bright area might help to find Luminal A, with a specificity of 82.61%. When to find TNBC, the cutoff value of EI at the internal bright area was 0.3494, the sensitivity was 64.52%, and the specificity was 68.99%. When distinguishing between Her2+ and TNBC, WOR of the internal overall had a cutoff of 5.7496 and a sensitivity of 74.19%.

CONCLUSION

The radiomics features of contrast-enhanced ultrasound could contribute to preoperative prediction of breast cancer molecular subtypes. Further research needed to be larger sample, multi-center expansion.

CLINICAL RELEVANCE/APPLICATION

The radiomics features of contrast-enhanced ultrasound could contribute to preoperative prediction of breast cancer molecular subtypes, which may help to predict efficacy and to select treatment options.

SSG01-05 Sonographic Features of Radial Scars and Complex Sclerosing Lesions

Tuesday, Nov. 27 11:10AM - 11:20AM Room: S406A

Participants
Reni S. Butler, MD, Madison, CT (*Presenter*) Nothing to Disclose
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Liane E. Philpotts, MD, New Haven, CT (*Abstract Co-Author*) Consultant, Hologic, Inc

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PURPOSE

To assess the morphologic characteristics of radial scars (RS) and complex sclerosing lesions (CSL) when they are visualized with ultrasound (US)

METHOD AND MATERIALS

A HIPAA-compliant, IRB-approved retrospective review of core needle biopsies (CNB) performed between 1/1/2007 and 12/31/2017 was performed and filtered for RS or CSL as the primary diagnosis. Patients with a concurrent diagnosis of malignancy or with only a microscopic incidental RS were excluded. The method of detection, mammographic and sonographic features, histology at CNB and at surgical excision, if performed, were recorded for all lesions visualized with US.

RESULTS

190 lesions with a CNB diagnosis of RS or CSL were identified. 57.4% (109/190) were visible on US. Most [75.2% (82/109)] US-visible lesions were initially detected on screening mammography, followed by screening US [19.3% (21/109)], diagnostic US [2.8% (3/109)], diagnostic mammography [1.8% (2/109)], and screening MRI [0.9% (1/109)]. Among US-visible lesions, 53.2% (58/109) appeared as non-mass areas of abnormal echogenicity, 44.0% (48/109) as masses, 1.8% (2/109) as architectural distortion only, and 0.9% (1/109) as dilated hypoechoic ducts. More lesions were anti-parallel [58.7% (64/109)] compared to parallel [41.3% (45/109)]. While most were hypoechoic [64.2% (70/109)], others were isoechoic [14.7% (16/109)], hyperechoic [3.7% (4/109)], or mixed [17.4% (19/109)]. Posterior acoustic features were most often none [58.7% (64/109)], followed by shadowing [28.4% (31/109)] and enhancement [12.8% (14/109)]. Color Doppler images, available in 87 lesions, showed no vascular flow in 34.5% (30/87), adjacent flow in 34.5% (30/87), and internal flow in 31.0% (27/87). Lesions presenting as architectural distortion on mammography [50.4% (55/109)] most often appeared as non-mass areas of variable echogenicity on US [89.1% (49/55)] rather than masses [10.9% (6/55)].

CONCLUSION

RS and CSL sonographic features are variable and include non-mass areas of abnormal echogenicity. While not strictly part of the BI-RADS lexicon, subtle 'nonmass' findings may be the only US correlate in some mammographically-detected lesions, especially those presenting as architectural distortion.

CLINICAL RELEVANCE/APPLICATION

As the incidence of RS and CSL increases with tomosynthesis utilization, understanding the variety of US appearances may increase the likelihood of detecting an US correlate and facilitate biopsy.

SSG01-06 Shear-Wave Elastography of the Breast: Value of a Novel 5-Point Technical Quality Score

Tuesday, Nov. 27 11:20AM - 11:30AM Room: S406A

Participants
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Wei Zhang, MD, Allston, MA (*Abstract Co-Author*) Nothing to Disclose
Sarah Mercaldo, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
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Constance D. Lehman, MD,PhD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company

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PURPOSE

To determine the value of a novel 5-point technical quality score on the diagnostic performance of shear-wave elastography (SWE) of the breast.

METHOD AND MATERIALS

This IRB-approved HIPAA-compliant study included 110 consecutive women (mean age 55.1 + 15.3 years) with 122 breast lesions who underwent SWE and ultrasound-guided biopsy from Oct. 2017 to Jan. 2018. We recorded the maximum (Emax), mean (Emean), and standard deviation (Esd) elasticity measurements for each lesion. We defined five specific SWE technical quality parameters: (1) lesion visibility on B-mode image panel, (2) red pattern (high stiffness) in the near field of the field-of-view (FOV), (3) size and location of FOV box relative to lesion, (4) heterogeneity, vertical streaks, and absence of color in tissue surrounding the lesion, (5) size and location of the region-of-interest circle on the lesion for elasticity measurements. Three blinded readers independently assessed each SWE parameter as low (score=0) or high (score=1) quality. SWE total quality score < 3.3 was classified as low and > 3.3 as high. Intra-class correlation coefficient (ICC) was used to measure inter-observer agreement for the total score and the Hanley and McNeil's method was used to compare areas under the receiver operating characteristic curve (AUC) of SWE in low vs. high-quality images.

RESULTS

Mean size of the 122 lesions was 13.9 + 10.4 mm; 64 (52%) were benign and 58 (48%) were malignant. Inter-observer agreement was good among readers (ICC 0.805). AUCs were significantly improved in the high-quality group compared to the low-quality group for Emean (0.858 vs. 0.631, p=0.009; AUC difference=0.227, 95%CI [0.056, 0.398]) and Esd (0.816 vs. 0.629, p=0.040; AUC difference=0.187, 95%CI [0.008, 0.366]). AUC for Emax also increased to 0.861 in the high-quality group compared to 0.714 in the low-quality group but without statistical significance (p=0.077; AUC difference=0.147, 95%CI [-0.015, 0.309]).

CONCLUSION

Incorporating our novel 5-point technical quality score can improve the diagnostic performance of SWE in differentiating malignant from benign breast lesions.

CLINICAL RELEVANCE/APPLICATION

A simple 5-point technical quality metric provides guidance to users during real-time acquisition and improves diagnostic performance of SWE in differentiating malignant from benign breast lesions.

SSG01-08 Can Mid-Treatment Ultrasound in Triple Negative Breast Cancer Patients Predict Residual Pathologic Disease in the Axillary Nodes?

Tuesday, Nov. 27 11:40AM - 11:50AM Room: S406A

Participants
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PURPOSE

To determine if the number of abnormal lymph nodes visualized on mid-treatment ultrasound in triple negative breast cancer (TNBC) patients who are undergoing neoadjuvant chemotherapy associates with residual nodal disease on surgical pathology

METHOD AND MATERIALS

As part of an on-going single-institution, clinical trial of stage I-III TNBC patients, the first 106 patients who underwent surgery were included in this interim analysis. Mid-treatment was defined as the period following completion of four cycles of AC (Adriamycin and cyclophosphamide) chemotherapy and before initiating either anticipated Taxol chemotherapy or an investigational therapy. The number of abnormal nodes at mid-treatment was assessed and recorded by experienced, fellowship-trained breast radiologists. These radiologists empirically categorized lymph nodes using a binary approach of sonographically abnormal versus normal. Pathologic lymph node positive was defined as the presence of macrometastasis and micrometastasis in at least one axillary node from sentinel lymph node biopsy and/or axillary lymph node dissection as stated in the surgical pathology reports. Wilcoxon rank sum test and Fisher's exact test were used to determine statistical significance.

RESULTS

There were 26 of 106 patients (25%) who had residual nodal disease at surgery and 80 of 106 patients (75%) who had nodal pathologic complete response. The median number of abnormal nodes at mid-treatment was 3 (range 0-16 nodes) for patients who had residual nodal disease compared to 0 (range 0-12 nodes) for patients who had nodal pathologic complete response. TNBC patients with residual nodal disease on surgical pathology had significantly more abnormal nodes at mid-treatment ($p<0.0001$). More specifically, TNBC patients with at least 2 abnormal lymph nodes at mid-treatment ultrasound had a significantly higher chance of being pathologic lymph node positive at surgery ($p<0.0001$).

CONCLUSION

There is a highly significant association between the number of abnormal lymph nodes identified at mid-treatment ultrasound and the presence of residual metastatic axillary nodes at surgery in triple negative breast cancer patients.

CLINICAL RELEVANCE/APPLICATION

The number of abnormal lymph nodes at mid-treatment may be an independent predictor of residual disease in TNBC patients and may assist in identifying chemoresistant patients who could benefit from investigational therapies.

SSG01-09 Is a BI-RADS 4 or 5 Assessment Reasonable on Screening Ultrasound?

Tuesday, Nov. 27 11:50AM - 12:00PM Room: S406A

Participants
Wendie A. Berg, MD, PhD, Pittsburgh, PA (*Presenter*) Nothing to Disclose
Golbahar Houshmand, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
David Gur, PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Terri A. Gizienski, MD, Greenwood Village, CO (*Abstract Co-Author*) Nothing to Disclose
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Jamie Hartman, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Margarita L. Zuley, MD, Pittsburgh, PA (*Abstract Co-Author*) Investigator, Hologic, Inc
Amy E. Kelly, MD, Bridgeville, PA (*Abstract Co-Author*) Nothing to Disclose
Cathy S. Tyma, MD, Sewickley, PA (*Abstract Co-Author*) Nothing to Disclose
Kimberly S. Harnist, MD, Gibsonia, PA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

For participants recalled for further testing, to determine the utility of a BI-RADS final assessment in determining management based on technologist-performed screening ultrasound.

METHOD AND MATERIALS

5689 women in three centers (1 academic and 2 private practice) were enrolled in an IRB-approved study of screening tomosynthesis (DBT) and technologist-performed handheld screening ultrasound (US, with orthogonal views of each finding other than simple cysts) and underwent 8151 screens (5689 yr1, 2462 yr2). Two experienced breast-imaging specialized radiologists prospectively reviewed each DBT-US set independently and in opposing order. Whenever additional imaging was recommended prior to the next annual screening, readers recorded a "final" assessment: BI-RADS 3, 4A, 4B, 4C or 5, together with recommendations, which could include immediate additional imaging and/or possible biopsy, or six-month follow-up. When US was read first and still resulted in a recall after integration with the DBT, we compared subsequent management and outcomes with the original BI-RADS assessments. We excluded technical recalls. At least targeted prior sonograms were available for 980 participants in year 1.

RESULTS

24 women were ultimately diagnosed with cancer after US recall, median patient age 55 (range 40-75). A total of 455 (5.6%) US exams prompted recall: 348/5689 (6.1%) in year 1 and 107/2462 (4.3%) in year 2. Of 209 women scored BI-RADS 3, 114 had immediate additional evaluation and 95 had 6-month follow-up; 20 (9.6%) ultimately had biopsy with 2 (1.0%) found to have cancer. Of 153 rated BI-RADS 4A on screening, 86 (56.2%) had biopsy and 2 (1.3%) proved malignant. Of 60 BI-RADS 4B, 40 (66.7%) had biopsy and 4 (6.7%) had cancer. Of 11 BI-RADS 4C, 11 (100%) had biopsy and 7 (63.6%) had cancer. Of 9 BI-RADS 5, 9 (100%) had biopsy and 9 (100%) were found to have cancer.

CONCLUSION

Malignancy and biopsy rates were lower than expected for a BI-RADS 4A or 4B assessment on technologist-performed screening US, but were reasonable for a BI-RADS 4C or 5 assessment.

CLINICAL RELEVANCE/APPLICATION

Directly scheduling biopsy based on screening US was appropriate for BI-RADS 4C and 5 assessments; 56% of 4A and 67% of 4B assessments resulted in biopsy after physician-targeted evaluation.

VW35

Wide-angle Digital Breast Tomosynthesis and Contrast Enhanced Mammography Self-guided Reading Sessions: Siemens Healthineers Vendor Workshop

Tuesday, Nov. 27 10:30AM - 5:00PM Room: Booth 5530

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 and contrast enhanced mammography cases presented as problem cases with a solution enables you to develop and test your reading skills.

VW36

Automated Breast Volume Scanner (ABVS) Self-guided Reading Sessions: Siemens Healthineers Vendor Workshop

Tuesday, Nov. 27 10:30AM - 5:00PM Room: Booth 5530

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.

VW62

Tomosynthesis Guided Prone Breast Biopsy Solutions in a Community Based Practice: Hologic Vendor Workshop

Tuesday, Nov. 27 10:30AM - 11:30AM Room: Booth 5524

Participants

Harriet B. Borofsky, MD, San Mateo, CA (*Presenter*)

Program Information

Clinical benefits of tomosynthesis guided biopsy which includes a hands-on demonstration of the Affirm® Prone Biopsy System and the Brevera® Breast Biopsy System (Affirm® Prone Biopsy System, Brevera® Breast Biopsy System and Viera™ Portable Breast Ultrasound)

Registration

https://hologicrsna.com

VW38

A Practical Approach to Breast Magnetic Resonance Imaging (MRI) Interpretation: An Interactive Session: Siemens Healthineers Vendor Workshop

Tuesday, Nov. 27 11:40AM - 12:50PM Room: Booth 5530

Participants

Susan Weinstein, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Program Information

This interactive session will include both didactic and hands-on case review at workstations equipped with syngo® MR Brevis. A practical approach to breast MRI interpretation will be discussed as well as utilizing the available sequences and techniques to improve interpretive skills.

VW63

Triaging Dense Breast Patients in Clinical Practice: Hologic Vendor Workshop

Tuesday, Nov. 27 12:00PM - 12:30PM Room: Booth 5524

Participants

Regina J. Hooley, MD, New Haven, CT (*Presenter*) Consultant, Hologic, Inc

Program Information

The Genius™ 3D Mammography™ exam is the only mammogram that is FDA approved as superior for women with dense breasts. Attend this 30 minute session to learn how to triage women with dense breasts using 3D Mammography. (3D Mammography™ Technology)

Registration

https://hologicrsna.com

BRS-TUA

Breast Tuesday Poster Discussions

Tuesday, Nov. 27 12:15PM - 12:45PM Room: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Samantha L. Heller, MD, PhD, New York, NY (*Moderator*) Nothing to Disclose

Sub-Events

BR241-SD-TUA1 Evaluating the Timeliness of Abnormal Mammography Follow-up Based on Race at an Urban Safety Net Hospitalty

Station #1

Awards
Student Travel Stipend Award

Participants
Neeta Kannan, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Amie Y. Lee, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Kimberly M. Ray, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Bonnie N. Joe, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Jessica H. Hayward, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To investigate racial and ethnic disparities in timeliness of abnormal mammography follow-up at an urban safety net hospital.

METHOD AND MATERIALS

All women who underwent screening or diagnostic mammography at our facility between 4/1/2016-4/1/2017 whose examinations received actionable Breast Imaging Reporting and Data System (BI-RADS) assessments 0, 4 or 5 were identified. Self-reported racial or ethnic group was recorded. Median follow-up times from abnormal screening to diagnostic mammogram and abnormal diagnostic mammogram to biopsy were calculated. Normality of time to follow-up values was assessed by the Shapiro-Wilk test. Median values were compared using the Wilcoxon test.

RESULTS

Seven hundred seventy-eight women were included in the study: 98 (12.6%) Caucasian, 275 (35.3%) Asian, 256 (32.9%) Hispanic, and 100 (12.9%) African-American. Six-hundred sixty-two women were recalled for abnormal screening mammograms of whom 30 were lost to follow-up. The remaining 632 women had median follow-up time for an abnormal screening mammogram as follows: 15 days (95% CI 15.5, 17.5) for all women combined, 14 (10, 22.8) for Caucasian, 15 (10, 22) for Asian, 14 (9, 21.5) for Hispanic, and 15 (12, 28) for African-American women. Of the 280 women with diagnostic mammography BI-RADS assessment of 4 or 5, 13 declined biopsy and 12 were lost to follow-up. The remaining 255 patients underwent biopsy with a median time interval to biopsy in days of 7.4 (95% CI 1.5, 14.5) for all women combined, 7.5 (3.5, 14.5) for Caucasian, 7.6 (2.5, 8.5) for Asian, 5.6 (1.4, 14.6) for Hispanic, and 8.4 (2.4, 14.5) for African-American women. Relative to Caucasian women, there were no significant differences in abnormal screening or diagnostic mammography follow-up intervals for any racial or ethnic group.

CONCLUSION

In contrast to previous studies, there were no significant delays in follow-up for abnormal screening and diagnostic mammograms for minority women relative to Caucasian women at the studied urban safety-net hospital. Further research is needed to identify factors that promote timely follow-up in the studied minority patient population.

CLINICAL RELEVANCE/APPLICATION

Delay in follow-up of abnormal mammograms can lead to adverse outcomes. Identifying where disparities occur can help address barriers to care.

BR242-SD-TUA2 Outcome Analysis of BI-RADS Category 3 Lesions in Young Women Imaged in Tertiary University Versus Safety-Net Hospital Setting: Is There an Impact of Healthcare Disparity?

Station #2

Participants
Jody C. Hayes, MD, Southlake, TX (*Presenter*) Nothing to Disclose
Lindsay Compton, MD, Dallas, TX (*Abstract Co-Author*) Researcher, QT Ultrasound, LLC
Lena A. Omar, MD, Dallas, TX (*Abstract Co-Author*) Researcher, QT Ultrasound, LLC

Kanwal A. Merchant, MD, Dallas, TX (*Abstract Co-Author*) Stockholder, Sensogram Technologies; Spouse, Stockholder, Sensogram Technologies
Yin Xi, PhD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Basak E. Dogan, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the follow up, image-guided biopsy and surgical excision patterns of women <30 with BI-RADS Category 3 lesions in a safety-net hospital and an academic tertiary care center.

METHOD AND MATERIALS

In an IRB approved, HIPAA compliant study, consecutive women younger than 30 years who received sonographic (US) BI-RADS 3 assessment between January 2013 to December 2014 in breast imaging facilities of a safety-net (PMH) and a tertiary university hospital (CUH) provided by the same fellowship-trained breast imaging group were retrospectively reviewed. We compared the patient clinical presentation, imaging findings, lesion size and number, frequency and time interval of follow up, and biopsy and excision status. Statistical analysis including chi-square and Cochran-Mantel-Haenszel (CMH) analysis for overall odds ratios were performed.

RESULTS

One hundred and ninety-seven lesions in 157 women in PMH and 92 lesions in 70 patients in CUH had US BI-RADS 3 assessment. Median patient age was the same in both groups (25 yrs). In PMH, 178 of 197 (90%) and in CUH 71 of 92 (77%) of lesions were palpable (p= 0.2965). Mean lesion size was 1.6 cm (SD±0.8) in PMH, and 1.3 cm (SD±0.6) at CUH (p=0.2338). Patients were less likely to complete all imaging follow up time points in PMH (n=29, 14.7%) compared to those in CUH (n=37, 52.8%) (p<0.05).While the overall biopsy rates were similar (PMH, 23.5%, CUH, 19.1%), a higher rate of initial biopsies was observed in PMH (35 of 50 biopsies,70%) vs CUH (4 of 14, 29%) (p=0.004). The odds of undergoing a biopsy at initial presentation at PMH were significantly higher [OR: 4.783 (95%CI 1.9-11.6)] compared to CUH [OR: 0.485, (95%CI 0.02-10.7)] (p= 0.0044). Biopsy was more likely to be prompted by patient preference in PMH (39,70%) compared to CUH (22.2%)(p=0.005). Surgical excision rates were similar (8%PMH vs 5%CUH) between the two groups. No malignancy was identified in either group.

CONCLUSION

There is a higher probability of incomplete follow up and initial needle biopsy for US BI-RADS Category 3 lesions identified in young women in safety-net setting compared to university setting.

CLINICAL RELEVANCE/APPLICATION

Radiologists should consider disparities between population groups while recommending follow up for probably benign lesions in women under 30, considering the low probability of malignancy in this age group.

BR243-SD-TUA3 Pre-Treatment Prediction of Pathologic Complete Response to Neoadjuvant Chemotherapy in Node-Positive Breast Cancer Patients: A Breast MRI Radiomics Pilot Study

Station #3

Participants
Karen Drukker, PhD, Chicago, IL (*Presenter*) Royalties, Hologic, Inc
Christopher Doyle, MD , Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Alexandra V. Edwards, Chicago, IL (*Abstract Co-Author*) Research Consultant, QView Medical, Inc; Research Consultant, Quantitative Insights, Inc
John Papaioannou, MSc, Chicago, IL (*Abstract Co-Author*) Research Consultant, QView Medical, Inc
Maryellen L. Giger, PhD, Chicago, IL (*Abstract Co-Author*) Stockholder, Hologic, Inc; Shareholder, Quantitative Insights, Inc; Shareholder, QView Medical, Inc; Co-founder, Quantitative Insights, Inc; Royalties, Hologic, Inc; Royalties, General Electric Company; Royalties, MEDIAN Technologies; Royalties, Riverain Technologies, LLC; Royalties, Mitsubishi Corporation; Royalties, Canon Medical Systems Corporation
Kirti M. Kulkarni, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Evaluate the ability of breast MRI radiomics to predict pathologic complete response of tumor and lymph nodes *prior* to neoadjuvant chemotherapy (NAC) treatment in patients with invasive lymph node-positive breast cancer.

METHOD AND MATERIALS

Sixtyfive patients were included in this retrospective HIPAA compliant IRB approved study. Upon surgery, 15 showed post-NAC complete pathologic response (pathologic TNM stage T0,N0,MX, 'complete-responders') and 50 showed incomplete response to NAC ('incomplete-responders'). Only pre-NAC MRIs underwent computer analysis, initialized by an expert breast radiologist indicating index cancers and metastatic axillary sentinel lymph nodes (LNs) on DCE-MRI (T2 and T1 postcontrast subtraction) images. Subsequent automated analysis included computer segmentation and extraction of 38 radiomic features describing (i) size, (ii) shape, (iii) margin, (iv) kinetic curve, (v) contrast-enhancement texture, and (vi) variance kinetics. For cancers and LNs separately, each radiomic feature was evaluated to determine whether a statistically significant difference between the complete-responders and incomplete-responders was demonstrated (Mann-Whitney U-test). The area under the ROC curve was calculated for the task of distinguishing between the two groups.

RESULTS

All radiomic features describing index cancers failed to show a statistically significant difference between complete-responders and incomplete-responders (p>0.05). Four radiomic features describing pre-treatment metastatic LNs demonstrated statistically significant differences between the two groups: effective diameter, sphericity, surface to volume ratio, and most enhancing nodal volume. The most predictive feature was sphericity with area under the ROC curve of 0.75 (standard error 0.07) in the prediction of pathologic response.

CONCLUSION

Radiomics for breast MRI shows promise in the pre-treatment prediction of pathologic response to neoadjuvant chemotherapy in patients with lymph-node positive invasive breast cancer.

CLINICAL RELEVANCE/APPLICATION

The ability to predict which patients will demonstrate pathologic complete response before initiating neoadjuvant chemotherapy could positively impact patient management by saving the cost of unnecessary chemotherapy and also the mortality and morbidity associated with additional adjunct treatment in cases of incomplete pathologic response such as axillary dissection and radiation therapy.

BR244-SD-TUA4 Histological Whole-Slide Imaging for Invasive Breast Cancer: A Novel Technique to Obtain Quantitative Parameters Correlating with the Apparent Diffusion Coefficient

Station #4

Participants
Naoko Mori, MD, PhD, Sendai, Japan (*Presenter*) Nothing to Disclose
Chihiro Inoue, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose
Shunji Mugikura, MD, PhD, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose
Kei Takase, MD, PhD, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate whether parameters obtained by quantitative analysis of histological whole-slide imaging (WSI) correlates with the apparent diffusion coefficient (ADC) in diffusion-weighted imaging (DWI) for invasive breast cancer.

METHOD AND MATERIALS

The Institutional Review Board approved this retrospective study and waived the requirement for informed consent. Between September 2015 and July 2016, 46 consecutive patients with 46 invasive breast cancer lesions diagnosed by surgery underwent preoperative breast magnetic resonance imaging (MRI), including DWI (b value: 50, 850s/mm2), followed by mastectomy or lumpectomy without neoadjuvant therapy. Regions of interest (ROIs) covering as much of the tumor volume as possible were placed manually on the maximum cross-section of the tumor on ADC maps, and the mean ADC values of the ROIs were recorded. For histological analyses, the digital data of cytokeratin-immunostained thin-slice sections using the largest cross-sectional area of the tumor were used for WSI. The cytoplasm, interstitium, and nucleus were identified and segmented by their brown, light blue, and purple colors, respectively. The area ratios of cancer cells (the sum of the cytoplasm and nucleus) and interstitial space were calculated by identifying the color of each component for the whole tumor area. For conventional cell counts, we randomly selected five areas at ×200 field and manually counted cancer cells, and then the average counts of five areas were recorded as cell counts. Then, all histological parameters were compared with the ADC using Pearson's correlation coefficient. A value of $p < 0.05$ was considered statistically significant.

RESULTS

The area ratios of the interstitial space were significantly positively correlated with the ADC (r=0.53; p=0.0001). The area ratios of cancer cells and conventional cell counts were significantly negatively correlated with the ADC with a lesser degree. (r=-0.36 and -0.32, respectively; p=0.012 and 0.027, respectively).

CONCLUSION

There is a significant positive correlation between the ADC value and area of the interstitium, as measured by WSI.

CLINICAL RELEVANCE/APPLICATION

There is a significant positive correlation between the ADC and the area of the interstitium, as measured by whole-slide imaging (WSI). The ADC reflects the amount of interstitium in breast cancer tissue.

BR245-SD-TUA5 Usefulness of CAD (Computer-Aided Detection) System for Screening Automatic Breast Ultrasound

Station #5

Participants
Jeong Min Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Bong Joo Kang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sung Hun Kim, Su Won, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kim Myeongjong, Suwon, Korea, Republic Of (*Presenter*) Nothing to Disclose

PURPOSE

To evaluate diagnostic performance of screening automated breast ultrasound using computer aided detection (CAD) system and to analyze the characteristics of CAD marks and the causes of false positive marks.

METHOD AND MATERIALS

A total of 846 women aged 40-49 years who underwent automated breast ultrasound for screening from January 2017 to December 2017 were included. We applied the CAD (QVCADTM) to all of the automated breast ultrasound examinations and evaluated its diagnostic performance. Then, we analyzed the frequency, characteristics, and causes of false positive marks and tried to find out a way to reduce the false positive marks. Furthermore, we analyzed whether adding CAD would shorten the reading time.

RESULTS

Out of a total of 846 patients, 534 CAD marks were displayed with an average CAD mark per person of 0.8 ± 1 (range 0-6). Through screening automated breast ultrasound, five breast cancers were diagnosed. The sensitivity, specificity, PPV, NPV, and accuracy of CAD were 60.0%, 59.0%, 0.9%, 99.6% and 59.0% for 846 patients, respectively, while those of 534 CAD marks were

60.0%, 48.3%, 0.6%, 99.6%, and 48.4%. Among 531 false positive marks, 459 false marks for pseudolesions were well identified; the most common cause was marginal shadowing (209, 39.1%), then, Cooper's ligament shadowing (143, 26.8%), periareolar shadowing (64, 12%), rib (37, 6.9 %), and skin lesion (6, 1.1%). The false marks for pseudolesions appeared in the upper portion rather than mid to lower portion and in the outer portion rather than mid to inner portion. In the case of a negative study, it was less time-consuming and easier to make a decision.

CONCLUSION

Adding CAD does not improve accuracy for screening automated breast ultrasound in this study, but adding it helps to reduce reading time nonetheless for negative screening ultrasound.

CLINICAL RELEVANCE/APPLICATION

Using CAD system is helpful to reduce reading time for screening automated breast ultrasound, but does not improve accuracy.

BR246-SD-TUA6 Analysis of Background Echotexture on Automated Breast Ultrasound: Correlation with Mammographic Density

Station #6

Participants
Eun Jung Choi, MD, PhD, Jeonju, Korea, Republic Of (*Presenter*) Nothing to Disclose
Ji Hyun Youk, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Bo Ram Kim, Jeonju, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To analyze the background echotexture (BE) on automated breast ultrasound (ABUS) according to BI-RADS and modified BE classification in correlation with mammographic breast density (BD).

METHOD AND MATERIALS

196 women (age, 31-72 yrs) who underwent ABUS and mammography were included. Their menopausal status, parity, and family history of breast cancer were collected. After independently reviewing all ABUS and mammography images, three radiologists assigned BE as homogeneous-fat, homogeneous-fibroglandular, or heterogeneous based on BI-RADS as well as homogeneous-fat, homogeneous-fibroglandular, or hetergeneous-mild, moderate, and marked based on modified BE classification. BD was classified into category A, B, C, or D based on BI-RADS. The interobserver agreement was measured by kappa statistics (κ). The association among demographics, BE, and BD was analyzed by Spearman's correlation coefficient (ρ) and multiple linear regression.

RESULTS

The overall interobserver agreement for BE based on BI-RADS (κ=0.83), modified BE classification (κ=0.66), and BD (κ=0.84) was substantial to nearly perfect. By consensus, 29 homogeneous-fat (14.8%), 144 homogeneous-fibroglandular (73.5%), and 23 heterogeneous (11.7%) were assigned based on BI-RADS, while 41 homogeneous fat (20.9%), 9 homogeneous-fibroglandular (4.6%), or 46 hetergeneous-mild (23.5%), 65 moderate (33.2%), and 35 marked (17.9%) were assigned based on modified BE classification. For BD, 21 category A (10.7%), 79 category B (40.3%), 63 category C (32.1%), and 33 category D (16.8%) were assigned. The result of modified BE classification was positively correlated with BD ($P<0.0001$; overall, ρ=0.61; premenopausal, ρ=0.42; postmenopausal, ρ=0.57). BE based on BI-RADS was significantly correlated with BD in overall (ρ=0.2, $P=0.005$) and postmenopausal women (ρ=0.3, $P=0.006$). On multiple linear regression, BD and modified BE classification or parity and BE based on BI-RADS was associated ($P<0.0001$).

CONCLUSION

Interobserver agreement of BE based on BI-RADS was nearly perfect, higher than modified BE classification. BE based on BI-RADS and modified BE classification on ABUS had good correlation with BD.

CLINICAL RELEVANCE/APPLICATION

Automated breast ultrasound would enable the objective analysis of background echotexture throughout the whole breast and its chronological change in correlation with mammographic density.

BR188-ED-TUA7 Missed Breast Cancers: The Unconscious Bias in Breast Imaging

Station #7

Awards
Cum Laude
Identified for RadioGraphics

Participants
Leslie Lamb, MD, Boston, MA (*Presenter*) Nothing to Disclose
Raman Verma, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Jean M. Seely, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Medical errors are a substantial cause of morbidity and mortality and the third leading cause of death in the United States. Errors resulting in missed breast cancer are the most prevalent condition precipitating medical malpractice lawsuits against all physicians. In breast imaging, missed and interval breast cancers at screening mammography ranges from 1 to 35%. As such, it is important to understand various cognitive processes during mammographic interpretation to improve awareness of unconscious biases and decrease the number of missed breast cancers. It is particularly important to be aware of these biases when encountering the most commonly missed and misinterpreted breast lesions. The purpose of this educational exhibit is to demonstrate various cognitive processes that lead to unconscious biases through a pictorial review of missed breast cancers, and highlight strategies to reduce the rates of these missed cancers.

TABLE OF CONTENTS/OUTLINE

The most commonly missed and misinterpreted lesions will be reviewed (stable, benign appearing and one-view masses, developing asymmetries). These will help illustrate the common unconscious biases with appropriate minimization strategies in breast imaging (anchoring, confirmation, satisfaction of search, hindsight, inattention, satisfaction of report and premature closing).

BR189-ED-TUA8 Perceptive and Interpretive Pitfalls at Digital Breast Tomosynthesis (DBT) - Lessons from Continued Clinical Practice

Station #8

Awards
Certificate of Merit

Participants
Sushma Gaddam, MD, New York, NY (*Presenter*) Nothing to Disclose
Samantha L. Heller, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Yiming Gao, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Digital breast tomosynthesis (DBT) is rapidly becoming the standard of care in mammographic screening, replacing conventional 2D mammography. DBT technique continues to evolve, with synthetic 2D images (s2D) increasingly substituting for full field 2D mammography, decreasing radiation dose. Because DBT is a relatively new technology, continued learning and improvement of radiologist skills are essential. We will discuss perceptive and interpretive pitfalls of DBT interpretation, illustrate exceptions to the rules in DBT diagnosis, and highlight teaching points via a case-based review.

TABLE OF CONTENTS/OUTLINE

1. Intro: a. 2D vs. DBT/2D vs. DBT/s2D b. Perceptive vs Interpretive errors2. Perceptive errors a. Satisfaction of search b. Localization or triangulation errors on DBT c. Calcifications on synthetic 2D images d. DBT occult cancers e. Extremely dense breast f. Invasive lobular cancers g. Technical issues - patient positioning, motion3. Interpretive errors a. Skin vs. superficial lesions b. One-view-only findings c. Developing asymmetries d. Fat containing lesions e. Architectural distortions f. DBT-only architectural distortions4. Case illustrations - highlight pearls and pitfalls

BR190-ED-TUA9 Breast Imaging of Ductal Carcinoma in Situ: Dilemma Between Overtreatment and Underestimation

Station #9

Participants
Hiroko Satake, MD, Nagoya, Japan (*Presenter*) Nothing to Disclose
Satoko Ishigaki, MD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinji Naganawa, MD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Given the uncertainty in determining whether ductal carcinoma in situ (DCIS) is likely to progress, every DCIS is intensively treated as invasive breast cancer. Overdiagnosis and overtreatment may potentially occur, especially for low-grade DCIS. On the other hand, a pathologically positive or a close-to-margin status, due to preoperative underestimation, are risk factors for local DCIS recurrence post-excision. Furthermore, we occasionally encounter preoperatively diagnosed DCIS that is then upgraded to invasive cancer postoperatively. We review the image findings in DCIS and discuss how they can be used to resolve dilemmas between overtreatment and underestimation.

TABLE OF CONTENTS/OUTLINE

1. Explain the controversies surrounding DCIS diagnosis and treatment. 2. Review the imaging features of DCIS on mammography, ultrasonography, and MRI. 3. Review the usefulness and pitfalls of preoperative MRI for DCIS to estimate tumor extensions. 4. Review the current literature and discuss the capabilities of diagnostic imaging, focusing on the following topics: · Differentiating low-grade from high-grade DCIS · Preoperative predictions concerning occult invasion in DCIS · Identifying imaging risk factors for local DCIS recurrence · Quantitative imaging analysis of DCIS

BR191-ED-TUA10 Not Your Mother's Breast Cancer - Imaging and Review of Breast Cancer Under 30 and Other Mimics

Station #10

Participants
Vincent G. Champion, MD, Westwood, MA (*Presenter*) Nothing to Disclose
Bonny Lee, MD, MS, brookline, MA (*Abstract Co-Author*) Nothing to Disclose
Eileen Delaney, MD, Worcester, MA (*Abstract Co-Author*) Nothing to Disclose
Amy K. Patel, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Evguenia J. Karimova, MD, Memphis, TN (*Abstract Co-Author*) Nothing to Disclose
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Priscilla J. Slanetz, MD, MPH, Belmont, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Review the role of imaging in the diagnosis of breast cancer and potential mimics for women under 30 years old. 2. Discuss the unique challenges involved in the diagnosis and management of breast cancer in young patients.

TABLE OF CONTENTS/OUTLINE

1. Review the current state of breast cancer in young women. 2. Discuss risk factors related to development of breast cancer in

young women including socioeconomic status and race 3. Review unique pathologic features encountered in young women with breast cancer as opposed to those in older women. 4. Review imaging protocols used in the diagnosis and management of breast cancer in the young women. 5. Provide examples of mimickers of breast cancer encountered in young women. 6. Discuss management considerations for the adolescent or young adults with breast cancer including risks of surgery, chemotherapy, radiation, and hormonal therapy.

BR192-ED-TUA11 The Bright Side of the Post-Surgical Breast: Benign Findings After Breast Manipulation

Station #11

Participants
Pedro Henrique Hasimoto e Souza, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Juliana H. Catani, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Prepare the radiologist to face common and uncommon presentations of manipulation / post-surgical benign changes in breast imaging; Exhibit clinical cases from our radiology department, with various types of manipulation resulting in breast benign imaging findings; Discuss the effects of manipulation on breast cancer detection; Provide management recommendations.

TABLE OF CONTENTS/OUTLINE

- Brief discussion on post-treatment follow-up care in breast cancer; - Risk factors and incidence of recurrence; - Imaging features (mammography, ultrasound and magnetic resonance imaging) of manipulation / post-surgical benign changes in breast imaging: 1. Mastectomy and variants 2. Breast implants Expanders and silicone implants Double prosthesis Implants in transexual patients Intra and extracapsular ruptures Industrial liquid silicone injection 3.Mastopexy Mesh Internal suture 4. Reduction mammoplasty Vertical incision Inferior pedicle 5. Autologous reconstruction Autologous fat grafting Pedicled TRAM flap Dorsal flap 6. Miscellaneous Fat necrosis Subcutaneous emphysema Radiotherapy actinic changes Keloid Tattoo Others

BR198-ED-TUA12 Luminal B Subtype Breast Cancer: Radiogenomic Correlation

Station #12

Participants
Bruna Mannato, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
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Mario S. Campos, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

1. The main objective of this pictorial review is to show the most prevalent imaging patterns of that luminal B subtype at mammography (MMG), ultrasound (US) and magnetic resonance (MR). 2. Series of cases of patients diagnosed with invasive breast cancer, between January 2015 and March 2018, classified as luminal B, analyzing the most prevalent features in the different imaging modalities (MMG, US and MR). 3. Recent literature review and comparison with the data found in our service.

TABLE OF CONTENTS/OUTLINE

• Introduction - The traditional clinicopathological model. - New classification Immunohistochemical • Luminal Subtype Breast - Cancer Luminal B x Luminal A • Imaging features -MMG - US - MR • Radiogenomics correlation • Conclusion

BR009-EB-TUA Quantitative MRI Radiomics in Breast Cancer: Tumor Perfusion and Heterogeneity

Hardcopy Backboard

Participants
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TEACHING POINTS

Radiomics is defined as the use of automated post-processing and analysis of quantitative imaging characteristics that can be extracted from medical images. Quantification of imaging features is important to link the biomarkers with biological processes and clinical endpoints. Magnetic resonance imaging(MRI) is the most sensitive imaging modality in breast cancer and has been used for staging before treatment and assessing the response to the chemotherapy. Perfusion and tumor heterogeneity are related with

cancer biological characteristics and prognosis. In this exhibit, we will illustrate how to quantitatively assess tumor perfusion and heterogeneity on breast MRI and correlate radiological imaging parameters with prognostic biomarkers and clinical outcomes. In addition, we will discuss the future potential of radiomics in oncology imaging.

TABLE OF CONTENTS/OUTLINE

1) Radiomics : Definition : Requirements for quantification of medical images 2) Assessment of tumor perfusion on breast MRI : Imaging technique : Quantitative parameters 3) Assessment of tumor heterogeneity on breast MRI : Texture analysis mechanism : Quantitative parameters 4) Correlation of quantitative parameters of tumor perfusion and heterogeneity with biomarkers and clinical outcomes 5) Future potential of radiomics in oncology imaging

LL21

Lunch and Learn: The Future of Women's Breast Health: Breakthrough Technologies in Breast Imaging, Patient Experience and Clinical Research: Presented by Mammosphere (invite-only)

Tuesday, Nov. 27 12:30PM - 1:30PM Room: S404AB

Participants

Ethan Cohen, MD, Assistant Professor, Department of Diagnostic Radiology, Division of Breast Imaging, The University of Texas MD Anderson Cancer Center; Heather Greenwood, MD, an Assistant Professor of Clinical Radiology in the Breast Imaging section at the University of California, San Francisco; Kathryn Pearson Peyton, MD, Founder of Mammosphere; Cristin Gardner, Director of Consumer Products & Markets, Mammosphere

Program Information

While Radiology continues to shift from a volume to value-based world, it's not a new concept for breast imagers who have been practicing value-driven care since the inception of the Mammography Quality Standards Act (MQSA) in the early 90s. At the core of these efforts, patient experience remains key to optimize care and reduce costs. This means offering patients the right tools that drive engagement to achieve these desired outcomes. In this digital age, it's no longer a "nice to have." For mammography, access to a patient's data - especially prior exams - is critical for a better experience and outcomes. As more patients live increasingly mobile lifestyles, it can be challenging for both the provider and patient to gather the data needed at the time of the exam. This can increase the rate of false-positive diagnoses, leading to unnecessary orders of additional expensive diagnostic tests and biopsies. Patients also experience needless anxiety. With so many health and wellness platforms available, how can providers, along with healthcare payers and employers, provide the right resources to women in the populations they serve to help them gather their medical data while empowering them to take control of their health? This lunch and learn session will feature a panel of clinical, academic and technology experts in this field exploring the following topics: The current state of breast health research and its impact on patient behavior and technology. The best practices organizations can follow to incorporate breast health resources into their population health strategy. How to effectively implement breast health technology to drive patient engagement.

LL23

Lunch and Learn: Real-World Deployment of Deep Learning for Breast Cancer Screening: Presented by Kheiron Medical Technologies (invite-only)

Tuesday, Nov. 27 12:30PM - 1:30PM Room: S403B

Participants

Peter D. Kecskemethy, PhD , London, United Kingdom (*Presenter*) Stockholder, Kheiron Medical Technologies Ltd
Hugh Harvey, MBBS, London, United Kingdom (*Presenter*) Employee, Kheiron Medical
Christopher C. Austin, MBBCh,MSc, Seattle, WA (*Presenter*)

Program Information

Kheiron is at the cutting edge of deep learning technology for breast cancer screening, and leading the way for healthcare and industry collaborations in real-world deployment of deep learning technologies. Please join us for this lunchtime session where we will use our experiences of partnerships and real-world deployment to explore and discuss this exciting new space, including: - the organizational benefits and challenges posed by the next generation of supportive technology - how radiologists can take a leading role in the development and adoption of deep learning in radiology - discussion on the challenges faced by the industry, including structural changes and operations of professional bodies, individual providers, and nationwide programs.

RSVP Link

https://www.kheironmed.com/rsna

VW11

3D ABUS: Hands-on Workshop: GE Vendor Workshop

Tuesday, Nov. 27 12:30PM - 1:30PM Room: Booth 8156

Program Information

Peer educator led workshop includes a live Invenia ABUS 2.0 scan station acquisition and hands-on review of clinical cases using the Invenia ABUS Viewer. Learn about the importance of the coronal view and how 3D ABUS screening helps increase cancer detection in women with dense breast tissue. *Registration is required; adding this session to the RSNA calendar tool alone does not secure your seat in this session. Click the link below to register.*

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2018-/agenda-e57e0b47e9aa4f5ba89b1a0da1e829b9.aspx

BRS-TUB

Breast Tuesday Poster Discussions

Tuesday, Nov. 27 12:45PM - 1:15PM Room: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

Participants
Samantha L. Heller, MD, PhD, New York, NY (*Moderator*) Nothing to Disclose

Sub-Events

BR247-SD-TUB1 Clinical Usefulness of Digital Breast Tomosynthesis (DBT) and Hybrid 18F-FDG PETMRI (PETMR) for Monitoring Neoadjuvant Chemotherapy (NAC) in Breast Cancer

Station #1

Participants
Nachiko Uchiyama, MD, Tokyo, Japan (*Presenter*) Nothing to Disclose
Hiroaki Kurihara, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Takayuki Kinoshita, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To compare the usefulness of DBT and PETMR for evaluation of loco-regional staging and treatment response of NAC with reference to pathological findings.

METHOD AND MATERIALS

30 invasive breast cancers (IDC: n=27, ILC n=2, and Metaplastic Ca: n=1) among 28 cases with 29 breasts, that NAC was preoperatively underwent, were enrolled. The average age was 49.71 ± 11.94 y. o. Clinical stages were IIA (n=6), IIB (n=9), IIIA (n=4), and IIIC (n=10). MMG+DBT, US, and PETMR were obtained before and after NAC. Regarding PETMR, as whole-body scans was obtained after intravenous injection of 18F-FDG followed by a resting period of 60 min in a spine position as early phase In addition, breast MRI were conducted with a dedicated bilateral 8-channel breast radiofrequency coil in a prone position and contrast enhanced four phases of dynamic studies were obtained. As well as breast MRI, breast PET images as late phase of 80 min. Regarding DBT, the images were acquired by MLO and CC views with the rotation angle of ± 25° and reconstructed into 2mm thick slice having 1mm overlap with high in-plane resolution of 85μm. NAC response was classified in accordance with RECIST and compared with pathological response in accordance with JBCS.

RESULTS

Before NAC, PETMR detected primary lesions with CEMR and with PET by 100% (30/30). Regarding LN metastasis, the diagnostic accuracy was 96.6% (28/29) by CEMR and 93.1% (27/29) by PET. Among the pathological response of Grade 0-1a (n=5), MMG+DBT demonstrated as SD (3/5: 60%) and PR (2/5: 40%). PETMR demonstrated as SD (2/5: 40%) and PR (3/5: 60%). Among Grade 1b-2 lesions (n=17), MMG+DBT detected as PR (13/17: 76.5%) and CR (4/17: 23.5%). PETMR demonstrated as PR (14/17: 82.4%) and CR (3/17: 17.6%). Among Grade 3 (n=8), MMG+DBT demonstrated as CR (6/8: 75.0%) and PR (2/8: 25.0%). PETMR demonstrated as CR (4/8: 50%) and PR (4/8: 50%). In addition, we evaluated estimated pathological responses with MMG+DBT and PETMR to compare the actual pathological results.

CONCLUSION

Concurrent usage of MMG+DBT and PETMR can demonstrate promising results for loco-regional staging prior to NAC and can predict more accurate treatment response after NAC.

CLINICAL RELEVANCE/APPLICATION

Concurrent usage of MMG+DBT and hybrid PETMR are useful among NAC cases of breast cancer, because they can provide detailed analysis by morphological evaluation with DBT, by evaluation of vascularity with dynamic MR , and by metabolic evaluation with PET.

BR248-SD-TUB2 Changes in the Utilization of the BI-RADS Category 3 Assessment in Recalled Patients Screened with Digital Mammography Before and After the Implementation of Diagnostic Digital Breast Tomosynthesis

Station #2

Participants
Tricia Stepanek, Cleveland, OH (*Presenter*) Nothing to Disclose
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Holly N. Marshall, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
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Donna M. Plecha, MD, Strongsville, OH (*Abstract Co-Author*) Research Grant, Hologic, Inc

PURPOSE

To compare the utilization of the Breast Imaging Reporting and Data System (BI-RADS) category 3 assessment in patients recalled from digital mammography (DM) screening before and after the implementation of digital breast tomosynthesis (DBT) in the diagnostic setting.

METHOD AND MATERIALS

This was an IRB-approved and HIPAA-compliant retrospective review of 22980 DM screening exams. The diagnostic DM cohort was limited to patients screened with DM between January 1, 2010 and August 31, 2011 (n = 11478) who were assigned a category 3 after diagnostic DM work-up without tomosynthesis. The diagnostic DM+DBT cohort was limited to patients screened with DM between January 1, 2014 and June 30, 2015 (n = 11502) who were assigned a category 3 after diagnostic DM+DBT work-up. Diagnostic ultrasound was performed at the discretion of the radiologist in both cohorts. Category 3 lesions were classified as architectural distortion, asymmetry, calcification, mass, and other and followed for a minimum of 2 years.

RESULTS

The addition of DBT to diagnostic work-up after screening with DM resulted in a 61.9% reduction (22.6 women per 1000) in the utilization of BI-RADS category 3 compared to diagnostic DM work-up alone (3.7% for DM vs. 1.4% for DM+DBT; $p < 0.0001$). There was a statistically significant change in the distribution of category 3 findings with DM+DBT characterized by an increase in masses ($p = 0.0056$) and a decrease in calcifications ($p = 0.0024$). There was no change in category 3 assessment for distortions ($p > 0.99$), asymmetries ($p = 0.073$), or other findings ($p = 0.58$). Diagnostic DM+DBT resulted in a two-fold increase in incidental findings leading to a category 3 compared to DM alone (2.3% for DM vs. 7.0% for DM+DBT; $p = 0.0053$). The delayed cancer detection rate was 1.4% (10 malignancies in 419 patients) for category 3 lesions diagnosed by DM and 0% (0 malignancies in 160 patients) for category 3 lesions diagnosed by DM+DBT ($p = 0.069$).

CONCLUSION

DBT in the diagnostic evaluation of patients recalled from DM screening decreased the number of patients assigned to short-term follow-up by 22.6 women per 1000 (61.9%), despite increased rates of category 3 incidental findings with 0% delayed cancer detection.

CLINICAL RELEVANCE/APPLICATION

The use of DBT for diagnostic work-up at recall from DM screening may reduce the utilization of the BI-RADS category 3 assessment, decreasing the number of women committed to short-term follow-up.

BR249-SD-TUB3 Management of Atypical Breast Papillomas by US-Guided Vacuum-Assisted Removal: Long-Term Outcomes

Station #3

Participants
Jose Maria Oliver-Goldaracena, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
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Maria Jesus Garcia Sanchez, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To review long-term outcomes of the percutaneous management of bening breast papillomas with atypia (AP) by US-Guided Vacuum-Assisted Removal (US-VAR).

METHOD AND MATERIALS

In our Institution, probable intraductal papillomas diagnosed with US (benign intraductal mass within a dilated duct or cyst with Color-Doppler signal or correlation on ductography) or papillomas diagnosed at US-CNB of less than 30mm are managed by US-VAR. Between April 2010 and March 2018 , 149 probable intraductal papillomas and 62 papillomas (diagnosed at US-CNB :54 Benign papillomas, BP and 8 atypical papillomas, AP) in 188 patients (pts) were removed with US-VAR. Histology showed benign papilloma (BP) in 149 (168pts), atypical papilloma in 12(11pts) and papillary carcinoma in 9 (9pts). Conservative management was decided in the 12 APs (mean size 7mm, range 5-26mm) of 11pts (mean age 61, range 35-68) because of appropiate radiologic-pathologic correlation (pathology report showed atypical hyperplasia without suspected DCIS). Pathologic dischargue was present in 4APs (4pts) with US findings that showed probable intraductal papillomas . The 8 asymptomatic APs(7pts) were previously diagnosed by US-CNB as 4 BPs and 4 APs. The US findings of the 12 APs were classified BIRADS 3 (8), BIRADS 4A (2) and BIRADS 4B (2). All patients underwent US follow-up at 1-2 months, 6-8 months, and 12-14 months after US-VAR and later annual US follow-up. When a residual or recurrent suspicious papilloma was detected at US follow-up, re-excision by US-VAR was performed. Clinical, US follow-up and pathologic outcomes were recorded.

RESULTS

US follow-up ranged between 84 and 19 months (mean 68 months). No recurrent lesions were detected . None were upgraded to carcinoma at long term US follow-up. Nipple discharge disappeared in all 4 symptomatic patients.

CONCLUSION

US-VAR allows percutaneous long-term management of atypical papillomas with proper radiologic-pathologic correlation.

CLINICAL RELEVANCE/APPLICATION

US-VAR is appropriate for the long-term percutaneous management of atypical papillomas with proper radiologic-pathologic correlation.

BR250-SD-TUB4 Longitudinal Investigation of Tumor Heterogeneity in Breast DCE-MRI to Improve Early Response Assessment to Neoadjuvant Chemotherapy for Locally Advanced Breast Cancer: Results From the ACRIN 6657/I-SPY-1 Trial

Station #4

Participants
Nariman Jahani, Philadelphia, PA (*Presenter*) Nothing to Disclose
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Lauren Pantalone, BS, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Susan Weinstein, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Christos Davatzikos, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Utilizing longitudinal dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) scans of locally advanced breast cancer under neoadjuvant chemotherapy (NAC), we evaluate voxel-wise spatio-temporal changes in tumor heterogeneity to improve early prediction of pathologic complete response (pCR) and recurrence free survival (RFS).

METHOD AND MATERIALS

We retrospectively analyzed 106 women from a subset of ACRIN 6657/I-SPY TRIAL with complete imaging and prognostic marker data using DCE-MRI scans acquired before and after the first cycle of NAC. Utilizing a robust deformable image registration technique, we identified corresponding voxels between pre- and post-treatment images and extracted two groups of voxel-wise features to quantify longitudinal tumor heterogeneity: 1) voxel-wise tumor deformation including local volume ratio and anisotropic deformation; and 2) parametric response maps of DCE-MRI kinetic variables (signal enhancement ratio, peak enhancement, wash-in/wash-out slope). Using best-subset regression, features were added to a baseline model including established prognostic markers and functional tumor volume to predict pCR and RFS. Multivariate logistic regression and Cox proportional hazard models were used to assess pCR and RFS, respectively. Furthermore, conventional analysis where analogous metrics were averaged over the tumor was conducted to compare to voxel-wise analysis. The performances of models were evaluated with area under curve (AUC) and c-statistics for pCR and RFS analyses, respectively (flowchart in Fig.1).

RESULTS

Voxel-wise analysis improved prediction significantly for both pCR and RFS, with AUC=0.85 and c-statistics=0.79, compared to the baseline model with AUC=0.76 and c-statistics=0.69, respectively. The aggregate model indicated similar performance to the baseline model with AUC=0.76 and c-statistics=0.70, respectively.

CONCLUSION

Our results suggest that quantification of voxel-wise changes after NAC can extract markers revealing spatio-temporal tumor heterogeneity that can significantly improve early tumor response assessment, while conventional aggregate tumor features may not adequately capture such longitudinal changes to add significant new information for prognosis.

CLINICAL RELEVANCE/APPLICATION

Improvement of early treatment assessment using markers based on voxel-wise feature analysis may provide complementary new information to better modify treatment plans and to optimize therapy.

BR251-SD-TUB5 Development and Validation of a Deep Learning Model For More Accurate and Consistent Assessment of MRI Background Parenchymal Enhancement

Station #5

Participants
Benjamin Wang, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Increased MRI background parenchymal enhancement (BPE) is associated with breast cancer risk. However, radiologist BPE assessment is variable. Our goal was to train a deep learning (DL) model to assess breast MRI BPE and to evaluate its performance

compared to expert radiologists.

METHOD AND MATERIALS

After IRB approval, consecutive breast MRI examinations from January 2011 to December 2014 with BPE assessment were identified (n=4683). 3249, 696, and 885 exams were selected for the training, validation, and test data sets, respectively. A single representative maximum intensity projection image from each examination and the radiologist's prospective assessment of BPE were used to train a deep learning classifier (ResNet). From the test data set, a sample of 100 MRI exams were then randomly selected and submitted for blinded review by 5 fellowship trained breast imaging radiologists for binary assessment of BPE (minimal versus non-minimal). We estimated both our DL model agreement and our radiologist readers' agreement with the original radiologist's BPE assessment using percent agreement with Wilson confidence intervals (CI) and with linear-weighted kappa statistics, compared across 5,000 bootstrap samples to assess significance.

RESULTS

For the subset of 100 reader study exams, DL model agreement with the original radiologist's BPE assessment was 80.0% (95% CI of 71.1, 86.7) for binary assessment. The 5 radiologist readers' agreement with the original radiologist's BPE assessment for the same 100 cases was 69.8% (95% CI 65.4, 73.5) for binary assessment (p=0.02). Compared to the original radiologist's BPE assessment, our DL model showed moderate agreement (K=0.55, 95% CI 0.38-0.74) on this subset compared to weak agreement by the 5 radiologist readers' consensus assessment (K=0.43, 95% CI 0.26-0.61).

CONCLUSION

A deep learning model can more accurately and reliably assess BPE based on maximal intensity projection images than a human reader.

CLINICAL RELEVANCE/APPLICATION

A deep learning model that accurately and consistently predicts BPE could reduce variability in radiologist BPE assessment and may also serve as a reliable tool for breast cancer risk prediction.

BR252-SD-TUB6 Diagnosis of Triple Negative Breast Cancer Using Machine Learning Methods of Quantitative Computerized Ultrasound Features

Station #6

Participants
Tong Wu, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Laith R. Sultan, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Theodore Cary, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Jiawei Tian, Harbin, China (*Abstract Co-Author*) Nothing to Disclose
Chandra Sehgal, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Triple negative (TN) breast cancers are known for aggressive biological characteristics and poor clinical outcomes. In the current-state-of-the-art much of the technological advances have been aimed at differentiating malignant and benign tumors where all the subtypes are grouped together. In this study, we go beyond this discrimination of the solid breast masses by applying computer methods with ultrasound imaging to differentiate TN and non-triple negative (NTN) subtypes.

METHOD AND MATERIALS

140 surgically confirmed breast cancer were classified into triple negative (TN) and non-triple negative (NTN) subtypes based on the expression of ER, PR, HER2. Nine quantitative grayscale features describing margin and shape characteristics of the lesion, and three tumor vascularity features describing the magnitude of vascularity were extracted from a manually drawn region of interest on grayscale and color Doppler images. The features that showed difference (P<0.05) were used with logistic regression and leave-one-out cross validation to train and test the differentiation of TN and NTN masses. Diagnostic performance was measured by the area under ROC (AUC) and sensitivity and specificity measured at the Youdons index.

RESULTS

Twenty-five of the 140 cases were found to be TN. Of the twelve grayscale and Doppler features, eight showed statistical difference (P< 0.002) for the TN and NTN. AUC of the statistically significant GS and Doppler features when used alone was 0.850 and 0.657, respectively. The AUC increased to 0.882 when all the significant GS and CD features were used. The improvement by inclusion of Doppler features was significant (P <0.0001). Sensitivity and specificity of combined grayscale and Doppler was 78.26% and 85.47%, respectively. Consideration of patient age in the analysis did not improve discrimination of TN and NTN.

CONCLUSION

The analysis of breast ultrasound by machine learning can achieve high level of differentiation between the TN and NTN subtypes that is comparable to the diagnostic performance by standard visual assessments of the images.

CLINICAL RELEVANCE/APPLICATION

TN breast cancers are high grade and aggressive with shorter survival time, higher metastasis and recurrence. This study proposes a quantitative sonographic approach for improving the TN diagnosis

BR253-SD-TUB7 Comparison of Automated Breast Ultrasound (ABUS) QVCAD Standalone Performance on Somo-v and Invenia Cases

Station #7

Participants
Yulei Jiang, PhD, Chicago, IL (*Presenter*) Research Grant, QView Medical, Inc; Research Consultant, QView Medical, Inc; Research Consultant, Quantitative Insights, Inc; Research Consultant, RadOnc eLearning Center, LLC

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PURPOSE

To evaluate QVCAD standalone performance on somo•v and Invenia cases, and to infer likely effect of QVCAD on Invenia cases from its effect on somo•v cases.

METHOD AND MATERIALS

Evaluation was made on 164 somo•v (31 with cancer) and 145 Invenia (25 with cancer) cases, all of BI-RADS density C or D. Area under ROC curve (AUC), per-patient sensitivity and specificity, false-positives per volume, and FROC curves were compared. Non-inferiority on Invenia vs. somo•v cases was tested with Bonferroni correction at a family-wise a=0.05 level for non-inferiority margins of -0.05 for AUC, -5% for sensitivity, -5% for specificity, and +0.05 for false positives per volume. A previous observer study of somo•v cases evaluated QVCAD effect on reader performance.

RESULTS

Somo•v and Invenia results were comparable. AUC was 0.73±0.05 (AUC ± standard error) for somo•v vs. 0.79±0.07 for Invenia. For QVCAD computer marks, sensitivity was 71.0% (22/31) [95% CI: 53.4%, 84.8%] vs. 84.0% (21/25) [65.8%, 94.7%], specificity was 49.6% (66/133) [41.2%, 58.0%] vs. 55.0% (66/120) [46.0%, 63.7%], and false-positive rate was 0.11 (101/891) [0.09, 0.14] per volume vs. 0.15 (107/697) [0.12, 0.19] per volume, respectively. For QVCAD computer-enhanced dark areas, sensitivity was 96.8% (30/31) [85.1%, 99.8%] vs. 100.0% (25/25) [88.7%, 100.0%], specificity was 6.0% (8/133) [2.8%, 11.1%] vs. 7.5% (9/120) [3.7%, 13.3%], and false-positive rate was 0.67 (596/891) [0.60, 0.74] per volume vs. 0.75 (525/697) [0.65, 0.85] per volume, respectively. Non-inferiority tests with Bonferroni correction did not show statistical significance. FROC curves were similar or apparently higher for Invenia than somo•v (Fig.). Previous observer study showed concurrent read of somo•v screening cases with QVCAD reduced reading time and produced non-inferior diagnostic accuracy compared with no QVCAD.

CONCLUSION

QVCAD standalone performance is comparable on somo•v and Invenia cases. Its benefit for reducing reading time and producing non-inferior reader performance can be expected on Invenia cases.

CLINICAL RELEVANCE/APPLICATION

This study provides a performance benchmark for clinical use of QVCAD on the current Invenia ABUS system and a frame of reference to the results of a previous observer study done on somo•v cases.

BR193-ED-TUB8 Freezing Instead of Excising: Cryoablation for Breast Cancer - How It's Done

Station #8

Awards
Magna Cum Laude

Participants
Linda DeMello, MD, Providence, RI (*Presenter*) Nothing to Disclose
Robert C. Ward, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Martha B. Mainiero, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Ana P. Lourenco, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. To illustrate the cryoablation techniques utilized in early stage breast cancer, highlighting the importance of avoiding potential complications and pitfalls. 2. To present a series of cryoablation cases from our breast center, including follow-up imaging. 3. To recognize the role of cryoablation in treating early stage cancers in patients who are not surgical candidates or prefer an alternative treatment to surgery.

TABLE OF CONTENTS/OUTLINE

1. Introduction to Cryoablation 2. Techniques and Equipment 3. Presentation of at least 5 cases from our breast center a. Each with a different dilemma with regard to clinical context and technique b. Detail potential pitfalls and complications along with strategies to avoid them 4. Patient experience and outcomes 5. Future applications of cryoablation and summary

BR194-ED-TUB9 Getting Acquainted with the Man(l)y Facets of the Lesser Known Male Breast: Lessons Learned From a 10-year Institutional Look-Back

Station #9

Awards
Certificate of Merit

Participants
Nayanatara Swamy, MD , Little Rock, AR (*Presenter*) Nothing to Disclose
Gwendolyn M. Bryant-Smith, MD, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

nswamy@uams.edu

TEACHING POINTS

1. The fundamental anatomical differences between the male and female breast helps us understand the vast difference in

epidemiology of male and female breast diseases, including breast cancer. Accordingly, breast imaging guidelines are different in men and women. 2.We used our institutional experience over the past decade to understand our regional male breast epidemiology. a. The most common finding in male diagnostic mammograms is gynecomastia. Hence, familiarity with the wide spectrum of gynecomastia appearances on mammography is crucial. b. Male patients are less likely to return for short term follow-up imaging. A change in our approach to male patients is necessary to improve their compliance.

TABLE OF CONTENTS/OUTLINE

1. Differences between male and female breast: - Anatomical differences. - The transgender breast. - How do male breast diseases differ from female breast diseases? - How does male breast cancer differ from female breast cancer? - Difference in screening guidelines for men and women. - Difference in ACR appropriateness criteria for an indeterminate palpable breast mass in males compared to females. - Is Imaging utilization different in male versus female patients? 2. Our Institutional 10 year results. 3. Lessons learned. 4. Conclusion.

BR195-ED-TUB10 The 123's of Breast Cancer Staging

Station #10

Participants
Tirth V. Patel, MD, Chapel Hill, NC (*Presenter*) Nothing to Disclose
Marie Vogel, BS, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Sheila S. Lee, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Sheryl G. Jordan, MD, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The purposes of this exhibit are to: 1. Educate radiologists on the American Joint Committee on Cancer (AJCC) eighth edition staging manual, the newly published (2018) prognostic stage for breast cancer 2. Review relevant breast and locoregional lymph node anatomy 3. Present breast cancer survival statistics by stage 4. Identify key imaging findings for radiologists to assure accurate breast cancer staging

TABLE OF CONTENTS/OUTLINE

1. Introduction with relevant anatomy and survival statistics on breast cancer 2. Outline the AJCC 8th edition breast cancer staging system and define the TNM (Tumor, Nodes, Metastasis) system 3. Case-based illustration of each breast cancer stage 4. Short video animation teaching tool highlighting key teaching points

BR196-ED-TUB11 The Future Breast Imager: Understanding the Clinician's Perspective

Station #11

Awards
Certificate of Merit

Participants
Hyung Won Choi, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Irene S. Tsai, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Bo Li, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

As there is increasing advocacy for a multidisciplinary approach to provide higher quality of patient care, it is becoming more pertinent for the radiologist to have an adequate understanding of current breast cancer treatment. The ideal breast radiologist will be able to identify salient imaging findings that change clinical management. After reviewing this presentation, participants will be familiar with: 1. Indications for surgical, radiation, and systemic treatment of breast cancer 2. Imaging findings that change the surgeon, radiation oncologist, or oncologist's treatment plan.

TABLE OF CONTENTS/OUTLINE

1. Surgical management A. Indications for mastectomy versus lumpectomy with example cases B. Types of mastectomy: Radical, modified radical, simple, and nipple sparing mastectomy C. Indications for full axillary dissection versus sentinel lymph node biopsy 2. Radiation treatment A. Indications for radiation treatment with example cases B. Types of radiation treatment: Whole breast versus partial breast irradiation 3. Systemic therapy A. Indications for neoadjuvant and adjuvant chemotherapy with example cases B. Different types of systemic therapy - chemotherapy, hormonal blockade, and biologic therapies

BR197-ED-TUB12 The Dark Side of the Post-Surgical Breast: Recurrence in Breast Cancer Follow-Up Care

Station #12

Participants
Pedro Henrique Hasimoto e Souza, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Tatiana C. Tucunduva, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Juliana H. Catani, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Barbara H. Bresciani, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Carlos Shimizu, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Nestor Barros, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Prepare the radiologist to face common and uncommon presentations of recurrence in breast imaging; Exhibit clinical cases from our radiology department, with breast malignant imaging findings in the post-surgical follow-up care, showing its pathologic correlation;

Discuss the effects of manipulation on breast cancer detection; Provide management recommendations.

TABLE OF CONTENTS/OUTLINE

Brief discussion on post-treatment follow-up care in breast cancer; Risk factors and incidence of recurrence; Imaging features (mammography, ultrasound, computerized tomography and magnetic resonance imaging) of recurrence in post-treatment breast imaging, with their pathologic correlation; Describe alarming signs that should raise suspicion for malignancy; Review differential diagnosis for recurrent breast cancer; Management recommendations.

VW64

Hologic's Biopsy Solutions Portfolio - A Clinical Perspective: Hologic Vendor Workshop

Tuesday, Nov. 27 1:00PM - 2:00PM Room: Booth 5524

Participants
Harriet B. Borofsky, MD, San Mateo, CA (*Presenter*)

Program Information

Experience Hologic's portfolio of breast biopsy products to meet your full biopsy suite needs under the guidance of an experienced radiologists and clinical education specialists. Affirm® Breast Biopsy Guidance System, Affirm® Prone Biopsy System, Brevera® Breast Biopsy System and Viera™ Portable Breast Ultrasound)

Registration

https://hologicrsna.com

VW39

Automated Breast Volume Scanner (ABVS) Physician Training Workshop: An Interactive Learning Experience: Siemens Healthineers Vendor Workshop

Tuesday, Nov. 27 1:05PM - 2:15PM Room: Booth 5530

Participants

Ingolf Karst, MD, Chicago, IL (*Presenter*) Nothing to Disclose

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 unique coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

ML36

Machine Learning Theater: How AI Can Improve Diagnostic Performance and Reduce Reading Time in Breast Tomosynthesis: Presented by iCAD

Tuesday, Nov. 27 1:30PM - 1:50PM Room: Machine Learning Showcase North Hall

Participants

Senthil Periaswamy, PhD, Nashua, NH (*Presenter*) Vice President, iCAD, Inc

Program Information

iCAD will share how its innovative breast health AI solution, built on the latest deep learning technology, improves breast cancer detection, reduces recalls and improves reading efficiency for digital breast tomosynthesis.

VW12

Are We Ready For Automated Breast Ultrasound (ABUS) Coronal View?: GE Vendor Workshop

Tuesday, Nov. 27 2:00PM - 2:30PM Room: Booth 8156

Participants

Simone Schiaffino, MD, Bogliasco, Italy (*Presenter*) Nothing to Disclose

Program Information

In this presentation, Dr. Schiaffino will discuss his study of 188 patients with dense breast, aimed to evaluate the value of automated breast ultrasound (ABUS) reconstructed coronal view, comparing diagnostic performance and reading times to the complete multiplanar assessment. *Registration is required; adding this session to the RSNA calendar tool alone does not secure your seat in this session. Click the link below to register.*

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2018-/agenda-e57e0b47e9aa4f5ba89b1a0da1e829b9.aspx

VW40

AI-based Mammography Reading: Hands-on session: Siemens Healthineers Vendor Workshop

Tuesday, Nov. 27 2:30PM - 3:40PM Room: Booth 5530

Participants

Nico Karssemeijer, PhD, Nijmegen, Netherlands (*Presenter*) Director and Shareholder, ScreenPoint Medical BV Shareholder, Volpara Health Technologies Limited Consultant, QView Medical, Inc Shareholder, QView Medical, Inc

Program Information

You will learn about the use of the AI-supported Transpara™* system from Screenpoint in combination with syngo® Breast Care to support 2D or 3D mammography reading. Transpara™ provides detection and decision support together with an overall exam based score for prioritization of reading. You will experience a case review session to explore the use of artificial intelligence in mammography reading. *Transpara™ is pending 510(k) clearance, and is not yet commercially available in the United States

VW65

Improving Tomosynthesis Read-times, While Maintaining Clinical Performance: Hologic Vendor Workshop

Tuesday, Nov. 27 2:30PM - 3:30PM Room: Booth 5524

Program Information

Discussion and case review focuses on Hologic's new innovations to improve workflow efficiency, without sacrificing clinical outcomes. (3D Mammography™ Technology, Clarity HD, Smart Mapping, SecurView® Workstations)

Registration

https://hologicrsna.com

SSJ01

Breast Imaging (Monitoring Response to Treatment)

Tuesday, Nov. 27 3:00PM - 4:00PM Room: E450A

BQ BR MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Wendy B. Demartini, MD, Stanford, CA (*Moderator*) Nothing to Disclose
Constance D. Lehman, MD,PhD, Boston, MA (*Moderator*) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company

Sub-Events

SSJ01-01 Complete Response on MR Imaging After Neoadjuvant Chemotherapy in Breast Cancer Patients: Factors of Radiologic-Pathologic Discordance

Tuesday, Nov. 27 3:00PM - 3:10PM Room: E450A

Participants
Jinyoung Chang, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Woo Jung Choi, 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
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
Eun Young Chae, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ga Young Yoon, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

PURPOSE

Although MR imaging may show radiologic complete response (rCR) after neoadjuvant chemotherapy (NAC), there may be discordance between the MR imaging and pathology. The purpose of this study was to evaluate the radiologic and clinicopathologic factors of discordance between rCR and pathologic complete response (pCR) after NAC in breast cancer patients, and to determine whether there are differences among molecular subtypes.

METHOD AND MATERIALS

Our institutional review board approved this retrospective study. We evaluated 209 consecutive patients who showed rCR in MR imaging after NAC between January 2013 and December 2015. All patients had mammography, ultrasound and MR imaging before and after completion of NAC prior to definitive surgery. rCR was diagnosed when no enhancement or faint enhancement was shown in the previous lesion site equal to that of the background normal breast tissue. pCR was defined as the complete absence of both invasive cancer and ductal carcinoma in situ in the breast on the surgical histopathological examination. Clinicopathologic and initial radiologic findings were assessed and factors affecting the radiologic-pathologic discordance were analyzed.

RESULTS

One hundred eight patients (51.7%) showed pCR and 101 (48.3%) had residual lesion on surgical histopathology. The false negative findings were significantly more frequent in luminal A and B subtype (67.3%, 68/101), with radiologic findings such as larger tumor size ($p = 0.048$) in mammography, irregular shape ($p = 0.021$), high proportion of persistent component ($p = 0.008$), and low proportion of washout component ($p = 0.001$). On multivariate analysis of radiologic findings in all patients to predict residual lesion, calcification in mammography ($p = 0.037$), multifocal lesion ($p = 0.004$), and nonmass enhancement in MR ($p = 0.023$) were significantly associated with residual lesion.

CONCLUSION

Luminal subtype has a significant high false negative rate who achieved rCR after NAC. Patients with calcification in mammography, multifocal lesion, and nonmass enhancement in initial MR imaging are significantly associated with residual lesion.

CLINICAL RELEVANCE/APPLICATION

Although MR imaging showed rCR after NAC, multifocal breast cancer with calcification and nonmass enhancement, residual lesions should be considered and may impact surgical planning.

SSJ01-02 How Should a Radiologist Diagnose a Complete Imaging Response on Breast MRI after Neoadjuvant Chemotherapy?

Tuesday, Nov. 27 3:10PM - 3:20PM Room: E450A

Participants
Shreena Shah, MD, New York, NY (*Presenter*) Nothing to Disclose
Mary C. Hughes, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Natsuko Onishi, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Junting Zheng, New York, NY (*Abstract Co-Author*) Nothing to Disclose

Marinela Capanu, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Elizabeth A. Morris, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Elizabeth J. Sutton, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

There is no standard definition regarding what constitutes a complete imaging response (CIR) on breast MRI post-neoadjuvant chemotherapy (NAC). The purpose is to evaluate the accuracy of a CIR defined as no residual enhancement in the tumor bed post-NAC in diagnosing a pathologic complete response (pCR).

METHOD AND MATERIALS

The IRB approved this HIPAA-compliant retrospective study and waived informed consent. Women were identified with biopsy proven invasive breast cancer who underwent: a) NAC, b) pre and post-NAC MRI and c) surgery between 2014-2016. CIR was defined as no residual enhancement on any of the three post-contrast phases on post-NAC MRI. Two breast radiologists (R1 and R2) independently reviewed all pre and post-NAC MRI blinded to pathology. pCR was defined as no residual invasive or in situ carcinoma. Measures of accuracy, including sensitivity, specificity, negative predictive value (NPV) and positive predictive value (PPV) were estimated using no enhancement on MRI to diagnose pCR. Kappa statistic was used to assess agreement between readers.

RESULTS

275 women were included with 280 breast cancers (n=5, 1.8% had bilateral cancers). Of the 280 breast cancers, 256 (91.4%) were invasive ductal carcinoma, 11 (3.9%) were invasive lobular carcinoma and 13 (4.7%) were other invasive carcinoma. 74 (26.4%) had a pCR and 186 (66.4%) had no pCR. The two readers had substantial agreement on enhancement (kappa=0.627, 87.5% concordant readings). Sensitivity was 40.5%(R1)/50.0%(R2), specificity was 87.9% (R1)/86.9%(R2), PPV was 54.5% (R1)/57.8% and NPV was 80.4%(R1)/82.9(R2). These measures of accuracy were not significantly different between different subtypes defined as: ERPR+HER2-(n=99), ERPR+HER2+(n=61), ERPR+HER2equiv (n=1), ERPR-HER2+(n=44) and ERPR-HER2- (n=75).

CONCLUSION

CIR defined as no residual enhancement in the tumor bed on post-NAC breast MRI is not sensitive in diagnosing a pCR. Residual enhancement can be seen with a pCR and a better definition of what constitutes a CIR is needed; our results suggest that it should include some degree of low-level tumor bed enhancement.

CLINICAL RELEVANCE/APPLICATION

Complete imaging response defined as no residual enhancement in the tumor bed is not an accurate assessment of pathologic complete response, which radiologists need to be aware of as management decisions based upon post-NAC MRI interpretation can impact the decision to perform breast conservation versus mastectomy.

SSJ01-03 Predicting Axillary Response to Neoadjuvant Chemotherapy Using Breast MRI and US Based Model in Patients with Clinically Node-Positive Breast Cancer

Tuesday, Nov. 27 3:20PM - 3:30PM Room: E450A

Participants
Jung Min Chang, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, General Electric Company
Rihyeon Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Soo-Yeon Kim, 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

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PURPOSE

The axillary LN pathologic complete response (pCR) is increasingly common after neoadjuvant chemotherapy (NAC) in breast cancer patients, for whom axillary LN dissection may be spared. The aim of our study was to develop a clinical model including MRI and US to better predict axillary pCR after NAC in clinically node-positive breast cancer patients.

METHOD AND MATERIALS

An IRB-approved retrospective review was performed for 172 consecutive clinically node-positive breast cancer patients who were treated with NAC and following surgery at our institution from 2016 to 2017. All the patients underwent breast MRI and US, before and after completion of NAC to evaluate the primary tumor extent and axillary LN status. The multivariate logistic regression analysis determined independent predictors of axillary pCR. With combination of those variables we developed a predictive model to increase axillary pCR rate.

RESULTS

Among 172 patients the overall axillary pCR rate was 59%, with 75% (46/61) and 42% (30/71) in cN1 and cN2 patients, respectively. Pretreatment characteristics of clinical N stage, axillary lymphadenopathy and tumor subtype were correlated with axillary pCR (all, $p<0.05$). Post-NAC imaging features including mean tumor size, the size change rate on MRI and the axillary LN cortical thickness on US were predictors of axillary pCR (all, $p<0.05$). From the multivariate logistic regression analysis, independent variables were clinical N stage, tumor subtype, tumor size change rate on MRI and axillary lymphadenopathy on post-NAC US, with an AUC of 0.884 (all, $p<0.05$). The axillary pCR rate of cN1 and non-luminal A model was 88% (38/43) and addition of absent axillary lymphadenopathy improved pCR rate to 94% (33/35). In cN2 patients, the axillary pCR rate of non-luminal A and no axillary lymphadenopathy model increased from 70% (24/34) to 91% (10/11) with additional condition of more than 80% size decrease on MRI.

CONCLUSION

Clinical N stage, tumor subtype and MRI/US findings were predictors of axillary LN pCR. Our predictive model including clinico-pathologic features and image findings could achieve high axillary pCR rate, which may guide LN dissection planning after NAC in clinically node-positive breast cancer patients.

CLINICAL RELEVANCE/APPLICATION

Our imaging based predictive model can improve risk stratification which may avoid unnecessary axillary LN dissection in clinically node-positive breast cancer patients after NAC.

SSJ01-04 Texture Analysis of Lymph Node MRI Characteristics Improves Prediction of Progression-Free Survival Following Chemotherapy in Breast Cancer

Tuesday, Nov. 27 3:30PM - 3:40PM Room: E450A

Participants
Renee Cattell, BA, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Haifang Li, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
James J. Kang, BA, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Pauline B. Huang, Douglaston, NY (*Abstract Co-Author*) Nothing to Disclose
Thomas Ren, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Jules A. Cohen, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Paul R. Fisher, MD, East Setauket, NY (*Abstract Co-Author*) Research Grant, Siemens AG;
Cliff Bernstein, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Sean Clouston, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Tim Duong, PhD, Stony Brook, NY (*Presenter*) Nothing to Disclose

PURPOSE

Pathological complete response and reduction in lesion volume (LV) after chemotherapy do not guarantee progression-free survival (PFS). About 1/3 of patients with pathological complete response had relapse at 5 years in our cohort. Breast cancer metastasizes through the lymphatic system. Axillary lymph node (LN) is clinically evaluated by palpation and using ultrasound. This study investigated the efficacy the texture analysis of the LN MRI in predicting PFS.

METHOD AND MATERIALS

Data were obtained from I-SPY 1 trial of breast cancer patients undergoing chemotherapy. We extracted 48 textures for pre- (T1), early- (T2), during (T3) and post-chemo (T4) time points for a subset of patients (N=41) in whom LN MRI were usable. Area under the receiver-operating curve (AUC) was calculated, with PFS at 5-year as a reference variable. Multivariable generalized linear modeling was used to estimate model fit and assign a risk score at each time point based on top-ranking features.

RESULTS

For early (T1) in treatment, LV along with LN histogram skewness and grey-level run length matrix long-run emphasis were top predictors of PFS (AUC=0.68). LV became less predictive in later time points. LN features surpassed LV in post-chemo (T4) time point; the top features were neighborhood grey-level matrix coarseness and grey-level zone length matrix zone length non-uniformity. When changes in texture features over time were analyzed, LN features outperformed LV. Top early (T2-T1) predictors were change in compacity, gray-level non-uniformity, and volume of the LN. Top late (T4-T1) predictors were change in zone length non-uniformity and coarseness. The combination of risk scores across all time points resulted in a model with an AUC of 0.89 (sensitivity:91%, specificity:95%, p= 0.004).

CONCLUSION

Texture analysis of lymph node MRI improves prediction of PFS. The multivariable risk prediction model identified key characteristics and could provide strong predictors of relapse.

CLINICAL RELEVANCE/APPLICATION

Texture analysis of axillary lymph node MRI has the potential to accurately predict 5-year progression free survival.

SSJ01-05 Breast 3D Magnetic Resonance Fingerprinting Relaxometry: Utility in Measuring Early Response to Neo-Adjuvant Chemotherapy in Breast Cancer

Tuesday, Nov. 27 3:40PM - 3:50PM Room: E450A

Participants
Ananya Panda, MD,MBBS, Rochester, MN (*Presenter*) Support, Siemens AG
Yong Chen, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Verena Obmann, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Satyam Ghodasara, MD, Cleveland, OH (*Abstract Co-Author*) Research support, Siemens AG
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Robert Shenk, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
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Nicole Seiberlich, PhD, Cleveland, OH (*Abstract Co-Author*) Research Grant, Siemens AG
Mark A. Griswold, PhD, Cleveland, OH (*Abstract Co-Author*) Research support, Siemens AG Royalties, Siemens AG Royalties, General Electric Company Royalties, Bruker Corporation Contract, Siemens AG
Donna M. Plecha, MD, Strongsville, OH (*Abstract Co-Author*) Research Grant, Hologic, Inc
Vikas Gulani, MD, PhD, Cleveland, OH (*Abstract Co-Author*) Research support, Siemens AG; Licensed Technology, Siemens Healthineers - both myself and my spouse. MR Fingerprinting, on which we are both inventors, has been licensed by Siemens.

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PURPOSE

To assess (1) Repeatability of breast 3D MRF-based relaxometry and (2) preliminarily assess utility in measuring early response to neo-adjuvant chemotherapy in breast cancer

METHOD AND MATERIALS

In this IRB approved pilot study,12 healthy pre-menopausal volunteers were scanned with 3D MRF twice within 7-15 days for repeatability analysis.In 5 volunteers,same-day test-retest scans were also performed with repositioning after a 10-minute scan interval.For breast cancer evaluation,13 women with biopsy-proven invasive ductal carcinoma underwent baseline 3D MRF scans before chemotherapy.So far,7 women have undergone repeat 3D MRF 7-10 days after first cycle of chemotherapy.All scans were performed at 3T(Siemens Verio) using 8-channel breast coil.A 3D FISP-based MRF sequence with fat suppression was used.Overall acquisition time was 5.5min.For repeatability analysis,ROIs were drawn on a 3D MRF partition containing the largest area of normal breast tissue by one radiologist(8 years radiology experience) in both breasts.In breast cancer patients,ROIs were drawn on partitions showing tumor and the opposite normal breast.Mean T1 & T2 were estimated for all scans.Treatment response was based on either final pathology staging after surgery or RECIST criteria and T1 & T2 changes were compared in responders & non-responders

RESULTS

Same-visit test-retest within-subject coefficient of variation(wCV) was <5% for T1 and <6.5% for T2.Two-visit wCV was <6% for T1 and <5% for T2,establishing a measurable effect size.In breast cancer,tumor T1 & T2 were longer than normal breast(mean±SD,Tumor T1:1175±203 ms,Normal T1:846±388 ms,Tumor T2:72±13 ms,Normal T2:48±12 ms,p=0.030 for T1,p<0.001 for T2).After one cycle of chemotherapy,responders(n=4) showed greater decrease in T1 & T2(p=0.026 for T1,p=0.033 for T2) while patients with stable/progressive disease(n=3) showed negligible changes in T1 & T2

CONCLUSION

Breast 3D MRF relaxometry was shown to be repeatable.Baseline tumor T1 & T2 were longer than normal breast.Treatment responders showed larger change in T1 & T2 compared to non-responders.These preliminary results suggest that breast 3D MRF may be useful in quantitatively predicting early response to chemotherapy

CLINICAL RELEVANCE/APPLICATION

Breast 3D MRF relaxometry is a repeatable technique for longitudinal studies in patients.Significant decrease in tumor T1 and T2 after one cycle of chemotherapy may predict treatment response

SSJ01-06 Are the Baseline Imaging Characteristics of Breast Cancer Associated With Reponses to Neoadjuvant Chemotherapy?

Tuesday, Nov. 27 3:50PM - 4:00PM Room: E450A

Participants
Andrew Evans, MRCP, FRCR, Dundee, United Kingdom (*Presenter*) Nothing to Disclose
Colin Purdie, MBChB,PhD, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sarah Savaridas, FRCR,MBChB, Hexham, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Yee Ting Sim, MBBCh, FRCR, 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

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PURPOSE

Predictors of response to neoadjuvant chemotherapy (NACT) within subgroups are poor and not commonly used. We aimed to establish if baseline mammographic (MGM) and ultrasound (US) features of breast cancer and breast cancer subtypes are associated with rates of pathological complete response (pCR) after NACT.

METHOD AND MATERIALS

The baseline imaging of 210 consecutive women who underwent NACT were reviewed by an experienced breast radiologist blinded to outcomes. The MGM features assessed were the presence or absence of spiculation and calcification. The US features documented were echogenicity, distal effect, the presence of a circumscribed border and the US lesion size. The relationships between baseline imaging features and pCR after NACT were documented. The findings according to sub-group (HER2+ve, triple negative and ER+ve HER2-ve) were also assessed. The significance of differences were analysed using the chi-square test and ROC curves.

RESULTS

Of the 210 patients, 46(22%) had a pCR while 164 did not. The cohort consisted of women with 82 triple negative (21 pCR's), 75 HER2+ve (21 pCR's) and 53 ER+ve HER2-ve (4 pCR's) cancers. For the complete cohort the features significantly associated with pCR were the absence of MGM spiculation (4 of 58 (7%) vs. 42 of 151(28%), p=0.001), the absence of distal shadowing on US (8 of 73(11%) vs. 38 of 136(28%), p=0.015) and small US size (AUC 0.62, P=0.02). In HER2+ve patients all the above associations were confirmed and in addition the presence of a circumscribed border on US was associated with high pCR rates (7 of 14(50%) vs. 14 of 60(23%), p=0.04). None of the above associations held true for triple negative cancers. The number of pCR's in the ER+HER2-ve group was to small to allow analysis.

CONCLUSION

The baseline imaging features of HER2+ve breast cancer are strongly associated with the chance of achieving a pCR following NACT. This is not so for triple negative cancers.

CLINICAL RELEVANCE/APPLICATION

This data could be helpful when discussing NACT and associated surgery with patients who have HER+ve breast cancer.

SSJ02

Breast Imaging (US Advanced Applications)

Tuesday, Nov. 27 3:00PM - 4:00PM Room: E353C

BR MR MI US

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Jung Min Chang, MD, Seoul, Korea, Republic Of (*Moderator*) Research Grant, General Electric Company
Wei T. Yang, MD, Houston, TX (*Moderator*) Consultant, General Electric Company; Medical Advisory Board, Seno Medical Instruments, Inc

Sub-Events

SSJ02-01 Can Baseline Ultrasound and Mammographic Features Help Predict Metastasis Free Survival in Patients Receiving Neoadjuvant Chemotherapy?

Tuesday, Nov. 27 3:00PM - 3:10PM Room: E353C

Participants
Sarah Savaridas, FRCR,MBChB, Hexham, United Kingdom (*Presenter*) Nothing to Disclose
Sarah J. Vinnicombe, MRCP, FRCR, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Colin Purdie, MBChB,PhD, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To determine if baseline mammographic and ultrasound features in patients receiving neoadjuvant chemotherapy (NACT) are associated with metastasis free survival (MFS).

METHOD AND MATERIALS

Informed consent for the study was obtained from consecutive women receiving NACT. All participants were metastasis free at diagnosis. Baseline images were retrospectively reviewed by a breast radiologist blinded to outcomes. Ultrasound (US) features documented included echo pattern, posterior effect, circumscribed margins, skin changes (invasion or thickening), lesion size and shear wave stiffness (mean). Mammogram (MMG) features documented were the presence or absence of spiculation and microcalcification. Tumour immunophenotype was assessed on core biopsy. Statistical significance was assessed using chi-square and ROC analysis.

RESULTS

134 breast patients were included; 52 had triple negative cancer, 48 were HER2+ve and 34 had ER+ve, HER2-ve disease. During the follow-up period (mean 4.3yrs) 41 women (31%) developed metastases. Across the whole cohort, skin involvement on baseline US was the only feature associated with metastasis development. MFS was 56% (23/41) vs 75% (70/93) for those with and without skin involvement respectively, p=0.03. US lesion size was not associated with MFS.In the HER2 positive subgroup mammographic calcification was associated with poorer MFS (12/24 (50%) vs 20/23 (87%), p=0.006). The presence of posterior shadowing on US was also associated with poorer MFS (11/22 (50%) vs 21/26 (81%), p=0.02) in this subgroup.No baseline imaging features were shown to be associated with MFS for triple negative and ER+ve HER-ve cancers.

CONCLUSION

We have demonstrated that baseline imaging characteristics are associated with MFS in patients treated with NACT particularly in the HER2 +ve subgroup. This prognostic information, which is available prior to treatment could aid patient treatment selection and counselling.

CLINICAL RELEVANCE/APPLICATION

Baseline imaging characteristics are associated with MFS in patients treated with NACT. This prognostic information, available prior to treatment, may aid patient treatment selection and counselling.

SSJ02-02 Combination of Different Types of Elastography in Downgrading Ultrasound Breast Imaging-Reporting and Data System Category 4a Breast Lesions

Tuesday, Nov. 27 3:10PM - 3:20PM Room: E353C

Participants
Xueyi Zheng, Guangzhou, China (*Presenter*) Nothing to Disclose
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PURPOSE

When using single type of elastography to downgrade ultrasound (US) Breast Imaging-Reporting and Data System (BI-RADS) category 4a lesions, some cancers would be missed. This study purposed to determine whether combination of different types of elastography could improve the accuracy of elastography aided downgrading BI-RADS category 4a lesions and reduce unnecessary biopsies.

METHOD AND MATERIALS

For this prospective institutional review board-approved study, verbal informed consent was obtained from all patients. From January 2016 to February 2018, 329 consecutive women with 347 US BI-RADS category 4a breast lesions were enrolled in the study. These lesions, prior to biopsy, were subject to conventional US supplemented by elastography assessments, including strain elastography of elasticity imaging (EI), virtual touch tissue imaging (VTI) and Virtual Touch IQ (VTIQ). The diagnostic performances were calculated for BI-RADS category, EI, VTI and VTIQ, and the combination among EI, VTI and VTIQ (combined EI and VTI [EI+VTI], combined EI and VTIQ [EI+VTIQ] and combined VTI and VTIQ [VTI+VTIQ]).

RESULTS

Pathologically, 313 lesions (90.2%) were benign and 34 (9.8%) were malignant. The cut-off values were EI score>3, VTI score>3 and shear wave speed (SWS) on VTIQ>3.29 m/s, respectively. For EI, VTI and VTIQ alone, the specificity were significantly higher than that of BI-RADS (P <0.001), while the sensitivity were significantly lower than that of BI-RADS (76.5%, 70.6%, 67.6% vs. 100%, respectively, P <0.05). Among the combinations of different types of elastography, EI+VTI yielded the highest AUROC of 0.800 and negative predictive value of 99.5%. The sensitivity of EI+VTI was significantly increased as compared with single type elastography (P <0.05). There was no significant difference in the sensitivity between EI+VTI and BI-RADS (97.1% vs 100%, P =1.000) while the specificity was significantly higher than that of BI-RADS (P <0.001). When using EI+VTI to downgrade the lesions, 57.1% of the lesions would be downgraded and 99.5% of these lesions were benign.

CONCLUSION

Combinations of EI and VTI to downgrade BI-RADS category 4a lesions increased the sensitivity and reduced the misdiagnosis of breast cancers.

CLINICAL RELEVANCE/APPLICATION

Combination of different types of elastography provides a high sensitive way to downgrade BI-RADS category 4a lesions, potentially applied in clinical practice without increasing misdiagnosed cancers.

SSJ02-03 Correlation Between Apparent Diffusion Coefficient Values and Ultrasound Elasticity kPa Values in Breast Cancers

Tuesday, Nov. 27 3:20PM - 3:30PM Room: E353C

Participants
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Inyoung Youn, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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Juhee Moon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

DWI reflects tumor cellularity and integrity of cell membranes. Breast ultrasound elastography is a method of imaging tissue stiffness and the shear-wave elastography (SWE) allows measurement of the propagation speed of shear waves within the tissue to locally quantify its stiffness in kilopascals (kPa) or meters per second (m/sec). This study was performed to evaluate the correlation between breast apparent diffusion coefficient (ADC) values and ultrasound Shear wave elastography kPa values in biopsy proven breast cancers.

METHOD AND MATERIALS

From January 2016 to November 2017, 121 patients who have breast cancer confirmed by US-guided biopsy underwent both pre-operative breast diffusion MRI and breast SWE. Among these patients we included only who underwent examination by same operator to reduce inter-operator variability. Finally, this study included 94 breast cancer patients. The investigated factors included the ADC values, mean kPa values (Emean), maximum kPa values (Emax), pathology, size of tumor, associated calcifications, ER/PR/HER2 status, molecular subtypes, Ki-67 index, mammographic density and BI-RADS US assessment category. The results were analyzed using the statistical software SPSS for Windows (version 24). The correlation analysis was used to study correlation between ADC values, Emean/Emax, size and Ki-67. And independent samples of t-test and ANOVA including post hoc test were performed to evaluate for the above variables.

RESULTS

There was no correlation between ADC values and Emean (p=0.791)/Emax (p=0.634)[Fig1]. However, Emean (p=0.001), Emax (p<0.001), and Ki-67 index value (p=0.010) were significantly correlated with the size of tumor. High Ki-67 index group showed statistically significant lower ADC values (p=0.034) and higher Emean (p=0.064)/Emax value (p=0.065) without statistical insignificance. The Emean (p=0.002)/Emax (p=0.001) were correlation with T stage but ADC (p=0.813) was not. Howevre, the

Eman (p=0.000)/Emax (p=0.000) and ADC (p=0.017) were also correlated with US BIRADS categories.

CONCLUSION

The ADC values and Emean/Emax in breast cancers were nor correlated each other. However, the size of tumor, Ki67 index, BI-RADS assessment category affected the ADC and Emean/Emax values independently.

CLINICAL RELEVANCE/APPLICATION

The size of breast cancer, Ki67 index, BI-RADS assessment category affected the ADC and Emean/Emax values independently.

SSJ02-04 Breast Cancer Staging: Combined Digital Breast Tomosynthesis and Automated Breast Ultrasound versus Magnetic Resonance Imaging

Tuesday, Nov. 27 3:30PM - 3:40PM Room: E353C

Participants
Rossano Girometti, MD, Udine, Italy (*Presenter*) Nothing to Disclose
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Lorenzo Cereser, MD, Udine, Italy (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To investigate whether combined Digital breast tomosynthesis and Automated breast volume scanner (DBT-ABVS) are comparable to Magnetic resonance imaging (MRI) in staging breast cancer.

METHOD AND MATERIALS

We retrospectively included seventy-three patients with histologically proven breast cancer who underwent preoperative DBT, ABVS and 1.5T MRI in the period July 2015-July 2016. Two radiologists in consensus recorded the number, site and BI-RADS category of breast findings during two independent reading strategies, i.e. DBT-ABVS vs. MRI. Using histology or 1-year follow up as the standard of reference, we calculated the accuracy for cancer of both imaging strategies. Bland-Altman analysis was used to evaluate the agreement between MRI vs. DBT or ABVS in cancer size assessment.

RESULTS

Patients showed a total of 160 lesions (108 malignant and 52 benign). Malignant lesions were monofocal, multifocal, multicentric and biltateral in 53, 15, 4 and 1 cases, respectively. Diagnostic accuracy of DBT-ABVS vs. MRI was comparable for all cancers (90.0% vs. 93.8%, respectively), though DBT-ABVS showed lower sensitivity and positive predictive values for additional disease (76.5% vs. 91.7%, and 78.8% vs 93.4%, respectively). Compared to MRI, ABVS+DBT missed 6 lesions, including two invasive cancers and one extensive intravascular invasion associated to ductal carcinoma in situ. Bland-Altman analysis showed ABVS to agree with MRI at a higher extent than DBT in assessing cancer size.

CONCLUSION

DBT-ABVS is less accurate than MRI in staging additional disease.

CLINICAL RELEVANCE/APPLICATION

Though less performing than MRI, DBT-ABVS showed acceptable diagnostic accuracy in staging breast cancer. This strategy might be used if MRI is unavailable or unfeasible.

SSJ02-05 Quantitative Elastic Heterogeneity as a Potential Noninvasive Marker of Lymphovascular Invasion in Breast Cancer

Tuesday, Nov. 27 3:40PM - 3:50PM Room: E353C

Participants
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PURPOSE

To evaluate the association between quantitative elastic heterogeneity (EH) and lymphovascular invasion (LVI) in breast cancers.

METHOD AND MATERIALS

This retrospective study consisted of 97 patients with breast cancers that had undergone shear wave elastography (SWE) with virtual touch tissue imaging quantification (VTIQ) between August 2015 and August 2017. Three region of interests (ROIs) were placed over the highest stiffness and the lowest stiffness areas of each lesion to measure shear wave velocity (SWV) and EH was determined as the difference between the averaged highest SWV and lowest SWV. Classical prognostic factors including lesion size,

histopathological type and grade, subtype [luminal A, luminal B (HER2-), luminal B (HER2+), HER2 enriched and basal-like], and axillary lymph node (LN) status were reviewed and their correlation with EH values were stratified by the presence or absence of LVI. The diagnostic performance of EH in distinguishing LVI or not were analyzed in lesions smaller than 2 cm.

RESULTS

Tumors with LVI showed significantly higher EH values when compared to tumors without LVI (adjusted $P < 0.001$), regardless of the tumor size, histological grade and type, and LN status. Lymphovascular invasion (adjusted $P < 0.001$), large tumor size (adjusted $P = 0.011$) and lymph node involvement (adjusted $P = 0.046$) showed statistically positive association with high EH values. In breast cancers smaller than 2 cm, tumors with LVI (4.31±1.16 m/s) showed significantly higher EH values when compared to tumors without LVI (2.99±1.18 m/s) (adjusted $P < 0.001$). Using EH higher than 3.66 m/s to suggest LVI, the area under the receiver operating characteristic curve was 0.796, and the sensitivity, specificity, positive predictive value and negative predictive value were 78 % (14/18), 75 % (39/52), 52 % (14/27) and 91 % (39/43), respectively.

CONCLUSION

EH could be served as a potential marker to assess LVI status on preoperative imaging, especially for breast cancer less than 2 cm in size.

CLINICAL RELEVANCE/APPLICATION

Quantitative elastic heterogeneity of breast cancer can be used as a non-invasive marker for preoperative evaluation of LVI, thereby guiding clinical regulation and predicting prognosis.

SSJ02-06 Multiparametric Quantitative Ultrasound of the Breast Can Improve the Diagnostic Performance of the Radiologist

Tuesday, Nov. 27 3:50PM - 4:00PM Room: E353C

Participants
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PURPOSE

To evaluate quantitative multiparametric ultrasound (mpUS) of the breast using B-mode US, elastography, Doppler and contrast enhanced US (CEUS) in different combinations of 2, 3 or 4 parameters for the differentiation of benign and malignant lesions and investigate a possible variation according to the degree of experience of the examiner.

METHOD AND MATERIALS

124 patients, each with one biopsy-proven, sonographically evident breast lesion were included in this prospective, IRB-approved study. Each lesion was examined with B-mode US, elastography (Virtual Touch IQ-VTIQ), Doppler US and CEUS. Different quantitative parameters were recorded for each modality: Shear Wave Velocity (SWV) for VTIQ, Pulsatility (PI) and Resistive Index (RI) for Doppler US. For CEUS, 11 different parameters were calculated using a dedicated software. 4 readers (2 experienced breast radiologists and 2 radiology residents) independently evaluated B-mode images of each lesion and assigned a BI-RADS score to it. Using ROC curve analysis, the quantitative parameter with the best diagnostic performance for each modality was chosen and cut-off values were calculated. Using these, all quantitative results were dichotomized. The BI-RADS scores of all readers were then combined with the quantitative parameters. Descriptive statistics were used to evaluate the diagnostic performance of mpUS. Histology served as the reference standard.

RESULTS

59 lesions were benign and 65 malignant. SWV, RI and mean transit time showed the highest diagnostic performance. MpUS with three parameters (B-mode, VTIQ and CEUS) showed the highest diagnostic performance irrespective of the experience level of the readers (averaged AUC 0.812 vs. 0.683 for B-mode US, p-value 0.0001), while the combination of B mode, VTIQ and Doppler US the second best (averaged AUC 0.789, p-value 0.0001). All other combinations (with 2, 3 or 4 parameters) showed a lower AUC. MpUS with B-mode, VTIQ and CEUS was able to significantly reduce the number of false positive biopsy recommendations ($p<0.0001$).

CONCLUSION

Quantitative breast mpUS with three parameters (B-mode US, VTIQ elastography and CEUS) significantly improves the diagnostic performance of B-mode US alone, irrespective of the experience level of the examiner.

CLINICAL RELEVANCE/APPLICATION

MpUS of the breast offers quantitative parameters that may be used as imaging biomarkers for the differentiation of benign from malignant breast lesions.

SSJ17

Science Session with Keynote: Nuclear Medicine (Chest/Breast Oncology Nuclear Imaging)

Tuesday, Nov. 27 3:00PM - 4:00PM Room: S504CD

BR CH CT MR NM OI

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Peter S. Conti, MD, PhD, Los Angeles, CA (*Moderator*) Nothing to Disclose
Andrew C. Homb, MD, Rochester, MN (*Moderator*) Nothing to Disclose

Sub-Events

SSJ17-01 Nuclear Medicine Keynote Speaker: Radiomics in Lung Cancer

Tuesday, Nov. 27 3:00PM - 3:10PM Room: S504CD

Participants
Lawrence H. Schwartz, MD, New York, NY (*Presenter*) Committee member, Celgene Corporation Committee member, Novartis AG Committee member, ICON plc Committee member, BioClinica, Inc

SSJ17-02 An Updated and Validated PET/CT Volumetric Prognostic Index for Non-Small Cell Lung Cancer

Tuesday, Nov. 27 3:10PM - 3:20PM Room: S504CD

Participants
Joshua H. Finkle, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Bill C. Penney, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Yonglin Pu, MD, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Whole-body metabolic tumor volume (MTVWB) and TNM staging are independent prognostic factors for overall survival (OS) in non-small cell lung cancer (NSCLC). We aimed to update and validate the PET/CT volumetric prognostic index (PVP index) using the new 8th edition TNM staging system to evaluate its prognostic power versus TNM staging and MTVWB alone.

METHOD AND MATERIALS

This study was a retrospective analysis of 949 non-small cell lung cancer (NSCLC) patients diagnosed between 2004 and 2014. Clinical TNM stage, MTVWB, age and gender, tumor histology type at the initial staging PET/CT exam, as well as treatment history and long-term survival data were obtained. Patients were randomly assigned to modeling or validation group. Univariate and multivariate Cox regression analyses were performed to compare PVP index, TNM stage, and MTVWB in the validation group.

RESULTS

The updated PVP index included the 3 variables TNM stage, and MTVWB and age. Univariate Cox models showed significant association of PVP index with overall survival (OS) in patients with NSCLC (with Hazard ratio HR= 2.88 in the validation group, $p<0.001$). The C-statistic of the PVP index (C-statistic = 0.71 in the validation group) was significantly greater than that of 8th edition TNM staging (C-statistic = 0.68, $p=0.029$), MTVWB (C-statistic = 0.68, $p=0.001$), and patient age (C-statistic = 0.53, $p<0.001$). Multivariate Cox regression analyses demonstrated significant association of PVP index with OS (with HR= 2.80, $p<0.001$) after adjusting patient's gender and tumor histology.

CONCLUSION

The updated PVP index provides a quantitative risk assessment for NSCLC patients using 8th edition TNM staging, MTVWB, and age. The index provides a simple and practical way for the care team to incorporate the independent prognostic value of both the TNM stage and MTVWB. This approach can further improve the accuracy of overall survival prognosis.

CLINICAL RELEVANCE/APPLICATION

The PVP index combines the prognostic power of the TNM stage, whole-body metabolic tumor volume and age, offering prognostic accuracy superior to whole-body metabolic tumor volume or TNM stage alone.

SSJ17-03 Prospective Comparison of 18F-FDG PET/MRI and 18F-FDG PET/CT for Thoracic Staging of Non-Small Cell Lung Cancer

Tuesday, Nov. 27 3:20PM - 3:30PM Room: S504CD

Participants
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Julian Kirchner, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
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Biosciences; Consultant, Ipsen SA; Consultant, Siemens AG; Research Grant, Advanced Accelerator Applications SA; Research Grant, Ipsen SA
Gerald Antoch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Heusch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic performance of 18F-FDG PET/MRI and 18F-FDG PET/CT for primary and locoregional lymph node staging in non-small cell lung cancer (NSCLC).

METHOD AND MATERIALS

In this prospective study a total of 84 patients (51 men, 33 women, mean age 62.5 ± 9.1 years) with histopathologically confirmed NSCLC underwent 18F-FDG PET/CT followed by 18F-FDG PET/MRI in a single injection protocol. Two readers independently assessed T and N staging in separate sessions according to the seventh edition of the American Joint Committee on Cancer staging manual for 18FFDG PET/CT and 18F-FDG PET/MRI, respectively. Histopathology as reference standard was available for N staging in all 84 patients and for T staging in 39 patients. Differences in staging accuracy were assessed by McNemars chi2 test. The maximum standardized uptake value (SUVmax) and longitudinal diameters of primary tumors were correlated using Pearson's coefficients.

RESULTS

T stage was categorized concordantly in 18F-FDG PET/MRI and 18F-FDG PET/CT in 38 of 39 (97.4%) patients. Herein, 18F-FDG PET/CT and 18F-FDG PET/MRI correctly determined the T-stage in 92.3% and 89.7% of patients, respectively. N-stage was categorized concordantly in 83 of 84 patients (98.8%). 18F-FDG PET/CT correctly determined the N stage in 78 of 84 patients (92.9%), while 18F-FDG PET/MRI correctly determined the N stage in 77 of 84 patients (91.7%). Differences between 18F-FDG PET/CT and 18F-FDG PET/MRI in T and N staging accuracy were not statistically significant ($p > 0.5$, each). Tumor size and SUVmax measurements derived from both imaging modalities exhibited excellent correlation ($r=0.963$ and $r=0.901$, respectively).

CONCLUSION

18F-FDG PET/MRI and 18F-FDG PET/CT showed an equivalently high diagnostic performance for T and N staging in patients suffering from NSCLC.

CLINICAL RELEVANCE/APPLICATION

PET/MRI as a dose-saving alternative to PET/CT proved coequal to the current gold standard for thoracic staging of NSCLC. Thus, clinicians might use PET/MRI instead of PET/CT for this purpose. However, considering the longer examination times and higher expenses of PET/MRI, a general recommendation in favor of PET/MRI cannot be drawn from this study.

SSJ17-04 The Relationship Between PET/CT Imaging Features and Pathological Types and Gene Mutations of Primary Lung Cancer: A Study of 213 Untreated Lung Cancer Patients with Bone Metastases

Tuesday, Nov. 27 3:30PM - 3:40PM Room: S504CD

Participants
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Ning Wu, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate the relationship between 18F-FDG PET/CT image characteristics and pathological types and gene mutations of primary lung cancer in untreated lung cancer patients with bone metastases.

METHOD AND MATERIALS

A total of 213 untreated lung cancer patients with bone metastases were enrolled in this study. All patients underwent 18F-FDG PET/CT examination, pathological and gene mutation examination of primary lung cancer. Spearman's correlation test was performed to evaluate the association between primary tumors and bone metastases. Single factor analysis of variance was used to compare groups.

RESULTS

(1)A total of 213 cases were evaluated. The mean SUVmax of primary lung cancer was 7.9±4.7; that of bone metastases was 8.2±4.3. The SUVmax of primary lesions had a significantly positive correlation with the SUVmax of bone metastases ($r = 0.622$; $p = 0.000$). Osteolytic metastasis was the most common type. (2)The SUVmax of primary lung lesions with different pathological types were statistically different (all $P = 0.000$): squamous cell carcinoma > small cell carcinoma > adenocarcinoma. Their SUVmax were 11.7±3.7, 9.3±3.1, and 6.7±4.6, respectively. (3)In non-small cell lung cancer (NSCLC), the gene mutation rates of epidermal growth factor receptor (EGFR), K-ras and anaplastic lymphoma kinase (ALK) were 35.7%, 10.1% and 3.8%, respectively. There was no statistical difference in SUV*max* of primary lung cancer between gene mutation type and wild type ($P>0.05$).

CONCLUSION

The SUVmax of primary lung lesions with different pathological types were statistically different. Squamous cell carcinoma was the highest, and adenocarcinoma was the lowest. The SUVmax of primary lung cancer had a significantly positive correlation with the SUVmax of bone metastases. In NSCLC, the mutation rate of EGFR is the highest. There was no statistical difference in SUVmax of primary lung cancer between gene mutation type and wild type.

CLINICAL RELEVANCE/APPLICATION

The SUVmax of primary lung cancer is suggestive of its pathological type. But the SUVmax of primary lung cancer is not helpful to predict the gene mutations in NSCLC.

SSJ17-05 Local and Whole-Body Staging in Patients with Primary Breast Cancer: A Comparison of One-Step to Two-Step-Staging-Algorithms Utilizing PET/MRI

Tuesday, Nov. 27 3:40PM - 3:50PM Room: S504CD

Participants
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Ann-Kathrin Bittner, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To compare the diagnostic value of a one-step to a two-step staging algorithm for local and whole-body staging utilizing 18F-FDG PET/MRI in breast cancer patients.

METHOD AND MATERIALS

A total of 38 patients (37 females and one male, mean age 57 ± 10 years; range 31-78 years) with newly diagnosed, histopathologically proven breast cancer were prospectively enrolled in this trial. All PET/MRI examinations were assessed for local tumor burden and metastatic spread in two separate reading sessions: (1) One-step algorithm comprising supine whole-body 18F-FDG PET/MRI, (2) Two-step algorithm comprising a dedicated prone 18F-FDG breast PET/MRI and supine whole-body 18F-FDG PET/MRI.

RESULTS

On a patient based analysis the two-step algorithm correctly identified 37 out of 38 patients with breast carcinoma (97%), while 5 patients were missed by the one-step 18F-FDG PET/MRI algorithm (33/38; 87% correct identification; p=0.37). On a lesion-based analysis 56 breast cancer lesions were detected in the two-step algorithm and 44 breast cancer lesions could be correctly identified in the one-step 18F-FDG PET/MRI (79%), resulting in statistically significant differences between the two algorithms (p=0.0015). For axillary lymph node evaluation sensitivity, specificity and accuracy was 93%, 95 % and 94%, respectively. Furthermore, distant metastases could be detected in 7 patients with both modalities.

CONCLUSION

The results demonstrate the necessity and superiority of a two-step 18F-FDG PET/MRI algorithm, comprising dedicated prone breast imaging and supine whole-body imaging, when compared to the one-step algorithm for local and whole-body staging in breast cancer patients.

CLINICAL RELEVANCE/APPLICATION

Two-step 18F-FDG PET/MRI comprising dedicated breast and whole-body imaging enables high-quality local and whole-body staging in patients with breast cancer.

SSJ17-06 Multimodal Radiomic Imaging: Comparison of PET and MRI-pCM Heterogeneity in Breast Cancer

Tuesday, Nov. 27 3:50PM - 4:00PM Room: S504CD

Participants
Bert-Ram Sah, MD, London, United Kingdom (*Presenter*) Nothing to Disclose
Marta Bogowicz, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Christian Leissing, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Stephanie Tanadini-Lang, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Patrick Veit-Haibach, MD, Zurich, Switzerland (*Abstract Co-Author*) Research Grant, Bayer AG Resaarch Grant, F. Hoffmann-La Roche Ltd Research Grant, General Electric Company

PURPOSE

This study investigated the value of pre-treatment F-18-Fluorodeoxyglucose (FDG)-positron-emission-tomography (PET) radiomics in comparison to T1-weighted-post-contrast-magnetic-resonance-imaging (MRI-pCM) radiomics in patients with breast cancer.

METHOD AND MATERIALS

Following IRB approval and informed consent, a total of 30 patients with histologically proven breast cancer were prospectively recruited. Patients were injected 225+/-55 MBq FDG intravenously. PET and MRI-pCM were acquired on the same machine. 154 radiomic features of first, second, and higher order were extracted from the primary tumor. Dimensionality of features was reduced with a Principal Component Analysis. The relationship of selected features to staging and histological parameters was determined. Association of features between the different modalities was compared (Spearman "ρ").

RESULTS

Selected radiomic features of PET showed moderate correlation to T-stage ($-0.52 < \rho < 0.54$) and weak correlation to N-Stage ($-0.35 < \rho < 0.38$). Selected radiomic features of MRI-pCM showed moderate correlation to T-stage ($-0.64 < \rho < 0.57$) and to N-stage ($-0.52 < \rho < 0.54$). Correlation of radiomic features of both modalities to hormone receptor status is shown in Table 1. Comparison between PET and MRI-pCM showed moderate to strong correlation for the comparison of all radiomic features (-0.66 <

ρ < 0.68) (Figure 1), whereas the correlation for the comparison of a respective radiomic parameter was only weak to moderate (0.22 < ρ < 0.56) (1st diagonal in Figure 1).

CONCLUSION

Radiomics in a multimodality approach might be a complementary tool for non-invasive pre-therapeutic characterization of breast cancer.

CLINICAL RELEVANCE/APPLICATION

Combining radiomic features from different imaging modalities may help in non-invasive specification of breast cancer.

VW13

Invenia ABUS 2.0 - Live Scanning Demo: GE Vendor Workshop

Tuesday, Nov. 27 3:00PM - 3:30PM Room: Booth 8156

Participants
Doug Whisler, Sunnyvale, CA (*Presenter*)

Program Information

This thirty minute session will cover the latest technological advancements in ABUS design and performance. Attendees will learn how improvements in workflow and image quality have the potential to increase cancer detection in women with dense breast tissue. *Registration is required; adding this session to the RSNA calendar tool alone does not secure your seat in this session. Click the link below to register.*

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2018-/agenda-e57e0b47e9aa4f5ba89b1a0da1e829b9.aspx

VW14

Invenia ABUS 2.0 - Live Scanning Demo: GE Vendor Workshop

Tuesday, Nov. 27 3:30PM - 4:00PM Room: Booth 8156

Participants
Doug Whisler, Sunnyvale, CA (*Presenter*)

Program Information

This thirty minute session will cover the latest technological advancements in ABUS design and performance. Attendees will learn how improvements in workflow and image quality have the potential to increase cancer detection in women with dense breast tissue. *Registration is required; adding this session to the RSNA calendar tool alone does not secure your seat in this session. Click the link below to register.*

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2018-/agenda-e57e0b47e9aa4f5ba89b1a0da1e829b9.aspx

VW41

Automated Breast Volume Scanner (ABVS) Physician Training Workshop: An Interactive Learning Experience: Siemens Healthineers Vendor Workshop

Tuesday, Nov. 27 3:50PM - 5:00PM Room: Booth 5530

Participants

Ingolf Karst, MD, Chicago, IL (*Presenter*) Nothing to Disclose

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 unique coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

VW66

Breast Density Assessment: Beyond Radiologist Visual Assessment: Hologic Vendor Workshop

Tuesday, Nov. 27 4:00PM - 4:30PM Room: Booth 5524

Participants

Regina J. Hooley, MD, New Haven, CT (*Presenter*) Consultant, Hologic, Inc

Program Information

A brief session for radiologists interested in learning more about implementing Breast Density Assessment Software. Including decreasing inter/intra-reader variability and increasing confidence in selecting appropriate patients that may need additional screening. (Quantra™)

Registration

https://hologicrsna.com

RC415

The Neoadjuvant Patient

Tuesday, Nov. 27 4:30PM - 6:00PM Room: E353B

BR MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Jessica W. Leung, MD, Houston, TX (*Moderator*) Scientific Advisory Board, Hologic, Inc; Speakers Bureau, Hologic, Inc; Speakers Bureau, FUJIFILM Holdings Corporation

For information about this presentation, contact:

JWLeung@MDAnderson.org

zuleyml@upmc.edu

LEARNING OBJECTIVES

1) To discuss three clinically significant areas involving care of the breast cancer patient undergoing neoadjuvant therapy. 2) To apply in everyday clinical practice the principles and conclusions learned.

Sub-Events

RC415A Ongoing Trials

Participants
Jessica W. Leung, MD, Houston, TX (*Presenter*) Scientific Advisory Board, Hologic, Inc; Speakers Bureau, Hologic, Inc; Speakers Bureau, FUJIFILM Holdings Corporation

For information about this presentation, contact:

JWLeung@MDAnderson.org

LEARNING OBJECTIVES

1) To learn the design of some of the ongoing clinical trials involving care of the breast cancer patient receiving neoadjuvant therapy. 2) To describe the imaging components of these trials.

RC415B Evaluation of the Axilla

Participants
Steven P. Poplack, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the key US criteria that are predictive of axillary lymph node metastases. 2) Appraise the accuracy of axillary US. 3) Describe the role of axillary US in the surgical management of the axilla after neoadjuvant treatment.

RC415C Role of MR

Participants
Eric L. Rosen, MD, Denver, CO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the role of Breast MRI in identifying candidates for Neoadjuvant Chemotherapy. 2) Discuss published data regarding the ability of Breast MRI to assess response to Neoadjuvant Chemotherapy. 3) Identify and review both the predictive and prognostic ability of Breast MRI in patients receiving Neoadjuvant Chemotherapy. 4) Identify advances in MRI likely to enhance its already established role in evaluating breast cancer patients receiving neoadjuvant Chemotherapy.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

ED001-WE

Breast Wednesday Case of the Day

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

AMA PRA Category 1 Credit ™: .50

Participants
Jessica H. Porembka, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Amy M. Fowler, MD, PhD, Madison, WI (*Abstract Co-Author*) Research support, General Electric Company
Susan O. Holley, MD, PhD, Raleigh, NC (*Abstract Co-Author*) Nothing to Disclose
Alexander B. Sevrukov, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Chandni Bhimani, DO, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Catherine A. Young, MD, JD, Saint Louis, MO (*Abstract Co-Author*) Research support, Hologic, Inc
Cheryl R. Herman, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Michelle V. Lee, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Mai A. Elezaby, MD, Madison, WI (*Abstract Co-Author*) Research Grant, Exact Sciences Corporation
Lonie R. Salkowski, MD,PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Roberta M. Strigel, MD, Madison, WI (*Abstract Co-Author*) Research support, General Electric Company
Ryan W. Woods, MD, MPH, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Urvi A. Tailor, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Lindsay Compton, MD, Dallas, TX (*Abstract Co-Author*) Researcher, QT Ultrasound, LLC
Ramapriya Ganti, MD, Dallas, TX (*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.

RC515

BI-RADS Interactive Challenge (Interactive Game)

Wednesday, Nov. 28 8:30AM - 10:00AM Room: N227B

BR MR US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Jay R. Parikh, MD, Houston, TX (*Moderator*) Nothing to Disclose

GENERAL INFORMATION

This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Sub-Events

RC515A Mammography

Participants
Cindy S. Lee, MD, Garden City, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Cindy.Lee3@nyumc.org

LEARNING OBJECTIVES

1) To define BIRADS terms used to describe mammography findings and recognize common appearances of malignant and benign disease.

ABSTRACT

This case-based session will review a variety of imaging findings at mammography, appropriate use of BI-RADS descriptors and categories, as well as highlight potential pitfalls and strategies to avoid them.

Active Handout:Cindy S. Lee

http://abstract.rsna.org/uploads/2018/18000473/RSNA 2018 DBT Handout RC515A.pdf

RC515B Case-based Session on Ultrasound

Participants
Ana P. Lourenco, MD, Providence, RI (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

alourenco@lifespan.org

LEARNING OBJECTIVES

1) Apply appropriate BI-RADS descriptors and categories to a variety of benign and malignant lesions on ultrasound. 2) Describe how certain imaging features may predict pathology.

ABSTRACT

This case-based session will review a variety imaging findings at US, appropriate use of BI-RADS descriptors and categories, as well as highlight potential pitfalls and strategies to avoid them.

Active Handout:Ana P. Lourenco

http://abstract.rsna.org/uploads/2018/18000474/Lourenco.RSNA.US RC515B.pdf

RC515C Case-based Session on MRI

Participants
Elizabeth S. McDonald, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define BIRADS terms used to describe MRI findings and recognize common appearances of malignant and benign disease.

RC515D Audit and Outcomes Monitoring

Participants
Jay R. Parikh, MD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the basic clinically relevant mammography medical outcomes audit based on BIRADS. 2) Strategies to monitor outcomes and provide radiologist feedback.

ABSTRACT

Bi-RADS enables annual the basic clnically relevant medical outcomes audit, which can be used to monitor outcomes and provide radioloigsts feedback.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
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VW44

Wide-angle Digital Breast Tomosynthesis and Contrast Enhanced Mammography Reading Sessions: Siemens Healthineers Vendor Workshop

Wednesday, Nov. 28 10:15AM - 11:25AM Room: Booth 5530

Participants

Luis Pina, MD, PhD, San Sebastian, Spain (*Presenter*) Nothing to Disclose

Program Information

Learn about the value of wide-angle Digital Breast Tomosynthesis (DBT) and Contrast Enhanced Mammography (CEM) in the daily routine from one of our most experienced clinical experts. The differences and respective advantages of the morphological (DBT) and functional (CEM) breast imaging methods will be discussed. This, all with the flexible assistance of our multi-modality reading solution syngo® via and the syngo® Breast Care applications.

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SSK01

Breast Imaging (Digital Breast Tomosynthesis: Screening and Diagnostic Indications)

Wednesday, Nov. 28 10:30AM - 12:00PM Room: E451A

BR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Sarah M. Friedewald, MD, Chicago, IL (*Moderator*) Consultant, Hologic, Inc; Research Grant, Hologic, Inc;
Susan Weinstein, MD, Philadelphia, PA (*Moderator*) Nothing to Disclose

Sub-Events

SSK01-01 Blinded Observer Study: "Virtual" Full-Dose (VFD) Digital Breast Tomosynthesis (DBT) Images Derived from Reduced-Dose Acquisitions versus Clinical Full-Dose DBT Images

Participants
Junchi Liu, MS, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Syed Ammar Qadir, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Amin Zarshenas, MSc, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Limin Yang, MD, PhD, Iowa City, IA (*Abstract Co-Author*) Nothing to Disclose
Laurie L. Fajardo, MD, MBA, Park City, UT (*Abstract Co-Author*) Consultant, Hologic, Inc; Consultant, Siemens AG; Consultant, FUJIFILM Holdings Corporation;
Kenji Suzuki, PhD, Chicago, IL (*Presenter*) Royalties, General Electric Company; Royalties, Hologic, Inc; Royalties, MEDIAN Technologies; Royalties, Riverain Technologies, LLC; Royalties, Canon Medical Systems Corporation; Royalties, Mitsubishi Corporation; Royalties, AlgoMedica, Inc

For information about this presentation, contact:

jliu118@hawk.iit.edu

PURPOSE

We developed a deep-learning-based "virtual" higher-dose (VHD) technology for radiation dose reduction in DBT. The purpose of our study was to compare the image quality of our VFD images generated from half-dose acquisitions to that of real clinical full-dose images in DBT.

METHOD AND MATERIALS

Our deep-learning-based VHD technology employed our original patched-based neural network convolutional deep learning to convert lower-dose (LD) to higher-dose (HD) tomosynthesis images. To evaluate our VHD technology, we collected half-dose (50% of the standard dose: 32±14 mAs at 33±5 kVp) and full-dose (100% of the standard dose: 68±23 mAs at 33±5 kvp) images of 51 clinical screening cases with a DBT system (Selenia Dimensions, Hologic, Inc, Bedford, MA) at University of Iowa Hospitals & Clinics. We applied our VHD technology to the 51 cases to convert half-dose images to VFD images. We invited 35 breast radiologists to participate in our observer rating study to rate and distinguish blinded VFD and real full-dose DBT images of 10 of the 51 cases. A VFD image and its corresponding real full-dose image were shown on two clinical LCD monitors (EIZO RadiForce GX540) in a blinded manner. Radiologists were asked to rate the image quality on a 0-to-100 scale and to provide their choices as to which one was better in image quality.

RESULTS

Among the 35 breast radiologists, 21 (60%) radiologists either preferred our VFD DBT images over the real full-dose images or could not distinguish between the two in our observer rating study. The mean scores of the image quality of our VFD images and the real full-dose images were 83.2±3.2 and 84.0±3.0, respectively. The difference in image quality between VFD and real-full dose images was not statistically significant (p=0.37).

CONCLUSION

Our blinded observer study with 35 breast radiologists demonstrated that our deep-learning-based VFD images generated from half-dose acquisitions were equivalent to real full-dose DBT images. Thus, our VHD technology achieved 50% dose reduction without sacrificing the image quality.

CLINICAL RELEVANCE/APPLICATION

Substantial radiation dose reduction with the observer-study-proven VHD technology would benefit patients by reducing the lifetime risk of radiation-induced cancer from DBT screening.

SSK01-02 Comparison of DM/Tomosynthesis and Synthesized DM/Tomosynthesis False Negative Cancers in a Population-Based Breast Cancer-Screening Program

Wednesday, Nov. 28 10:40AM - 10:50AM Room: E451A

Awards
Student Travel Stipend Award

Participants
Samantha P. Zuckerman, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Rebecca Hubbard, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Elizabeth S. McDonald, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Susan Weinstein, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Lauren Pantalone, BS, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Marie Synnestvedt, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Emily F. Conant, MD, Philadelphia, PA (*Abstract Co-Author*) Grant, Hologic, Inc; Consultant, Hologic, Inc; Grant, iCAD, Inc; Consultant, iCAD, Inc; Speaker, iiCME

For information about this presentation, contact:

samantha.zuckerman@uphs.upenn.edu

PURPOSE

Synthesized 2D imaging (s2D) is replacing 2D digital mammography (DM) in digital breast tomosynthesis (DBT) screening to reduce radiation dose. However, there have been reports of decreased rates of detection of in situ carcinomas with s2D/DBT screening. The purpose of this study is to compare screening outcomes as well as false negative rates and lesion types in DM/DBT versus s2D/DBT screening.

METHOD AND MATERIALS

Recall rate percentage (RR), cancer detection (CDR) and false negative (FN) rates per 1000 screened, false negative cancer subtype (invasive versus in situ) and the method of detection of the false negative cancer (symptomatic versus by another imaging modality) were compared for 37,184 women screened with DM/DBT from 10/3/2011-1/6/2015 and 37,996 women screened with s2D/DBT from 1/7/2015-1/6/2018. Differences were compared using chi-squared tests at the standard a=0.05 significance level with Yates correction. All statistical tests were two-sided.

RESULTS

RR decreased with s2D/DBT versus DM/DBT screening - 6.9% versus 8.9% ($p<0.001$). CDR for DM/DBT and s2D/DBT screening were not statistically different (6.0/1000 vs. 5.5/1000, p=0.37). However, FN rate doubled for s2D/DBT (0.84/1000, n=32) versus DM/DBT screening (0.40/1000, n=15), p=0.02. While not statistically significant, there was a trend of more asymptomatic FN cancers detected by other modalities (i.e., MR, US, CT) in the s2D cohort than in the DM/DBT cohort (13/32 (41%) versus 5/15 (33%), p=0.11) and a trend of higher proportion of DCIS in the s2D cohort than in the DM cohort (9/32 (28%) versus 3/15 (20%), p=0.16).

CONCLUSION

s2D/DBT maintains CDR with the benefit of decreased recall rates. However, the FN rate increased with s2D/DBT compared to DM/DBT with both in situ and invasive FN cancers increased in the s2D cohort. While not statistically significant, a greater proportion of s2D FN cancers were detected by other modalities in asymptomatic patients. The increase in false negative rates is multifactorial and may be intrinsically related to the new technology and/or a learning curve in implementing the s2D technology.

CLINICAL RELEVANCE/APPLICATION

The replacement of DM with s2D in a large DBT breast cancer screening program maintained cancer detection rates and decreased recall rates, but increased false negative rates.

SSK01-03 Integration of Digital Breast Tomosynthesis into Breast Cancer Screening Practices in the United States: A Comparative Modeling Analysis

Wednesday, Nov. 28 10:50AM - 11:00AM Room: E451A

Participants
Kathryn Lowry, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Natasha K. Stout, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Oguzhan Alagoz, PhD, Madison, WI (*Abstract Co-Author*) Consultant, Renaissance Rx
Elizabeth S. Burnside, MD,MPH, Madison, WI (*Abstract Co-Author*) Dr. Burnside has a research grant from Hologic
Emily F. Conant, MD, Philadelphia, PA (*Abstract Co-Author*) Grant, Hologic, Inc; Consultant, Hologic, Inc; Grant, iCAD, Inc; Consultant, iCAD, Inc; Speaker, iiCME
Karla Kerlikowske, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Anne Marie McCarthy, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Diana Miglioretti, PhD, Seattle, WA (*Abstract Co-Author*) Scientific Advisory Board, Hologic, Inc
Brian L. Sprague, PhD, Burlington, VT (*Abstract Co-Author*) Nothing to Disclose
Anna N. Tosteson, Lebanon, NH (*Abstract Co-Author*) Nothing to Disclose
Martin J. Yaffe, PhD, Toronto, ON (*Abstract Co-Author*) Research collaboration, General Electric Company; Shareholder, Volpara Health Technologies Limited; Co-founder, Mammographic Physics Inc; Research Consultant, BHR Pharma LLC
Clyde Schechter, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Amy Trentham-Dietz, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To project long-term outcomes and cost-effectiveness of transitioning from breast cancer screening using digital mammography (DM) to digital mammography with digital breast tomosynthesis (DBT) in the United States.

METHOD AND MATERIALS

Two established breast cancer models were used to simulate two scenarios: complete transition from DM to DBT for all women ages 40+ between 2011-2020 versus continued use of DM alone. Screening utilization was based on observed dissemination patterns from national surveillance datasets. We assumed current screening and treatment patterns continued, and women were followed for their remaining lifetimes. DM and DBT performance was based on screening data from the NCI's Population Based Research Optimizing Screening through Personalized Regimen (PROSPR) consortium from 2011-2014. Costs and quality of life weights were based on US national averages and published literature. Outcomes included life-years (LY), quality-adjusted life-years (QALYs), breast cancer deaths, false positive exams (FP), costs (2017 US$) and incremental cost-effectiveness ratios (ICER). Analyses were performed from the payer perspective. Results were summarized within and across models.

RESULTS

Transition to DBT had the greatest impact on FP screening mammograms, which reduced FP exams by 278-288/1,000 women. The small difference in test sensitivity observed in the PROSPR data translated to minimal differences in breast cancer deaths and LY gains, with a reduction in deaths from 0 to 0.03/1,000 women and LY gains from -1 to 0.05 years/1,000 women. Total costs increased by $5.64-$5.66 million, with ICERs of $193,634-$217,532/QALY with DBT relative to DM. In sensitivity analyses, ICERs were sensitive to both the test performance and costs of screening DBT. For example, ICERs decreased to $141,043/QALY with 2% absolute improvement in DBT sensitivity; ICERs decreased to $163,092/QALY and $59,872 with $20 and $40 reductions in cost of DBT exams, respectively.

CONCLUSION

The transition from DM to DBT for routine breast cancer screening in the U.S. reduces FP results, but substantially increases costs assuming current estimates of performance and reimbursement rates.

CLINICAL RELEVANCE/APPLICATION

Digital breast tomosynthesis for routine breast cancer screening in the U.S. reduces false positive exams, but substantially increases costs based on current estimates of performance and reimbursement rates.

SSK01-04 Interval Cancers at Digital Breast Tomosynthesis (DBT) and Full-Field Digital Mammography (FFDM) in a Hybrid Imaging Environment

Wednesday, Nov. 28 11:00AM - 11:10AM Room: E451A

Participants
Gunjan M. Senapati, MD, Boston, MA (*Presenter*) Nothing to Disclose
Aijia Wang, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Pragya A. Dang, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Sona A. Chikarmane, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ivan Ip, MD, MPH, Brookline, MA (*Abstract Co-Author*) Nothing to Disclose
Ronilda Lacson, MD, PhD, Brookline, MA (*Abstract Co-Author*) Nothing to Disclose
Ramin Khorasani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Catherine S. Giess, MD, Wellesley, MA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

gsenapati@bwh.harvard.edu

PURPOSE

To review imaging features and histopathology of interval cancers (IC) on screening full-field digital mammography (FFDM) and screening digital breast tomosynthesis (DBT) in a hybrid imaging environment.

METHOD AND MATERIALS

This HIPAA-compliant IRB approved retrospective review of consecutive screening exams (9,828 DBT and 41,713 FFDM exams) from October 2012-September 2014 identified interval cancers by cross reference to the institutional cancer registry. Interval cancer was defined as cancer detected within 365 days of a negative screening exam. During the study period a hybrid imaging environment for screening existed, using both FFDM and DBT. Three breast radiologists reviewed prior mammograms of all IC in consensus. Cancers were classified as missed (actionable), minimal signs (non-actionable), or true negative. Mammographic lesion features and breast density were described. Electronic medical record review of patient demographics and histopathology was performed. Percentages were compared using Fisher's exact test.

RESULTS

There were 34 interval cancers (20 FFDM, 14 DBT). IC were considered missed, actionable in 2/20 (10%) FFDM and 2/14 (14%) DBT; minimal signs, non-actionable in 3/20 (15%) FFDM and 0/14 (0%) DBT, and true negative in 15/20 (75%) FFDM and 12/14 (86%) DBT (p-value = 0.4061). Of the 5 cancers visible (2 missed, 3 minimal signs) on prior FFDM, 3 were asymmetries, 1 calcifications, and 1 architectural distortion. Both cancers visible (both missed) on prior DBT were spiculated masses. Most IC on both FFDM and DBT were moderate-to-high grade invasive carcinoma (n=29): 17/20 (85%) FFDM and 12/14 (86%) DBT (p-value = 0.9999). 1 case of pure intermediate grade DCIS, presenting as nipple discharge, was missed on FFDM; the remaining four, 2 FFDM and 2 DBT, were grade 1 invasive carcinoma. Most IC were in Category 3 and 4 dense breasts (n=26): 15/20 (75%) FFDM and 11/14 (79%) DBT (p-value = 0.9999).

CONCLUSION

In this hybrid FFDM/DBT screening environment, most IC are mammographically occult at prior imaging, occur in dense breast tissue, and are moderate to high grade invasive cancers.

CLINICAL RELEVANCE/APPLICATION

Because FFDM and DBT techniques both rely on lesion morphology for detection, IC on each technique have similarities, occurring in dense tissue and with moderate to high grade invasive histopathology.

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 EducatorCatherine S. Giess, MD - 2017 Honored Educator

SSK01-05 Evidence Supporting Digital Breast Tomosynthesis as Primary Mammographic Screening Tool: Sustained Improved Outcomes over 7 Consecutive Years

Wednesday, Nov. 28 11:10AM - 11:20AM Room: E451A

Participants
Liane E. Philpotts, MD, New Haven, CT (*Presenter*) Consultant, Hologic, Inc
Tamara Y. Carroll, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Madhavi Raghu, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

liane.philpotts@yale.edu

PURPOSE

Digital breast tomosynthesis (DBT) has shown promise in multiple individual, multi-institutional and population based practices to improve screening metrics, particularly reduce recall rates and improve cancer detection. The sustainability of the early results has not yet been well demonstrated. Long term results are needed to demonstrate if the technology is the preferred screening tool compared with 2D full field digital mammography (FFDM). The purpose of this study was to assess screening metrics with DBT over a 7 year period.

METHOD AND MATERIALS

DBT screening (Dimensions, Hologic, Inc, Bedford, MA) was offered to all women free of charge at a dedicated academic breast center starting in August 2011 and 3 out-patient satellite offices that obtained DBT units in the following years. Over a 7 year period, 124,669 screening DBT exams were performed. Screening metrics were obtained from the breast imaging electronic database (PenRad, MN) and assessed by one-year intervals starting in August 2011. Recall rate (RR), Cancer detection rate (CRD), positive predictive value of screening recall (PPV1) and of biopsy (PPV3) were assessed. Comparison with historic 2D rates (8/1/08 though 7/31/11) were performed.

RESULTS

The RR was significantly reduced over 2D and showed a decreasing trend for each consecutive year: 7.9%, 8.8%, 7.8%, 7.5%, 6.9%, 6.7%, 6.2% (2D = 11.4) ($p<0.0001$). The CDR (per 1000) showed a stable trend that was statistically significantly improved over 2D: 5.8, 5.2, 5.4, 5.6, 6.6, 5.6, 5.1 (2D = 3.8)($p<.0001$). The PPV1 showed a sustained significant improvement over 2D: 7.2, 5.8, 7.0, 7.5, 9.5, 8.4, 8.2 (2D=3.3) ($p<.0001$). The PPV3 also showed a striking significant increase over 2D and an upward trend over consecutive DBT years: 35%, 31%, 36%, 37%, 47%, 42%, 44% (2D=29%) ($p<0.05$).

CONCLUSION

Screening metrics with DBT over 7 years were sustainably significantly improved over 2D rates and further demonstrate favorable trends of improvement over time. This may reflect learning curve and/or increasing availability of prior comparison tomosynthesis exams.

CLINICAL RELEVANCE/APPLICATION

The sustained use of DBT demonstrates that there are fewer false positive screening recalls and biopsies which is essential for shifting the harms and benefits of screening.

SSK01-06 Impact of Using Digital Breast Tomosynthesis in Diagnostic Mammography

Wednesday, Nov. 28 11:20AM - 11:30AM Room: E451A

Participants
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PURPOSE

The use of digital breast tomosynthesis (DBT) in the screening setting has been shown to decrease recall rate and improve cancer detection. This study evaluates the impact of using DBT in the diagnostic setting at a large academic institution.

METHOD AND MATERIALS

All diagnostic mammograms performed from 7/1/2013 to 8/24/2017 were reviewed. Diagnostic mammograms performed to further evaluate calcifications were excluded, as spot magnification views, rather than DBT views, are typically used for diagnostic evaluation in these cases. Studies were divided into two groups: those performed with at least one DBT view and those performed with only full field digital mammography (FFDM). We compared the frequency of a negative/benign assessment (BI-RADS 1 or 2), a probably benign assessment (BI-RADS 3), and a suspicious or highly suspicious assessment (BI-RADS 4 or 5) between the two groups. We also compared positive predictive value 2 and cancer detection rate between the two groups. The Chi-squared test was used for statistical analysis.

RESULTS

12,324 studies were included in the DBT group and 11,775 studies were included in the FFDM group. There was a significantly higher percentage of BI-RADS 1 or 2 assessments (77.8% vs. 74.9%, p<0.001) and a significantly lower percentage of BI-RADS 3 assessments (10.6% vs. 12.9%, p<0.001) in the DBT group compared to the FFDM group. There was no significant change in the percentage of BI-RADS 4 or 5 assessments (biopsy recommendations) between the two groups (12.1% vs. 11.6%, p=0.20). Both PPV2 and CDR were significantly higher for studies performed with DBT compared to FFDM (PPV2: 36.1 vs. 26.6, p<0.001; CDR: 41.8 vs. 32.3, p<0.001).

CONCLUSION

In our study, using DBT in the diagnostic setting led to more studies being assessed as normal with less frequent need for short-term follow-up, implying decreased associated cost of follow-up and decreased stress and anxiety for patients. While the number of biopsy recommendations was similar between the groups, PPV2 and CDR increased when DBT views were included, suggesting improved accuracy of biopsy recommendations.

CLINICAL RELEVANCE/APPLICATION

Routine use of digital breast tomosynthesis for diagnostic mammography may result in more confident assessments, and could lead to resource savings and improved patient-centered care.

SSK01-07 Architectural Distortion (AD) on Digital Breast Tomosynthesis (DBT): Outcomes, Histopathology, and Predictive Features of Malignancy

Wednesday, Nov. 28 11:30AM - 11:40AM Room: E451A

Participants
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PURPOSE

1) To determine histopathologic outcomes for architectural distortion (AD) detected on tomoshynthesis (3D) mammography, (2) to investigate imaging features predictive of malignancy.

METHOD AND MATERIALS

A HIPAA-compliant IRB approved retrospective review of a mammography screening database between 12/2012-5/2015 identified 297 consecutive screening mammograms classified as BI-RADS 0 for AD. All breast imaging available for cases classified as BI-RADS 4 and 5 at diagnostic work-up were reviewed in consensus by 3 breast radiologists. Imaging features and biopsy accuracy were assessed. Medical records were reviewed for patient demographics, histopathology and follow-up imaging. Chi-square tests were performed with <0.05 significance.

RESULTS

Of 297 BI-RADS category 0 screening detected AD on DBT, 45 (15.2%) were subsequently categorized as BI-RADS category 4-5. Cases were excluded if the finding was a mass rather than AD alone (n=3) or if no pathology results were available (n=2). Within the study population of 40 cases, 20/40 (50%) were malignant (18/20 [90%] invasive, 2/20 [10%] ductal carcinoma in situ), 3/40 (7.5%) atypical ductal hyperplasia, and 17/40 (42.5%) benign. 31/40 (77.5%) cases of AD were visible on 3D only and 9/40 (22.5%) were seen on 2D and 3D. Malignancy was found in 15/31 (48.4%) 3D only AD and 5/9 (56%) AD visible on 2D and 3D (p=1.00). While presence of a sonographic correlate did not increase likelihood of malignancy (US correlate in 33 cases [17 benign, 16 malignant] and no US correlate in 7 cases [3 benign, 4 malignant] [p=1.00]), the specific finding of a mass was more likely malignant than non-mass findings (17 masses [4 benign, 13 malignant] and 16 non-mass [13 benign, 3 malignant] [p=0.0016]. Diagnostic MRI was performed in 7/40 (17.5%) cases, of which 3/7 (1 malignant, 2 benign) had a correlate for AD and 4/7 (0 malignant) did not.

CONCLUSION

The majority of AD cases in this series were seen on 3D only, although risk of malignancy for 3D only visible compared to 2D plus 3D visible was similar. AD is more likely to represent invasive disease than in situ and is more likely malignant if a sonographic mass is present. Given the high malignancy rate, negative US or breast MRI should not obviate the need for biopsy of mammographic detected AD.

CLINICAL RELEVANCE/APPLICATION

Given the high malignancy rate associated with AD detected on 3D mammography, lack of US or MRI correlate should not obviate biopsy.

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 EducatorCatherine S. Giess, MD - 2017 Honored Educator

SSK01-08 Evaluating the Clinical Performance of Stationary 3D Mammography

Wednesday, Nov. 28 11:40AM - 11:50AM Room: E451A

Awards
Student Travel Stipend Award

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PURPOSE

The purpose of this study was to assess the clinical performance of *stationary* 3D mammography, which is a new approach to digital breast tomosynthesis that uses a fixed array of carbon nanotube-based x-ray sources to acquire the projection views.

METHOD AND MATERIALS

Women with a suspicious abnormality (BIRADS 4 lesion) identified by screening digital mammography were recruited for the study, which involved imaging by *stationary* 3D mammography prior to biopsy. Pre-clinical testing has demonstrated that *stationary* 3D mammography offers a higher spatial resolution than commercially-available 3D mammography devices, since it solves the problem of source blur. In this study, the *stationary* 3D mammography device collected 15 projections over an angular span of 28°. Four radiologists were asked to evaluate the likelihood of malignancy and rate breast density (BIRADS 1-4) when interpreting the standard mammogram and *stationary* 3D mammography images. Using pathology as ground truth, reader performance was quantified as the area under the receiver operating characteristic curve (AUC), while multivariate analysis with a fitted linear mixed-effect model was used to relate breast density to reader performance.

RESULTS

43 women [average age: 56.7 (35 to 83) years] provided a lesion-enhanced image set, in which malignancy was found to be present in 28% of participants by pathology. On average, readers were more accurate identifying malignancy when interpreting the *stationary* 3D mammography images compared to the standard mammograms, as demonstrated by the significantly higher ($p<0.0001$) mean AUC for *stationary* 3D mammography. This higher accuracy was present and statistically-significant across the full range of breast densities.

CONCLUSION

In this first-in-human study, readers were more likely to identify malignancy correctly when interpreting *stationary* 3D mammography images compared to the standard digital mammogram. Given these encouraging findings, as well as the results of pre-clinical testing, future trials are being designed to compare the performance of *stationary* 3D mammography to commercially-available 3D mammography devices in the clinic.

CLINICAL RELEVANCE/APPLICATION

Stationary 3D mammography may prove to be a valuable clinical tool, as readers were more accurate identifying malignancy when interpreting its images compared to the standard digital mammogram.

SSK01-09 Molecular Characterization of Breast Cancers: Could It Change Potential Overdiagnosis Analysis?

Wednesday, Nov. 28 11:50AM - 12:00PM Room: E451A

Participants
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PURPOSE

To compare the amount of potentially overdiagnosed breast cancers in two screening populations using tomosynthesis (DBT) and digital mammography (FFDM) considering only tumor stage or also molecular features.

METHOD AND MATERIALS

Cancers detected within a prospective screening trials using DBT were compared with those obtained from an historical FFDM screening cohort. The amount of potentially overdiagnosed breast cancers in the two cohorts was calculated according to two different assumptions: (1) stages 0 and 1 cancers (DCIS, IDCs, ILCs); (2) considering low-grade DCIS and IDCs/ILCs that are simultaneously grade 1, stage IA or IB, luminal A subtype. Rates (Fisher exact test) were used to compare the two hypotheses of potential overdiagnosis. A p-value lower than 0.05 was considered statistically significant. The same analysis was performed on the complementary subgroups for the two hypotheses: (1) stage > 1 tumors; (2) any other combination of features with the exception of that defined with the second assumption.

RESULTS

Cancers detected in the two screening populations was 322 from the DBT trial and 153 from the FFDM cohort. Considering only tumor stage, cancers potentially overdiagnosed were 268 with DBT and 116 with FFDM, equivalent to 83.2% and 75.8%, respectively. Comparing rates, DBT found 7.9/1000 stage 0/1 cancers vs. 4.0/1000 found by FFDM (P<0.0001), with an incidence rate ratio (IRR) equal to 1.99 (95%CI = [1.60-2.50]. Rates of cancers with stage >1 were 1.6/1000 with DBT vs. 1.3/1000 with FFDM, not significantly different (P=0.2817); the IRR was 1.26 (95%CI = [0.81-1.97]). Including in the definition of potentially overdiagnosed cancers also molecular features, the numbers become 61/322 (18.9%) with DBT and 13/153 (8.5%) with FFDM; rates of overdiagnosed cancers with the second assumption were 1.8/1000 with DBT and 0.4/1000 with FFDM (P<0.0001) corresponding to an IRR of 4.04 (95%CI = [2.20-8.02]). Rates of any other cancers (not overdiagnosed) were 7.7/1000 with DBT vs. 4.8/1000 with FFDM (P<0.0001), with an IRR of 1.61 [95%CI = [1.30-1.99]].

CONCLUSION

DBT increased the amount of potentially overdiagnosed cancers with both definitions. However, the second assumption (inclusion of stage, grade, and molecular features) showed that cancers detected by DBT were mostly not overdiagnosed.

CLINICAL RELEVANCE/APPLICATION

Overdiagnosis by DBT is overestimated using only cancer stage as metric for overdiagnosis.

SSK02

Breast Imaging (Artificial Intelligence)

Wednesday, Nov. 28 10:30AM - 12:00PM Room: E451B

AI BR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
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Sub-Events

SSK02-01 Using Deep Convolutional Neural Networks to Predict Readers' Estimates of Mammographic Density from Raw and Processed Mammographic Images

Participants
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PURPOSE

Mean percentage density assessed visually by two independent readers using Visual Analogue Scales (VAS) has a strong association with breast cancer risk, but is resource-intensive and impractical for stratified screening. We describe a fully-automated method for predicting this mammographic percent density measure from raw (for processing) or processed (for presentation) mammograms, and compare association of predicted VAS score with risk.

METHOD AND MATERIALS

Convolutional Neural Networks (CNNs) were trained using 67520 whole-image mammograms from 16968 women, each labelled with the average VAS score of two independent readers. The networks learned a mapping between mammographic appearance and mammographic density so that they can predict density for unseen images. To evaluate its use for risk assessment, we tested on case-control datasets of contralateral mammograms of screen detected cancers (SDC) and prior screening mammograms of women with cancers detected subsequently. Each cancer was matched to three controls on age, menopausal status, parity, HRT and BMI. The test datasets contained 366 cancers (SDC) and 338 (priors). Odds ratios between the top and bottom quintile were derived, and matched concordance indices were estimated. All images were acquired on GE Senographe systems, and none of the images from the case-control test sets were used in the training process.

RESULTS

For density estimates derived from raw images, odds ratios of cancer in the highest vs lowest quintile were 3.07 (95%CI: 1.97 - 4.77) for SDC and 3.52 (2.22 - 5.58) for priors, with matched concordance indices of 0.59 (0.55 - 0.64) and 0.61 (0.58 - 0.65) respectively. For processed images we obtained odds ratios of 3.22 (2.06 - 5.03) for SDC and 3.65 (2.27 - 5.88) for priors. Matched concordance indices were 0.58 (0.53 - 0.62) for SDC and 0.61 (0.57 - 0.65) for priors.

CONCLUSION

Our fully automated method demonstrated encouraging results on both raw and processed mammographic images, indicating that either image type could be used for screening stratification.

CLINICAL RELEVANCE/APPLICATION

Mammographic density is one of the most important risk factors for breast cancer. Our fully automated method could provide a pragmatic solution for population-based stratified screening.

SSK02-02 Breast Density Classification with Deep Convolutional Neural (DCN) Networks Utilizing 200,000 Screening Mammograms

Wednesday, Nov. 28 10:40AM - 10:50AM Room: E451B

Participants

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PURPOSE

To develop a DCN network to reliably assess mammographic breast density

METHOD AND MATERIALS

In this retrospective study, we trained a multi-column DCN network on 200,000 digital screening mammograms performed at our institution from 2010-2016 to assess breast density. We extracted the textual reports associated with each exam to obtain the breast density as determined by the original interpreting radiologist. The algorithm was trained on 80% of the data sets, validated on a separate 10%, and tested on the remaining 10%. Once this convolutional neural network classifier was trained, we performed a reader study comparing our model to 3 radiologists. All readers independently evaluated the breast density in 100 mammograms in a randomized order. Breast density was assessed using the conventional BI-RADS categories: Class 0 - fatty, Class 1 - scattered fibroglandular densities, Class 2 - heterogeneously dense, and Class 3 - extremely dense. Performance of the model and the readers were assessed using the area under the ROC curve (AUC). Kappa score was used to assess for intra-observer and inter-observer variability.

RESULTS

Both the radiologists and our DCN model achieved a fair agreement (k = 0.34 - 0.51) with the labels in the reader study. The agreement between the predictions of our model and the labels in the data were higher (k = 0.65 - 0.72) compared to the inter-observer agreement between the radiologists. There was higher agreement for the fatty and extremely dense breast tissue. Comparing our CNN model to an average of the radiologists, the CNN achieved AUC of 0.934 (class 0: 0.971, class 1: 0.859, class 2: 0.905 and class 3: 1.000) while the radiologists achieved an AUC of 0.892 (class 0: 0.960, class 1: 0.812, class 2: 0.807 and class 3: 0.990) (Figure 1).

CONCLUSION

The level of agreement between the trained classifier and the classes in the data was found to be similar to that between the radiologists and the classes in the data, as well as among the radiologists.

CLINICAL RELEVANCE/APPLICATION

The classifier provides quantitative, reproducible prediction of breast density, while there is often poor intra-reader and inter-reader correlation in the qualitative assessment of breast density.

SSK02-03 Improving Radiologists' Breast Cancer Detection with Mammography Using a Deep Learning-Based Computer System for Decision Support

Wednesday, Nov. 28 10:50AM - 11:00AM Room: E451B

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PURPOSE

To compare the breast cancer detection performance of radiologists reading mammography exams unaided versus reading using an interactive deep learning-based computer system for decision support (DS).

METHOD AND MATERIALS

A retrospective, fully-crossed (two sessions >4 weeks apart), multi-reader multi-case (MRMC) study was performed. 240 cases (100 cancers, 40 false positive recalls, 100 normals) were scored by 14 MQSA-qualified radiologists, once with and once without using DS. For each case, a forced BI-RADS® score and a level of suspicion (1-100) were provided. When reading with the DS system (Transpara, Screenpoint Medical, Nijmegen, The Netherlands), radiologists could activate the DS for a specific breast region by clicking on it and the system then displayed a cancer likelihood score (1-100). Additionally, traditional computer-aided detection was available to prompt calcification and soft tissue lesion markers. Area under the receiver operating characteristic curve (AUC), specificity and sensitivity, and reading time were compared using MRMC Analysis of Variance.

RESULTS

On average, with the DS system, the AUC increased significantly from 0.866 to 0.886 (P=0.0019) compared to unaided reading. Sensitivity increased from 83% to 86% (P=0.046), while specificity only slightly improved from 77% to 79% (P=0.061). Considering lesion type, AUC increased for soft tissue lesions (0.886 to 0.902, P=0.033), and calcifications (0.878 to 0.898, not significant, P=0.1021). Reading time per case was similar in both situations (unaided = 146 s, with DS = 149 s, P=0.147). As a stand-alone, the computer system had an equal detection performance (AUC=0.887) than the average of radiologists (P=0.333).

CONCLUSION

Radiologists significantly improved their cancer detection in mammography when using a deep learning-based computer system for decision support without taking more time.

CLINICAL RELEVANCE/APPLICATION

The use of decision support might prevent overlook and interpretation errors that are relatively common in the reading of mammography. The increase in performance when concurrently using DS does not lengthen radiologists reading time per case, as opposed to traditional computer-aided detection systems. The use of single-reading in combination with the computer system might achieve a performance similar to double human reading considering that the stand-alone performance of the system is similar to the average of radiologists.

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/ Elizabeth A. Krupinski, PhD - 2017 Honored Educator

SSK02-04 Data-Driven Imaging Biomarker for Breast Cancer Screening in Mammography-Reader Study

Wednesday, Nov. 28 11:00AM - 11:10AM Room: E451B

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PURPOSE

Previously, we demonstrated data-driven imaging biomarker in mammography (DIB-MMG; an imaging biomarker that is derived from large-scale mammography data by using deep learning technology) for detection of malignant lesions. Now, we assess the feasibility of DIB-MMG as a diagnosis-support-tool for radiologists.

METHOD AND MATERIALS

Total 96,191 exams of 4-view digital mammograms were retrospectively collected from two institutions. All cancer exams were proven by biopsy. Benign exams were proven by biopsy or at least 1 year of follow-up mammography, and normal exams were proven by at least 1 year of follow-up mammography. 90,637 exams of training data (16,086 cancer, 31,237 benign, and 43,314 normal exams) and 5,554 exams of test data (1,692 cancer, 2,780 benign, 1,082 normal cases) were used for developing the DIB-MMG. Sensitivity, specificity, and AUC of the final DIB-MMG on the test data were 82.6%, 93.3%, and 0.94, respectively. Total 120 exams of mammograms (38 cancer and 82 non-cancer exams) were independently collected for reader study, and five radiologists participated. For each exam, readers first read the exam without the help of DIB-MMG and Task-1) annotate the most suspicious lesion with DMIST 7-pt scores and Task-2) decide recall or not per breast. After reading of each exam, readers modify their decision based on the heat-map of DIB-MMG which denotes the likelihood of malignancy.

RESULTS

Per-breast standalone performance of DIB-MMG for 120 exams was 0.942 of AUC in Task-1, and 89.7% of sensitivity, 89.6% of specificity in Task-2. Average performance of five radiologists without DIB-MMG was 0.807 of AUC in Task-1, and 70.8% of sensitivity, 86.2% of specificity in Task-2. With DIB-MMG, the average performance was improved to 0.879 of AUC (p=0.024) in Task-1, and 79.5% of sensitivity, 86.5% of specificity in Task-2. Fig.1 shows exemplary DIB-MMG heat-maps.

CONCLUSION

This retrospective reader study showed the potential of DIB-MMG as a diagnosis support tool for radiologists in breast cancer screening. Further clinical validation with prospective study is needed.

CLINICAL RELEVANCE/APPLICATION

DIB-MMG is purely based on data-driven features from a large-scale mammography data instead of manually designed features of conventional computer-aided detection (CAD) algorithms. With further clinical validation, DIB-MMG can be practically used as a diagnosis support tool for radiologists in breast cancer screening.

SSK02-05 Generative Neural Network Inserting or Removing Cancer into Mammograms Fools Radiologists and Deep Learning Alike: Example of an Adversarial Attack

Wednesday, Nov. 28 11:10AM - 11:20AM Room: E451B

Participants
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PURPOSE

To investigate whether a cycle-consistent generative adversarial network (CycleGAN) can insert or remove cancer-specific features into mammographic images in a realistic fashion.

METHOD AND MATERIALS

From two publicly available datasets (BCDR and INbreast) 680 mammographic images from 334 patients were selected, 318 of which exhibited potentially cancerous masses, and 362 were healthy controls. We trained a CycleGAN, using two pairs of generator and discriminator networks to convert cancerous breast images to healthy and back, and vice versa for the controls, without the need for paired images. The network, implemented in TensorFlow, was trained for 40 epochs on an augmented dataset enlarged ten-fold by random rotation, scaling, and contrast perturbations. To investigate how realistic the images appear, we randomly selected 20 image pairs of original and generated images, and 10 single images of each category (60 images in total). The images were presented to three radiologists (5 and 3 years of experience, and PGY-5 resident) who rated them on a 5-point Likert-like scale and had to indicate whether the image was real or generated/modified. The readout was analysed with a receiver-operating-characteristics (ROC) analysis, performance was expressed as area under the ROC curve (AUC).

RESULTS

For the most experienced radiologist, the modifications introduced by CycleGAN reduced diagnostic performance, with the AUC dropping from 0.85 to 0.63 (p=0.06), respectively, while the two less experienced ones seemed unaffected at a lower baseline performance (AUC 0.75 vs. 0.77 and 0.67 vs. 0.69). None of the radiologists could reliably detect which images were real and which were modified by CycleGAN (AUC 0.50-0.66).

CONCLUSION

CycleGAN can inject or remove malignant features into mammographic images while retaining their realistic appearance. These artificial modifications may lead to false diagnoses.

CLINICAL RELEVANCE/APPLICATION

Modern adversarial attacks may go undetected by humans as well as deep learning algorithms, and could be used in cyber warfare. It is vital to secure healthcare devices and information systems against such attacks mediated by neural networks.

SSK02-06 Deep Learning for Detection of Breast Cancer and Negative Screening Exams Using an In-House Million Mammogram Dataset

Wednesday, Nov. 28 11:20AM - 11:30AM Room: E451B

Participants
Hari Trivedi, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Peter Chang, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Dmytro Lituiev, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
April Liang, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Maryam Panahiazar, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
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Benjamin L. Franc, MD, Sacramento, CA (*Abstract Co-Author*) Nothing to Disclose
Bonnie N. Joe, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Breast cancer is the second leading cause of cancer death in women in the US. Screening mammography is effective for early detection, however suffers from unnecessary recall imaging and biopsies. Deep learning shows promise in medical image recognition tasks, but requires large-scale, robustly-annotated datasets. We expand upon our previously described end-to-end process of constructing a million mammogram dataset using routine clinical data and present results of two preliminary deep learning models for cancer detection and the identification of true negative images.

METHOD AND MATERIALS

923,685 DICOM images and 37,730 free-text pathology reports were used to generate an in-house database labeled with ground-truth pathology results.The first deep learning model was created for cancer detection only in biopsy proven specimens - the most difficult subset of data as each image contained a suspicious finding. The model was comprised of two components: patch-based pre-training and end-to-end fine tuning. Training set size was 34,390 images (12,251 positive, 22,139 negative), and test set size was 6,778 images equally split.The second model was designed to have a high NPV for screening and diagnostic studies. An attention-based object detection network was used, with potential abnormalities identified by a region-proposal network and resolved by a separate head classifier network. The model was trained with 359,574 images (4,738 positive, 354,837 negative).

RESULTS

The first model achieved an AUC of 0.81, sensitivity of 0.764, and specificity of 0.797. The second model when tested on 100 positive and 100 negative cases achieved an AUC of 0.90, sensitivity of .866, and specificity of .873 . If the test cases were

changed to a more clinically relevant distribution of 99% benign and 1% cancer, the AUC increased to 0.96.

CONCLUSION

We demonstrate the efficacy of deep learning for mammography in both cancer detection and the identification of negative studies. Future work includes enrichment of the dataset with further clinical data such as history of breast cancer, prior surgeries, and hormone replacement therapy. We also aim to improve model performance and efficiency through novel model architectures.

CLINICAL RELEVANCE/APPLICATION

We develop novel deep learning models for mammography using routine clinical data from a single institution with the potential to decrease recall imaging and unnecessary biopsies.

SSK02-07 Improved Cancer Detection using Artificial Intelligence: A Retrospective Evaluation of Missed Cancers on Mammography

Wednesday, Nov. 28 11:30AM - 11:40AM Room: E451B

Participants
Alyssa T. Watanabe, MD, Manhattan Beach, CA (*Presenter*) Consultant, CureMetrix, Inc
Vivian Lim, MD, La Jolla, CA (*Abstract Co-Author*) Consultant, CureMetrix, Inc
Jenna I. Liu, MD, La Jolla, CA (*Abstract Co-Author*) Consultant, Curemetrix, Inc
Eric Weise, La Jolla, CA (*Abstract Co-Author*) Software developer, CureMetrix, Inc;
Chi Yung Chim, La Jolla, CA (*Abstract Co-Author*) Researcher, CureMetrix, Inc
William G. Bradley JR, MD, PhD, La Jolla, CA (*Abstract Co-Author*) Officer, CureMetrix, Inc
Christopher E. Comstock, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To determine whether artificial intelligence-based (AI) software can be used to improve radiologists' sensitivity in breast cancer screening and detection.

METHOD AND MATERIALS

A set of 2-D Digital Mammograms originally interpreted with R2 ImageChecker CAD (Hologic, Sunnyvale, CA) and performed between October 2011 to March 2017 was collected from a community facility. Of the 317 cancer patients with available prior mammograms, 139 had retrospective findings, and 90 of those were deemed actionable. A blinded retrospective study was performed with a panel of seven radiologists comprised of false negative actionable mammograms obtained up to 5.8 years prior to diagnosis and 32 normal studies. Each radiologist viewed the cases without and then with benefit of cmAssist TM (CureMetrix, La Jolla, CA) AI based computer-aided detection (AI-CAD) flags and neuScore TM (quantitative AI-based probability for malignancy of flagged lesions, 1-100 scale). Reader decision making changes in true and false positive recalls with and without AI were analyzed.

RESULTS

All radiologists showed a significant improvement in their cancer detection rate (CDR) with the use of AI-CAD and neuScore ($p = 0.0069$, C.I. = 95%). With the assistance of AI software, the sensitivity of less experienced general radiologists improved to a level higher than a fellowship-trained academic mammographer. The readers detected between 25% and 71% (mean 51%) of the early cancers without assistance. With AI software results,, overall reader CDR was 41% to 76% (mean 62%). Overall, there was less than 1% increase in the readers' false positive recalls with use of the AI software.

CONCLUSION

There was a statistically significant improvement in radiologists' sensitivity for cancer detection in this enriched data set of primarily false negative mammograms with the benefit of the AI-CAD with neuScore. The percentage increase in CDR for the radiologists in the reader panel, ranged from 6% to 64% (mean 27%) with the use of AI-CAD, with negligible increase in false positive recalls.

CLINICAL RELEVANCE/APPLICATION

This study shows a measurable, significant benefit for radiologists in mammography interpretation with the use of artificial intelligence (AI) based computer-aided detection software with quantitative scoring. The use of AI in clinical practice may potentially expedite workflow, enhance earlier detection of cancer, and reduce false negative mammograms.

SSK02-08 Data-Driven Imaging Biomarker for Breast Cancer Screening in Digital Breast Tomosynthesis

Wednesday, Nov. 28 11:40AM - 11:50AM Room: E451B

Participants
Sungwon Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hyo-Eun Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, Lunit Inc
Jin Chung, 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
Minsung Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, Lunit Inc
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PURPOSE

To assess feasibility of a data-driven imaging biomarker in digital breast tomosynthesis (DIB-DBT) using the deep learning technology and evaluate its potential for detection of breast cancer.

METHOD AND MATERIALS

We retrospectively collected 49,577 exams of 4-view digital mammograms (MMG) and 1,196 exams of 4-view digital breast tomosynthesis images (DBT) from a single institution. We also collected 41 (10 cancer, 16 benign, 15 normal) exams of 4-view DBT retrospectively from another institution for external validation. 49,577 exams of MMG consists of 47,719 (5,599 cancer, 17,971 benign, and 24,149 normal) and independent 1,858 (619 cancer, 620 benign, 619 normal) exams of training and validation data, respectively. 1,196 exams of DBT consists of 996 (822 cancer, 40 benign, 134 normal) and independent 200 (120 cancer, 30 benign, 50 normal) exams of training and validation data, respectively. Previously, we assessed the feasibility of DIB-MMG as a screening tool for breast cancer detection in mammograms through external validation and pilot reader study. Thus, we exploit DIB-MMG for developing DIB-DBT in this study. Training of DIB-DBT consists of two stages - semi-supervised pre-training with partially-annotated large-scale MMG followed by fully-supervised fine-tuning with fully-annotated small-scale DBT. Residual network for image recognition is used as a baseline model. Diagnostic accuracy of DIB-DBT was assessed using receiver operating characteristic analysis.

RESULTS

Area under the curve (AUC) on the internal validation dataset of DIB-DBT with and without the pre-training stage of DIB-MMG was 0.9227 and 0.9081, respectively. AUC of the external validation dataset of DIB-DBT with and without the pre-training stage of DIB-MMG was 0.9710 and 0.9232, respectively.

CONCLUSION

This study showed the feasibility of DIB-DBT as a screening tool for breast cancer detection in DBT. This research also showed the potential of DIB-MMG as a base model for DIB-DBT. Further clinical validation of DIB-DBT is needed for using it as a reliable screening tool for breast cancer screening.

CLINICAL RELEVANCE/APPLICATION

With further clinical validation, DIB-DBT could be practically used as a second-reader to help radiologists detecting and diagnosing breast cancer in DBT efficiently.

SSK02-09 Improved Performance of Machine Learning-Based Analysis of Mammography by Using Digital Breast Tomosynthesis Versus 2D Mammography

Wednesday, Nov. 28 11:50AM - 12:00PM Room: E451B

Participants
Bill Lotter, Boston, MA (*Abstract Co-Author*) Officer, DeepHealth Inc
Jerrold L. Boxerman, MD, PhD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
A. Gregory Sorensen, MD, Belmont, MA (*Presenter*) Employee, DeepHealth, Inc; Board member, IMRIS Inc; Board member, Siemens AG; Board member, Fusion Healthcare Staffing; Board member, DFB Healthcare Acqusitions, Inc; Board member, inviCRO, LLC;

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PURPOSE

Digital Breast Tomosynthesis (DBT) has been shown to be clinically superior to both full-field digital mammography and synthetic two-dimensional mammography (2D) for breast cancer detection. However, few studies to date have compared machine learning (ML) algorithmic performance in DBT versus 2D in large data sets. Technically, the much larger size of a DBT acquisition could actually be a hindrance for training convolutional neural networks (CNNs), for example via overfitting. Such technical issues could in turn imply impracticality of ML for DBT or a need for much larger training datasets. We sought to implement CNNs for both DBT and synthetic 2D X-ray mammograms and compare their performance.

METHOD AND MATERIALS

We compiled two separate datasets consisting of de-identified images and linked reports, collected from multiple mammography centers following an IRB-approved protocol. Data originated from equipment from the same manufacturer across all sites, and included presentation DBT and synthetic 2D images. We developed a novel CNN architecture and trained this model on the first dataset consisting of 22,000 DBT studies (323 cases of confirmed malignancy), where radiology reports and MQSA outcome data were used as estimates of ground truth. To simulate a more realistic evaluation scenario, the CNN was then tested on the second dataset collected from a different center. Using a test set of 1,750 screening DBT studies (94 confirmed cancers), receiver operating characteristic (ROC) curves and the corresponding area-under-the-curve (AUC) were calculated on both the full DBT study, and on just the synthetic 2D data alone.

RESULTS

AUC values for performance on the test dataset were: 2D: 0.894. DBT: 0.915. ($p < 0.01$ for difference between 2D and DBT on the full test dataset). At typical operating points (sensitivity 0.75 to 0.90) this corresponds to an average 19.6% relative decrease in model callback rates for the model (e.g., at sensitivity=0.8, from ~15% to ~11%).

CONCLUSION

ML can be applied successfully to DBT and results in improved performance over synthetic 2D mammography.

CLINICAL RELEVANCE/APPLICATION

Machine learning could play an important role in screening mammography, not only for traditional 2D mammography, but also when used with DBT; thus, ML is not in conflict with DBT but complementary and could further improve breast cancer screening performance.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

VW42

Wide-angle Digital Breast Tomosynthesis and Contrast Enhanced Mammography Self-guided Reading Sessions: Siemens Healthineers Vendor Workshop

Wednesday, Nov. 28 10:30AM - 5:00PM Room: Booth 5530

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 and contrast enhanced mammography cases presented as problem cases with a solution enables you to develop and test your reading skills.

VW43

Automated Breast Volume Scanner (ABVS) Self-guided Reading Sessions: Siemens Healthineers Vendor Workshop

Wednesday, Nov. 28 10:30AM - 5:00PM Room: Booth 5530

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.

VW67

Integrating Contrast Enhanced 2D Imaging into Your Practice to Optimize Patient Care: Hologic Vendor Workshop

Wednesday, Nov. 28 10:30AM - 11:30AM Room: Booth 5524

Participants

Matthew Covington, MD, St. Louis, MO (*Presenter*) Nothing to Disclose

Program Information

Explore the benefits of adding contrast enhanced mammography to your practice. Discussion will highlight: • Cost effectiveness • Patient contraindications • Alternative to bMRI (I-View™ Software, SecurView® Workstations)

Registration

https://hologicrsna.com

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November 25–30 | McCormick Place, Chicago

ML42

Machine Learning Theater: AI-driven Mammography: Applying the Right Filter: Presented by Densitas, Inc.

Wednesday, Nov. 28 11:30AM - 11:50AM Room: Machine Learning Showcase North Hall

Participants
Ryan Duggan, Halifax, NS (*Presenter*) Nothing to Disclose
Mohamed Abdolell, MSc, Halifax, NS (*Presenter*) Founder and CEO, Densitas Inc

PROGRAM INFORMATION

Densitas builds machine learning and AI solutions for breast screening that provide actionable information for radiologists and technologists to help improve existing workflows and quality, and lead to better care for patients.

VW45

Automated Breast Volume Scanner (ABVS) Physician Training Workshop: An Interactive Learning Experience: Siemens Healthineers Vendor Workshop

Wednesday, Nov. 28 11:40AM - 12:50PM Room: Booth 5530

Participants

Ingolf Karst, MD, Chicago, IL (*Presenter*) Nothing to Disclose

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 unique coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

VW68

A Clinical Perspective on Increasing Confidence with Synthesized 2D Imaging Technology: Hologic Vendor Workshop

Wednesday, Nov. 28 12:00PM - 1:00PM Room: Booth 5524

Participants

Jacqueline S. Holt, MD, Wilmington, DE (*Presenter*) Nothing to Disclose

Program Information

Clinical perspective of Synthesized 2D Imaging Technology to increase reading confidence. This session includes a facilitated review of relevant cases.

Registration

https://hologicrsna.com

BRS-WEA

Breast Wednesday Poster Discussions

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

BR

AMA PRA Category 1 Credit ™: .50

Participants
Stamatia V. Destounis, MD, Scottsville, NY (*Moderator*) Research Grant, Hologic, Inc; Research Grant, Delphinus Medical Technologies, Inc

Sub-Events

BR254-SD-WEA1 Associations Between Magnetic Resonance Imaging (MRI) Biomarkers and Tumor-Infiltrating Lymphocytes (TILs) in Breast Cancer: Results from a Preliminary Study

Station #1

Participants
Elena Venturini, MD, Milan, Italy (*Presenter*) Nothing to Disclose
Marta Maria Panzeri, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Claudio Losio, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Silvia Ravelli, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesca Gallivanone, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Pietro Panizza, Milan, Italy (*Abstract Co-Author*) Speaker, Koninklijke Philips NV; Research Grant, Koninklijke Philips NV

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PURPOSE

TILs reflect the attempt of the host immune system to eradicate malignancies and own an interesting prognostic value in breast cancer. Our purpose is to assess the role of multiparametric breast MRI in the prediction of the presence of TILs.

METHOD AND MATERIALS

We retrospectively reviewed the examinations of patients who underwent a multiparametric breast MRI from 01/2015 to 04/2017 and fulfill the following inclusion criteria: invasive ductal carcinoma histotype, core needle/VABB performed at our Institute with TILs evaluation, mass-like lesion at breast MRI. MRI protocol included T2, diffusion-weighted imaging (DWI) and dynamic contrast-enhanced (DCE) study (1.5T). The immunohistochemical and histologic data were evaluated on core biopsies by experienced pathologists. On T2 presence of intratumoral necrosis, pseudocapsule and perilesional edema was assessed. On subtracted images presence of early peripheral and delayed rim enhancement (DRE) was recorded. DWI, DCE and T2 images were analyzed using OLEA software; tumor VOIs were manually depicted slice by slice avoiding necrosis. The software generated histograms for each VOIs and first order texture parameters were obtained. Univariate and multivariate regression analyses were performed.

RESULTS

The study population was composed by 45 women with 47 breast carcinomas (23 G1-G2 24 G3; 19/47 40% HER2- luminal, 23/47 26% HER2+, 16/47 34% triple negative). The presence of TILs was significantly associated to high tumor grade and molecular subtype quale ? ($p<0,05$). A significant association was found between TILs and DRE ($p<0,05$). A correlation was found between presence of TILs and lower mean ADC (Apparent Diffusion Coefficient) ($p<0,05$), higher ADC skewness and kurtosis ($p<0,05$). Focusing on G3 and TN tumors the association between the presence of TILs and DRE or lower mean ADC remained significant ($p<0,05$). At multivariate analysis, the variables associated to presence of TILs are tumor grade, DRE and mean ADC ($p<0,05$).

CONCLUSION

The results of our exploratory study provide a new insight into the relationships between MRI biomarkers and tumor environment. The presence of TILs seems to be related to lower mean ADC, reflecting an increased cellularity in the tumoral stroma.

CLINICAL RELEVANCE/APPLICATION

Multiparametric MRI may provide new insights into breast cancer micro-environment suggesting the presence of Tumor-Infiltrating Lymphocytes.

BR255-SD-WEA2 Patient and Tumor Characteristics to Predict the Benefit of Pre-Operative Breast MRI: Results from a Machine Learning Approach at a High Volume Academic Center

Station #2

Awards
Student Travel Stipend Award

Participants
Safia H. Cheeney, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Habib Rahbar, MD, Seattle, WA (*Abstract Co-Author*) Research Grant, General Electric Company
Daniel S. Hippe, MS, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Grant, General Electric

Company; Research Grant, Canon Medical Systems Corporation; Research Grant, Siemens AG
Yifan Wu, MS, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Christoph I. Lee, MD, Mercer Island, WA (*Abstract Co-Author*) Research Grant, General Electric Company; Investigator, General Electric Company
Savannah C. Partridge, PhD, Seattle, WA (*Abstract Co-Author*) Research Grant, General Electric Company

PURPOSE

Pre-operative breast MRI (pMRI) is a powerful tool for identifying additional mammographically occult disease in women newly diagnosed with breast cancer. However, it also prompts many unnecessary biopsies, which are costly and can lead to treatment delays. Surgeons vary in their use of pMRI, often basing their decisions on breast density, age, and tumor type without evidence to support these approaches. We sought to identify patient and tumor characteristics that can predict which patients benefit from pMRI using a machine learning approach.

METHOD AND MATERIALS

In this IRB-approved retrospective study, we identified all patients who underwent pMRIs (1/2005-2/2015) less than 6 months after a core needle biopsy (CNB) diagnosis of breast cancer from our prospectively populated MRI database linked to pathology outcomes. CNBs that occurred after pMRI were classified by worst outcome (invasive>DCIS>high-risk>benign). Patient and tumor features, including age, density, tumor type, grade, hormone receptor, HER2, and Ki-67 were also extracted from the database. The LASSO machine learning algorithm was used to generate multivariate models using these factors to predict additional, true positive (TP) (DCIS or invasive breast cancer), and false positive (FP) (benign or high-risk pathology) CNBs after pMRI. The resulting models were internally validated using the bootstrap with overall performance summarized using the c-statistic.

RESULTS

1396 women underwent pMRI during the study period, and 30% underwent a pMRI-prompted CNB (13% TP, 17% FP). While women with dense breasts more often underwent pMRI-prompted CNB (32% vs 26%, p=0.02) with greater FP CNB rates (19% vs 14%, p=0.02), there was no significant difference in TP CNB rate (13% vs 12%, p=0.6). During multivariate analysis, the LASSO selected age, density, and HER2 status for predicting additional CNBs and FP CNBs; however, overall prediction performance was low (c-statistics 0.55 and 0.56, p<0.05). The LASSO did not find any factors with sufficient predictive value to create a model for predicting TP CNBs.

CONCLUSION

Our study demonstrates that clinical features, including age, density, and tumor features are weak predictors of who will benefit most from pMRI.

CLINICAL RELEVANCE/APPLICATION

Pre-operative breast MRI is not more or less likely to benefit patients based on patient age, breast density, or tumor characteristics and should not be denied to patients solely on these factors.

BR256-SD-WEA3 Peritumoral Fat Content Correlates with Histologic Prognostic Factors in Breast Carcinoma: Iterative Decomposition of Water and Fat with Echo Asymmetry and Least-Squares Emission (IDEAL) Study

Station #3

Participants
Sachi Hisanaga, MD,PhD, Fukuoka, Japan (*Presenter*) Nothing to Disclose
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Masanori Hisaoka, MD, Kitakyushu, Japan (*Abstract Co-Author*) Nothing to Disclose
Toshiyuki Nakayama, Kitakyushu, Japan (*Abstract Co-Author*) Nothing to Disclose
Yukunori Korogi, MD, PhD, Kitakyushu, Japan (*Abstract Co-Author*) Nothing to Disclose
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Yoshiko Hayashida, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Breast cancer cells express receptors for adipokines secreted by adipocytes, which can affect tumor growth. In vitro and in vivo data indicate that adipocytes are modified by cancer cells to acquire characteristics different from naive adipocytes (cancer-associated adipocytes: CAAs). Histologically, CAAs located around breast cancer display smaller sizes and are less lipid. The purpose of this study is to correlate peritumoral fat content using IDEAL with histologic prognostic factors in breast carcinoma.

METHOD AND MATERIALS

This study consisted of 100 patients who were diagnosed with invasive carcinoma of breast and underwent breast MRI including IDEAL before surgery. The scan time of IDEAL fat fraction (FF) map imaging was 23 sec. Four regions of interests (ROIs), which are a distance of 5mm from the tumor edge, and 4 ROIs in the mammary fat of the healthy side were set on the FF map. Then average peri-tumoral FF values (FT), average FF values in the healthy side (FH), and peri-tumoral fat ratio (pFTR: defined as FT/FH) were calculated. Histologically, the presence of lymph node metastasis and the MIB-1 index were evaluated by 2 pathologists.

RESULTS

FT and pTFR for breast carcinoma with lymph node metastasis (79.27±10.36 and 0.897±0.078) were significantly lower than those without (86.23±4.53 and 0.945±0.032) (p<.001 and p=.005). Spearman rank correlation suggested that the FT correlated with the MIB1 index (r=-340, p=.001).

CONCLUSION

The peritumoral fat content calculated with IDEAL is associated with the histologic prognostic factors, and may therefore be a useful prognostic biomarker for breast carcinoma.

CLINICAL RELEVANCE/APPLICATION

In vivo IDEAL imaging is simple to perform without extrinsic contrast agent and the quantification of the peritumoral FF using IDEAL

may be useful for therapeutic strategy for breast carcinoma.

BR257-SD-WEA4 Cancer Detection Rate for Stereotactic Biopsies Performed on Initially Categorized BI-RADS 3 Calcifications

Station #4

Participants
Monica Froicu, MD, Danville, PA (*Presenter*) Nothing to Disclose
Katherine Chung, Scranton, PA (*Abstract Co-Author*) Nothing to Disclose
Margarita L. Zuley, MD, Pittsburgh, PA (*Abstract Co-Author*) Investigator, Hologic, Inc

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PURPOSE

To determine the malignancy rate and indications for biopsy of calcifications initially categorized as BI-RADS 3 and converted to BI-RADS 4/5 during the ensuing surveillance period.

METHOD AND MATERIALS

Following IRB approval, our Radiology Information System (RIS) was searched for all BI-RADS 4/5 categorized mammograms performed from January 1, 2013 to July 30, 2016 that underwent stereotactic biopsy and had been classified as BI-RADS 3 for calcifications within the prior 2 years. Data collected included: patient age, prior biopsies, personal/family history of breast cancer, pathogenic mutations, breast density, calcification morphology, extent, distribution and increase in size or change in morphology during surveillance. BI-RADS scores changed from 3 to 4/5 with no change in the grouping were categorized as difference in interpretation.

RESULTS

The search identified 162 patients with mean age 55.7 (range 32-81) years. 55% (90/162) were heterogeneously dense, 15% (25/162) had personal history and 17.8% (29/162) had family history of breast cancer, none had pathogenic mutations and 14% (23/162) had prior benign biopsies. The average BI-RADS conversion time was 9.5 months with 41.9 % (69/162) changed at 6 months. Change was due to increasing calcifications in 42.3% (69/162), morphology change 9.8% (16/162), distribution change 2.4% (4/162) or difference in interpretation 16.6% (27/162). Distribution was 78.4% (127/162) grouped, 11.11% (18/162) regional, 10.5% (17/162) linear, 1.2% (2/162) segmental, 0.6% (1/162) diffuse. PPV at biopsy was 11.7 % (19/162) including 13 DCIS and 6 invasive carcinomas. There were 67.2% (109/162) benign and 20.9% (34/162) high risk lesions 2 of which were upgraded to low grade DCIS at surgery.

CONCLUSION

Calcifications initially classified as BI-RADS 3 that increase in number or change in morphology during surveillance have a significant upgrade rate to malignancy.

CLINICAL RELEVANCE/APPLICATION

BI-RADS 3 lesions that change during surveillance should undergo biopsy.

BR258-SD-WEA5 Radiologists versus Deep Learning Model Inter-Observer Variability in Mammographic Breast Density Assessment

Station #5

Participants
Brian N. Dontchos, MD, Boston, MA (*Presenter*) Nothing to Disclose
Regina Barzilay, PhD, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose
Adam Yala, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose
Tal Schuster, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose
Kyle Swanson, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Manisha Bahl, MD,MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Christine E. Edmonds, 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

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PURPOSE

Qualitative breast density assessment by radiologists is highly variable and currently available automated quantitative tools are limited. Our purpose was to evaluate the inter-observer variability amongst radiologists vs our deep learning (DL) model in mammographic breast density assessment.

METHOD AND MATERIALS

Four expert radiologists independently assessed BI-RADS density on a random subset of 100 screening mammograms, blinded to the original radiologist's assessment. Our DL model (previously reported) was trained and tested using a deep convolutional neural network on 50,071 consecutive digital screening mammograms performed June 2009 to June 2014 to predict the original radiologist's assessment. We estimated both our DL model agreement and our radiologists blinded reader agreement with the original radiologist's density assessment using percent agreement with Wilson confidence intervals (CI) and with linear-weighted kappa statistics, compared across 5,000 bootstrap samples to assess significance.

RESULTS

Radiologist agreement with the original assessment was 80.5% (95% CI 76.8, 84.5) for binary assessment (dense vs not dense) and was 66.3% (95% CI 61.5, 70.9) for 4-category density assessment. Our DL model agreement for the same cases was 85.0% (95%

CI of 76.7, 90.7) for binary assessment and 71.0% (95% CI of 61.5, 79.0) (p>0.05 for each comparison). Compared to the original density assessment, our DL model showed substantial agreement (K=.61, 95% CI .49-.74) compared to moderate agreement by radiologists (K=.57, 95% CI .50- .63).

CONCLUSION

Our DL model can accurately and consistently assess breast density, particularly into clinically relevant dense vs non-dense categories.

CLINICAL RELEVANCE/APPLICATION

Implementation of a deep learning model that accurately and consistently assesses breast density could lead to more precise identification of women who might benefit from supplemental imaging.

BR259-SD-WEA6 Convolutional Neural Network Based Breast Cancer Risk Stratification Using a Mammographic Dataset

Station #6

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PURPOSE

We propose a novel convolutional neural network (CNN) based pixel-wise breast cancer risk model using a mammographic dataset.

METHOD AND MATERIALS

An IRB approved retrospective case-control study of 1474 mammographic images was performed in average risk women. First, 210 patients with new incidence of breast cancer were identified. Mammograms from these patients at least two years prior to developing breast cancer were identified and made up the case group [420 bilateral craniocaudal (CC) mammograms]. The control group consisted of 527 patients without breast cancer from the same time period. Prior mammograms from these patients made up the control group [1054 bilateral CC mammograms]. A CNN architecture was designed for pixel-wise breast cancer risk prediction. Briefly, each mammogram was normalized as a map of z-scores and resized to an input image size of 256x256. Then a contracting and expanding fully convolutional CNN architecture was composed entirely of 3x3 convolutions, a total of four strided convolutions instead of pooling layers, and symmetric residual connections. L2 regularization and augmentation methods were implemented to prevent overfitting. Cases were separated into training (80%) and test sets (20%). Fivefold cross validation was performed.

RESULTS

The average age of patients between the case and the control groups was not statistically different [case: 57.4 years (SD, 10.4) and control: 58.2 years (SD, 10.9), p=0.33]. Mammographic breast density (BD) was significantly higher in the case group [2.39 (SD, 0.7)] than the control group [1.98 (SD, 0.75), p<0.0001]. On multivariate logistic regression analysis, both CNN pixel-wise mammographic risk model and BD were significant independent predictors of breast cancer risk (p < 0.0001). The CNN risk model showed greater predictive potential [OR=4.42 (95% CI, 3.4-5.7] compared to BD [OR =1.67 (95%CI, 1.4 -1.9). The CNN risk model achieved an overall cross validation accuracy of 72% (95%CI, 69.8-74.4%) in predicting patients in the case group.

CONCLUSION

A novel pixel-wise CNN architecture can stratify breast cancer risk in mammography, independent of the BD. A larger dataset will likely improve our model.

CLINICAL RELEVANCE/APPLICATION

Personalized breast cancer risk stratification may be aided by using a novel pixel-wise CNN model. This may have clinical implications in screening guidelines.

BR260-SD-WEA7 The Significance of Asymmetries in Screening Mammograms with Digital Breast Tomosynthesis

Station #7

Awards

Student Travel Stipend Award

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PURPOSE

Digital breast tomosynthesis (DBT) can result in significantly decreased recall rate (RR) of screening mammograms. However, asymmetries remain one of the most frequently recalled abnormalities and a major source of false positives. The purpose of this study is to determine the significance and characteristics of asymmetries detected in DBT screening and their diagnostic work up to

aid in further reducing false positive findings on DBT.

METHOD AND MATERIALS

In this retrospective Institutional Review Board approved study, we reviewed all DBT screening mammograms performed from 10/1/2014 through 9/30/2016 at our academic center. The number of recalled exams and type of recalled abnormalities were identified. For each recalled asymmetry, imaging characteristics, diagnostic work up, biopsy, and imaging follow up were documented. RR and positive predictive value (PPV1, PPV2, and PPV3) of asymmetries were calculated. The characteristics of true and false positive asymmetries were compared.

RESULTS

Of 15620 DBT screening mammograms, 1100 exams were recalled for further evaluation (overall RR=7.04%). 482 asymmetries were recalled in 440 exams (asymmetry RR=3.09%). The false positive rate of recalled asymmetries was 97.93% with only 10 true positive cancers (asymmetry PPV1=2.07%). There was a significant difference in cancer yield of "developing" asymmetries (7%) versus asymmetries not otherwise specified (1.2%) (p=0.002). Focal asymmetries had higher cancer yield (3.3%) compared to asymmetries seen only on one view (1.3%), but the difference was not significant (p=0.19). The majority of true positive asymmetries (9 out of 10) had a suspicious ultrasound correlate at the time of first diagnostic work up and underwent ultrasound guided biopsy yielding invasive carcinoma. Only one case of ductal carcinoma in situ did not have an immediate sonographic correlate.

CONCLUSION

Asymmetries recalled on DBT screening have a high false positive rate. Identifying asymmetries with a higher cancer yield such as developing asymmetries may further reduce RR while preserving the cancer detection rate. In addition, our findings suggest that follow up imaging of recalled asymmetries without suspicious ultrasound correlates may not be necessary.

CLINICAL RELEVANCE/APPLICATION

Given the relatively high RR and low PPV1 of asymmetries on DBT screening, efforts can be made towards reducing recall of benign asymmetries and avoiding unnecessary follow up.

BR199-ED-WEA8 The Forgotten Male Breast: A Comprehensive Review of Male Breast Disease

Station #8

Awards
Certificate of Merit

Participants
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TEACHING POINTS

Although males make up a small percentage of our clinical practice, male breast disease is important to recognize and be familiar with. Gynecomastia is the most common disease affecting males. However, there is a wide spectrum of other conditions which can also occur in the male breast. Two major teaching points the learner should accomplish by viewing this exhibit is: 1) To become familiar with the appearance and work up of gynecomastia 2) To become familiar with the numerous other conditions that affect the male breast

TABLE OF CONTENTS/OUTLINE

This is an educational exhibit demonstrating the spectrum of disease in the male breast. The exhibit will include the following cases seen in the male breast at our institution and will be presented with a brief history and pertinent mammographic and sonographic images. 1. Unilateral gynecomastia 2. Bilateral gynecomastia 3. Pseudogynecomastia 4. Epidermal inclusion cyst 5. Abscess 6. Hematoma 7. Lipoma 8. Hibernoma 9. Intraductal papilloma and ductal carcinoma in situ 10. Papillary carcinoma 11. Metastatic infiltrating ductal carcinoma 12. Infiltrating ductal carcinoma and ductal carcinoma in situ 13. Lymphoma 14. Transgender male to female breast after hormone replacement therapy

BR200-ED-WEA9 What the Breast Radiologist Needs to Know About Imaging Transgender Patients

Station #9

Awards
Identified for RadioGraphics

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TEACHING POINTS

There is increasing awareness of the need for optimal breast imaging approaches for transgender individuals, as well as for evidence-based understanding of transgender breast cancer risk. In this case-based review, we will focus on screening and diagnostic imaging scenarios involving transgender individuals and will also explore what is known about breast cancer risk and

breast cancer detection in the transgender population.

TABLE OF CONTENTS/OUTLINE

1. Intro a. Define "transgender" i. Terminology: transgender, transsexual, male-to-female (MtF), female-to-male (FtM)2. Mammographic screeninga. Review of literature/paucity of datab. Screening and risk factors i. Exogenous Hormone use (MtF)ii. Breast densityiii. Residual breast tissue (FtM)iv. Risk associated with natal sexv. High risk mutations and family historyc. Screening and suggested guidelinesi. UCSF Center of Excellence for Transgender Healthii. Fenway Guide3. Diagnostic imaging a. Review of the literatureb. Diagnostic scenarios with attention to pearls and pitfalls i. Hormone related symptoms and imagingii. Altered breast 1. Augmentation/silicone injections (MtF)2. Post-mastectomy (FtM)4. Special considerations and challengesa. Healthcare access and public educationb. Patient and physician awareness

BR201-ED-WEA10 Unilateral Palpable Male Breast Lump: What Is Underneath!

Station #10

Participants
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TEACHING POINTS

Broad range of lesions from benign to malignant can present in male breast as palpable mass. The purpose of this scientific exhibit is: 1. To describe the imaging findings of various lesions that present as unilateral masses. 2. To help the viewer learn an imaging pattern-based approach to develop a reasonable differential diagnosis and in many cases make the specific diagnosis. 3. To familiarize the viewer with those imaging findings which can be definitely considered benign, require no further work-up and to familiarize from those findings which should be considered sufficiently suspicious or indeterminate to warrant further work-up.

TABLE OF CONTENTS/OUTLINE

The contents of this exhibit will be organized as follows with short discussions, illustrated examples and images: 1. Male breast anatomy 2. Imaging work-up Algorithm 3. Categories: A. Skin and subcutaneous tissues origin: Sebaceous cyst/epidermal inclusion cyst -Lipoma -Angiolipoma -Hematoma -Fat necrosis -Oil cyst B. Glandular and Stromal elements origin: -Gynecomastia -Pseudogynecomastia -Pseudoangiomatous stromal hyperplasia -Myofibroblastoma -Hemangioma -Mason tumor -Schwanomma -Granular cell tumor -Fibroadenoma -Abscess C. Malignancies: -Invasive ductal carcinoma -Recurrent breast carcinoma -Lymphoma -Angiosarcoma -Metastasis

BR202-ED-WEA11 Multimodality Imaging of Lobular Neoplasia: Review of Imaging Features and Updates on Controversies in Management

Station #11

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TEACHING POINTS

Atypical lobular hyperplasia (ALH) and lobular carcinoma in situ (LCIS) are noninvasive proliferations of lobular cells. The term 'lobular neoplasia' (LN) is used to encompass both ALH and LCIS. LN is not an obligate precursor of invasive carcinoma. However, LN is associated with increased risk of developing invasive carcinoma or ductal carcinoma in situ in either breast. Usually incidental findings at core needle biopsy, LN has no reliable imaging features attributable to them. Knowing the most common imaging findings of LN on mammography, ultrasound, and MRI is important to understand if there is imaging-histologic concordance or discordance as this will affect management. The management of incidental ALH and LCIS at core biopsy is controversial and ranges from immediate surgical excision to monitoring with clinical and imaging evaluation.

TABLE OF CONTENTS/OUTLINE

Review the definition of ALH and LCIS and their distinction on histopathology. Describe LN's natural history, its clinical significance, and its associated increased risk of developing invasive cancer and DCIS. Demonstrate the most common imaging findings of LN on mammography, ultrasound, and MRI using a case-based approach. Examine the different strategies and controversies for management of LN including surgical excision, chemoprevention, and monitoring with imaging.

BR203-ED-WEA12 Inserting Colors into the Diagnosis: When Doppler Makes the Difference in Breast Ultrasound

Station #12

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TEACHING POINTS

1- Review types of lesion vascularity and their blood flow characteristics 2-Describe the importance of color Doppler to distinguish solid and cystic lesions, including complicated and complex cysts, as well as assessing vascular lesions.3- Correlate the amount and distribution of blood-flow in breast lesions and their tendency to malignancy.4- Describe how color and pulsed-wave Doppler can influence BIRADS classification as an associated feature, and consequently the patient's management and prognosis.

TABLE OF CONTENTS/OUTLINE

1. Doppler as an associated feature in the BI-RADS classification2. Imaging aspects of lesion vascularity and its assessment by power/ color Doppler, and pulsed-wave Dopplerinternal and rim-like vascularitynumber of vesselsblood-flow velocityintra-tumoral vessel resistance3. Applicability of color Doppler in the evaluation of breast lesionsCorrelation of blood flow and lesion suspiciousnessCan vascularity evidence in a breast lesion change its BI-RADS category?4. Illustration of vascular breast lesions, including:Cystic lesionsSolid lesionsVascular lesionsNon-mass lesions

BRS-WEB

Breast Wednesday Poster Discussions

Wednesday, Nov. 28 12:45PM - 1:15PM Room: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

Participants
Stamatia V. Destounis, MD, Scottsville, NY (*Moderator*) Research Grant, Hologic, Inc; Research Grant, Delphinus Medical Technologies, Inc

Sub-Events

BR261-SD-WEB1 Utility of Targeted Ultrasound for the Evaluation of Palpable Breast Symptoms in Breastfeeding Women

Station #1

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PURPOSE

To determine the accuracy of targeted breast ultrasound as the primary imaging modality for the evaluation of palpable symptoms in breastfeeding women.

METHOD AND MATERIALS

A retrospective database review identified all breastfeeding women with a palpable symptom evaluated by targeted breast ultrasound over a 15-year period (1/1/2000 -1/1/2015) at an academic facility. No patients were pregnant at time of imaging. Each palpable site was designated as a case and all analyses were performed at the case level. BI-RADS assessments and lesion characteristics were obtained from review of the radiology reports. Malignant outcomes were determined by pathology results. Benign outcomes were determined by biopsy or >2 years clinical or imaging follow-up. Descriptive statistics and 2x2 contingency table analyses were performed.

RESULTS

The final study cohort consisted of 139 palpable cases in 119 patients. Mean age was 36, and 24% were at least 40-years-old. Sixty-three (45%) underwent targeted ultrasound alone and 76 (55%) underwent mammography in addition to ultrasound. On ultrasound, 53 had no sonographic correlate (BI-RADS 1), 41 had benign findings (BI-RADS 2), and 3 were probably benign (BI-RADS 3). In the 42 positive ultrasound cases, 39 were suspicious (BI-RADS 4) and 2 were highly suggestive of malignancy (BI-RADS 5). The most common biopsy results were galactocele, lactating adenoma, and lactational change. Frequency of malignancy was 1.4% (n=2), and all malignancies were assessed as BI-RADS 5. Targeted ultrasound had high sensitivity (100%) and NPV (100%), but limited specificity (71%) and low PPV2 (5%). In cases with mammography, 95% had heterogeneously or extremely dense breasts. The addition of mammography yielded no additional cancers, and mammography missed one sonographically identified malignancy. Mammography detected 7 false positive lesions unrelated to the palpable symptom.

CONCLUSION

Targeted ultrasound detected all malignancies in breastfeeding patients with palpable symptoms. The addition of mammography increased false positives and yielded no additional cancers. Our results suggest that targeted ultrasound alone may be sufficient for evaluation of symptomatic breastfeeding women.

CLINICAL RELEVANCE/APPLICATION

Current literature on breast imaging for symptomatic lactating women is sparse, and practice patterns vary widely. Our results support the use of ultrasound as the primary imaging modality in this setting.

BR262-SD-WEB2 Ductal Carcinoma in Situ Detected on Ultrasound Only Showed More Favorable Features Than Ductal Carcinoma in Situ Detected on Mammography in Asymptomatic Women with Dense Breasts

Station #2

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PURPOSE

To compared the clinical and pathological characteristics of ductal carcinoma in situ detected on mammography and ultrasound (US) in asymptomatic patients with dense breasts.

METHOD AND MATERIALS

From February 2014 to September 2016, 236 asymptomatic patients with primary pure ductal carcinoma in situ and dense breasts were included. The patients were classified into two groups. The mammography group (n=165) included patients with ductal carcinoma in situ detected on mammography, and the US group (n=71) included patients with ductal carcinoma in situ detected on US only. Clinico-pathological characteristics were compared between the two groups. Subgroup analyses were performed with a cut-off age of 50 years and a cut-off tumor size of 20 mm.

RESULTS

Tumor size was significantly smaller in the US group (11.8±9.9 mm vs. 17.9±13.8 mm, $p<0.001$). Younger age, smaller tumor size, low nuclear grade, no comedo necrosis, and progesterone receptor positivity were observed more in the US group ($p<0.05$). HER2 and Ki67 positivity were observed more in the mammography group ($p<0.05$). Similar results were found in 168 patients with ductal carcinoma in situ < 20 mm. Regardless of the patient age, smaller tumor size, low nuclear grade, and no comedo necrosis were observed significantly more in the US group.

CONCLUSION

Ductal carcinoma in situ in the US group showed significantly more low nuclear grade, no comedo necrosis, and hormone receptro positivity, while HER2 and Ki67 positivity were observed significantly more in the mammography group. Ductal carcinoma in situ detected on US only showed more favorable prognostic features than ductal carcinoma in situ detedted on mammography in asymptimatic patients with dense breasts.

CLINICAL RELEVANCE/APPLICATION

Ductal carcinoma in situ deteted on US only in asymptomatic patients showed nore favorable prognostic factors than ductal carcinoma in situ detected on mammography.

BR263-SD-WEB3 Is the Contrast Enhanced Mammography an Alternative to Magnetic Resonance Imaging for the Presurgical Evaluation of Tumor Response in Breast Cancer Patients Treated with Neoadjuvant Chemotherapy?

Station #3

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PURPOSE

The neoadjuvant chemotherapy (NAC) is the standard therapeutic strategy for locally advanced breast cancer, allowing to increase the breast conservation rate and it is increasingly being used for patients with early stage breast cancer. The magnetic resonance imaging (MRI) is the most accurate diagnostic tool for assess the residual invasive disease after NAC. The Contrast Enhanced Mammography (CE2D) is a recent imaging method that allows to show if tumor neovascularization exists in the breast parenchyma. To evaluate the CE2D diagnostic accuracy to assess the residual disease extension of breast cancer patients receiving NAC.

METHOD AND MATERIALS

A prospective CE2D study was performed in 43 breast cancer patients treated with NAC from March to December 2017. All patients underwent a CE2D and breast MRI after NAC. The residual tumor size determined by both techniques was correlated with the pathological tumor size of the specimen.

RESULTS

CE2D showed a superior interclass correlation coefficient than MRI (0.9 vs. 0.7). The CE2D sensibility and specificity (83,9% and 83,3% respectively) were high and comparable to the MRI ones (74,2% and 91,6% respectively). Besides, the negative predictive value of the CE2D was higher than the MRI one (66,7% vs. 57,9%) and the positive predictive value was similar (92,9% vs. 95,8%). All these results could lead us to reduce the overall costs of diagnostic tests during the follow-up of breast cancer patients in the neoadjuvant setting. CE2D could even replace pre- and post-treatment MRI studies, particularly for claustrophobic patients.

CONCLUSION

CE2D can replace MRI for the presurgical assessment of residual tumor size as well as on additional breast lessions visualization in the ipsilateral breast or in the contralateral one, and therefore leading to costs savings and better accessibility.

CLINICAL RELEVANCE/APPLICATION

The CE2D could be an effective alternative to MRI for the residual tumor evaluation after neoadjuvant chemotherapy in breast cancer patients. This technique could significantly save costs and improve patient flows. Furthermore, CE2D has almost no contraindications.

BR264-SD-WEB4 Microcalcifications of Ductal Carcinoma in Situ of the Breast: Correlation between Breast Imaging and Pathological and Biological Features

Station #4

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PURPOSE

To evaluate the correlation between microcalcifications of ductal carcinoma in situ (DCIS) visible in breast imaging and pathological and biological features.

METHOD AND MATERIALS

From December 2003 to December 2016, we retrospectively reviewed the mammography findings of 159 lesions of 155 patients who were diagnosed with pure DCIS, and comparable sonographic images of 150 lesions of 146 patients, according to the Breast Imaging Reporting and Data System (BI-RADS) lexicon. Sonographic findings of microcalcifications were divided into three groups compared with mammographic microcalcifications: G1 (MMG -, US -), G2 (MMG +, US -) and G3 (MMG +, US +). Pathological findings (nuclear grades, comedo necrosis) and biological features (ER positive group, HER2 positive group, triple negative group, Ki-67 index) were compared with mammography and sonographic features. P values less than 0.05 were considered statistically significant.

RESULTS

Mammographic microcalcifications were observed in 90 out of 159 lesions (56.6%) of DCIS. Presence of microcalcifications on mammography was significantly more common in high nuclear grade (p=0.001) and comedo necrosis (p=0.001). Fine pleomorphic, fine linear or linear branching microcalcifications is the only morphologic feature that is significantly associated with nuclear grade (p=0.004). Presence of microcalcifications on mammography were significantly associated with ER-negative group (p=0.010), HER2-positive group (p=0.025), and increased Ki 67 index (p=0.001) respectively. Lesions with no visible microcalcifications in ultrasound (G1+G2) were 93 out of 150 lesions (62%) and 57 out of 150 lesions (38.0%) showed microcalcifications in ultrasound (G3). Calcification outside of a mass was the most common feature of sonographic microcalcification (36/150, 25.4%). Presence of microcalcifications in the ultrasound were associated with high nuclear grade (p=0.001), comedo necrosis (p=0.001), ER-negative group (p=0.028), HER2-positive group (p=0.028) and high Ki-67 index (p=0.001).

CONCLUSION

Microcalcifications of DCIS visible on mammography and ultrasound showed statistically significant association with poor pathological and biological features.

CLINICAL RELEVANCE/APPLICATION

When DCIS, precursor of invasive breast cancer, developing to invasive cancer, ER and HER2 status and breast cancer subtype are usually maintained and emphasize the evolution of breast cancer subtype specificity.

BR265-SD-WEB5 Potential of Deep Learning and Conventional Radiomics in the Task of Distinguishing Between Malignant and Benign Breast Lesions in a Large Clinical MRI Dataset from China

Station #5

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PURPOSE

To evaluate the potential of combining deep learning and lesion-based radiomic methods in the task of distinguishing between malignant and benign breast lesions in a large MRI dataset from China.

METHOD AND MATERIALS

Our research involved a HIPAA-compliant, DCE-MRI database of 600 breast cases [average patient ages of the 300 benign and 300 malignant patients were 41.8 and 47.2 years with a standard deviation of 9.5 and 9.6 years, respectively]. MRIs had been obtained using gadodiamide-enhanced T1-weighted spoiled gradient-recalled acquisition in the steady state sequence. A breast radiologist located the lesions on the MRIs as input to our artificial intelligence workflow, which subsequently conducted two analyses. In the first analysis, each lesion was automatically segmented from the surrounding parenchyma, and lesion phenotypes were extracted serving as "lesion-segmented radiomics", including categories of size, shape, morphology, enhancement texture, kinetics, and enhancement-variance kinetics. In the second analysis, transfer learning with a pre-trained deep convolutional neural network (CNN), VGGNet, allowed for the extraction of features derived directly from the MRI data, yielding CNN-based radiomics. Each

method was investigated separately and in combination in the task of distinguishing between malignant and benign lesions, with area under the ROC curve (AUC) serving as the figure of merit.

RESULTS

Both methods yielded promising classification performances with AUC values of 0.88 (se=0.01) and 0.84 (se=0.02) for the lesion-segmented radiomics and the CNN-based radiomics methods, respectively. Combination of the two methods enhanced the performance in malignancy assessment resulting in an AUC value of 0.90 (se=0.01), a statistically significant improvement over the performance of the lesion-segmented radiomics method alone (p=0.0017).

CONCLUSION

Deep learning and lesion-segmented radiomics methods provide different information to the diagnostic classification task as demonstrated by both yielding high but different performance levels, thus promoting the use as a combined predictor of malignancy.

CLINICAL RELEVANCE/APPLICATION

Our computerized combination of deep learning and segmentation-based radiomics CADx methods has potential to help radiologist improve breast cancer diagnostic accuracy.

BR266-SD-WEB6 Performance of Screening Breast MRI According to Different Risk Categories

Station #6

Participants
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PURPOSE

To evaluate screening breast MRI performance according to different risk categories in women at elevated risk of breast cancer

METHOD AND MATERIALS

This retrospective IRB-approved, HIPPA-compliant study included all screening breast MRI examinations performed between 2010 and 2012 in 5039 women (9208 examinations). Risk category were categorized as follows: (1) known BRCA1 or 2 mutation or untested first degree relative of known BRCA carrier (BRCA), (2) history of chest radiation (CR), (3) high (>=20%) lifetime risk (HLR), (4) personal history of breast cancer (PH), and (5) low (<20%) lifetime risk (LLR). Recall rate (BI-RADS assessment 0, 3, 4, or 5), cancer detection rate (CDR), positive predictive value of biopsies performed (PPV3), sensitivity, and specificity were compared for the risk categories.

RESULTS

Of the 9208 MRI examinations, there were 5310 (57.7%) in PH, 2442 (26.5%) in HLR, 973 (10.5%) in BRCA, 257 (2.8%) in LLR, and 226 (2.5%) in CR. 138 cancers were diagnosed, 114 at MRI, 19 at mammography, and 5 interval cancers. Recall rate ranged from 8.6% to 15.6% and the highest recall rate was found in the BRCA group (15.6%; 95% CI: 13.4%, 18.1%). The CDR was highest in the BRCA group (19.5/1000), followed by CR (17.7/1000), HLR (14.3/1000), PH (10.2/1000), and LLR (7.8/1000). The PPV3 was highest in the CR group (36.4%; 95% CI: 10.9%, 69.2%) and lowest in the LLR group (16.7%; 95% CI: 2.1%, 48.4%). Overall sensitivity was 84.1% (95% CI: 76.9%, 89.7%) for all cancers and 84.8% (95% CI: 76.2%, 91.3%) for invasive cancers. Sensitivity was lowest in the BRCA group (79.2%; 95% CI: 57.8%, 92.9%) and higher in the PH group (88.7%; 95% CI: 78.1%, 95.3%) and the LLR group (100%). Specificity was highest in the PH group (92.5%; 95% CI: 91.7%, 93.2%) and lowest in the BRCA group (86.1%; 95% CI: 83.7%, 88.2%).

CONCLUSION

MRI performance differed among women with various risk categories for breast cancer. Recall rate and CDR were highest and sensitivity lowest in the BRCA group. Performance of screening breast MRI in women with PH was similar to that in other high-risk women.

CLINICAL RELEVANCE/APPLICATION

Screening MRI may be possibly expanded to women at intermediate risk of breast cancer such as a personal history of breast cancer or high-risk lesion.

BR267-SD-WEB7 Multi-reader Multi-case Virtual Clinical Trial of Lesion Detection in Digital Mammography and Digital Breast Tomosynthesis

Station #7

Participants
Andrew D. Maidment, PhD, Philadelphia, PA (*Presenter*) Research support, Hologic, Inc; Research support, Barco nv; Research support, Analogic Corporation; Spouse, Employee, Real-Time Tomography, LLC; Spouse, Stockholder, Real-Time Tomography, LLC; Scientific Advisory Board, Real-Time Tomography, LLC;
Predrag R. Bakic, PhD, Philadelphia, PA (*Abstract Co-Author*) Research collaboration, Barco nv; Research collaboration, Hologic, Inc;
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Ali N. Avanaki, PhD, Beaverton, OR (*Abstract Co-Author*) Employee, Barco nv
Kathryn S. Espig, MSc, Beaverton, OR (*Abstract Co-Author*) Employee, Barco nv
Albert Xthona, BS, Beaverton, OR (*Abstract Co-Author*) Employee, Barco nv
Susan Weinstein, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Tom Kimpe, Kortrijk, Belgium (*Abstract Co-Author*) Employee, Barco nv

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PURPOSE

To compare detectability of lesions between digital mammography (DM) and digital breast tomosynthesis (DBT) in virtual clinical trials (VCTs) using multi-reader multi-case (MRMC) analysis.

METHOD AND MATERIALS

VCTs were conducted using an open-source VCT pipeline (OpenVCT) with observer modeling software (MeVIC), to assess the detection of masses and microcalcifications in DM and DBT. Twelve breast phantoms were used (simulating 700ml breasts with compressed thickness of 6.33cm) with variations in simulated anatomy. Breast masses were simulated by oblate ellipsoids with various diameter and thickness. Single calcifications were simulated as polycubes with various numbers of 100 µm cubes. A total of 1920 lesions were simulated. A clinical imaging geometry (Selenia Dimensions, Hologic) was simulated; exposure settings were selected to match AEC performance. Mammographic phantom projections were processed and tomosynthesis images reconstructed using commercially available software (Briona, Real-Time Tomography). Lesion detection was modeled by channelized Hotelling observers with 15 Laguerre-Gauss channels and a spread of 22, using independent training and testing sets (each set consisting of 160 ROIs). The detectability of simulated lesions was assessed by the area under the ROC (AUC) using a one-shot MRMC approach, assuming five independently trained observers. Two-sided Students' t-tests were used to test the statistical significance between estimated AUCs.

RESULTS

For detection of simulated calcifications, we observed AUC of 0.802±0.023 and 0.799±0.026, for DM and DBT, respectively; these AUCs do not differ significantly (p=0.856; 95% CI -0.040, 0.034). For the detection of masses, we observed AUC of 0.794±0.022 and 0.900±0.017, for DM and DBT, respectively, which is statistically significant (p<0.001; 95% CI 0.089, 0.124). Our observations show close agreement with clinical results by Rafferty et al., who obtained AUC difference of 0.025 and 0.096, for calcifications and masses respectively.

CONCLUSION

VCTs have demonstrated significant improvement in the detection of masses between DM and DBT, while AUCs for simulated microcalcifications did not differ, in close agreement with published clinical results.

CLINICAL RELEVANCE/APPLICATION

We have demonstrated that virtual clinical trials can predict the clinical performance improvements seen with DBT over DM in the detection of breast masses and microcalcifications.

BR205-ED-WEB8 Interval Breast Cancers in the Era of Precision Medicine: A Multimodality Approach

Station #8

Participants
Sarah G. Mizuguchi, MD, Louisville, KY (*Abstract Co-Author*) Nothing to Disclose
Lane M. Roland, MD, Louisville, KY (*Abstract Co-Author*) Nothing to Disclose
Stacey M. Crawford, MD, Louisville, KY (*Abstract Co-Author*) Nothing to Disclose
Elizabeth Riley, MD, Louisville, KY (*Abstract Co-Author*) Nothing to Disclose
Mary Ann Sanders, MD,PhD, Louisville, KY (*Abstract Co-Author*) Nothing to Disclose
Jason D. Messinger, MD, ST LOUIS, MO (*Presenter*) Nothing to Disclose

TEACHING POINTS

1. Review the definition of interval breast cancers and how they present. 2. Display imaging findings of interval cancers. 3. Discuss how interval breast cancers typically have a worse prognosis. 4. Review receptor sensitivity, with histopathologic correlation, to correlate with prognosis. 5. Review the current trend of precision medicine with medical oncology perspective. 6. Highlight the role of the radiologist in precision medicine for breast cancer.

TABLE OF CONTENTS/OUTLINE

Interval breast cancer subtypes - true negative, false negative, occult, minimal sign - prognosis of interval cancers vs screen detected - imaging findings Receptor sensitivity and tumor marker - review ER, PR, HER2 - Luminal A, Luminal B, HER2 enriched, and Normal like - Ki-67 - histopathologic correlation Review of precision medicine - history - how receptor sensitivity influences treatment - treatment strategies and outcomes from medical oncology persepctive Case examples to include imaging, histopathology, and treatment with multimodality approach Summary

BR206-ED-WEB9 A Wolf in Sheep's Clothing: Cancer Masquerading as a Benign-appearing Breast Mass

Station #9

Awards
Certificate of Merit

Participants
Lindsey Storer, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Cheryce P. Fischer, MD, Santa Monica, CA (*Abstract Co-Author*) Nothing to Disclose
Stephanie A. Lee-Felker, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Melissa M. Joines, MD, Santa Monica, CA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Although most circumscribed breast masses are benign, up to 10-20% of breast malignancies can be relatively circumscribed. Invasive ductal carcinoma, not otherwise specified, is the most common form of breast cancer and most often presents as an irregular mass with spiculated margins; however, less common types can present as round or oval masses with predominately circumscribed margins. After reviewing this presentation, participants will: Expand their differential diagnosis of circumscribed breast masses to include less common types of breast cancer, including mucinous carcinoma, medullary carcinoma, papillary carcinoma, malignant phyllodes tumors, and high grade triple negative intraductal carcinoma, as well as lymphoma and metastases; describe the common and distinct imaging characteristics of these tumors; and integrate radiologic assessment with clinical scenario to

provide appropriate BIRADS category and management recommendation.

TABLE OF CONTENTS/OUTLINE

Mutimodality imaging review of the types of breast cancer that more often present as circumscribed masses on 2D and 3D mammography, ultrasound, and MRI with clues that may help favor a specific diagnosis among these entities Epidemiology of these breast cancer subtypes Clinical clues that may aid in diagnosis and review of prognosis Correlation with histologic features

BR207-ED-WEB10 Coming Out: Making Your Breast Imaging Center LGBT Friendly

Station #10

Awards

Certificate of Merit

Participants
Valerie J. Fein-Zachary, MD, Boston, MA (*Presenter*) Nothing to Disclose
Jordana Phillips, MD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company; Consultant, General Electric Company
Hannah Perry, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Nancy Littlehale, 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
Michael D. Fishman, MD, Boston, MA (*Abstract Co-Author*) Consultant, Zebra Medical Vision Ltd
Evguenia J. Karimova, MD, Memphis, TN (*Abstract Co-Author*) Nothing to Disclose
Priscilla J. Slanetz, MD, MPH, Belmont, MA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Diversity and inclusion in healthcare includes respect for and understanding of lesbian, gay, bisexual and transgender (LGBT) people. 2. Improving access to care includes creating a welcoming environment. 3. Improving healthcare outcomes can be achieved as providers increase their knowledge about issues specific to LGBT people and support patients by empowering them. 4. Including lesbian, gay, bisexual and transgender women, and transgender men in breast cancer outcomes research is critical to fill in gaps in medical knowledge.

TABLE OF CONTENTS/OUTLINE

1. Diversity and Inclusion: Understanding Healthcare Disparities in the LGBT population a. Historic discrimination by the medical community b. Factors contributing to health disparities c. Current disparity issues 2. Improving access to care a. Create a welcoming space, with verbal and visual clues of inclusion b. Provide staff education and training about LGBT issues c. Publicize your efforts 3. Improve health outcomes for your LGBT patients a. Understand the unique needs of lesbians, gay women and bisexual patients b. Know appropriate screening examinations and intervals for transgender patients c. Improve patient compliance with recommendations d. Expand knowledge of the LGBT community through increased inclusion in research

BR208-ED-WEB11 Anything but Binary: Exploring the Spectrum of Imaging Concerns in the Transgender Patient

Station #11

Participants
Christopher McAdams, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Jean M. Kunjummen, DO, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Margaret Fleming, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Discuss approrpiate terminology and the review the gender spectrum concept 2. Identifiy pre-imaging considerations for transgender patients with suggestions for application to your practice 3. Highlight unique pathologies and teaching points through case examples

TABLE OF CONTENTS/OUTLINE

I. Introduction II. Patient-Centered Approach & Terminology (Gender Spectrum, etc.) III. Barrier to Care (Discrimination, Provider Training, Insurance Coverage, Clinic Environment) IV. Current Screening Recommendations V. Case Vignettes (e.g. - Abscess, Ectatic Ducts, Kaposi's Sarcoma, etc.) VI. Conclusions & Future Needs

BR209-ED-WEB12 A Comprehensive Breast Cancer Risk Management Program Developed in a Radiology Department to Share with Referring Physicians

Station #12

Participants
Richard G. Barr, MD, PhD, Campbell, 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, Canon Medical Systems Corporation; Research Grant, Esaote SpA; Research Grant, BK Ultrasound; Research Grant, Hitachi, Ltd

TEACHING POINTS

The purpose of this exhibit is: 1. To review the different risk methods and describe their pros and cons 2. To highlight the importance of the involvement of refering physicians for a better patient's empowerment

TABLE OF CONTENTS/OUTLINE

- Different breast cancer risk scores Breast density and breast cancer risk management The unsuitability of lifetime risk - Breast cancer risk management program development - Evaluation of the referring physicians point of view

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/ Richard G. Barr, MD, PhD - 2017 Honored Educator

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

MSRT44

ASRT@RSNA 2018: Hindsight is 20/20 - The Earliest Appearance of Breast Cancer

Wednesday, Nov. 28 1:00PM - 2:00PM Room: N230B

BR OI

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Rita Gidwaney, MD, San Rafael, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review some of the key imaging features on mammography, tomosynthesis, ultrasound and MRI of detecting early breast cancer. 2) To review common pitfalls in breast imaging and how to avoid them in the future. 3) To be better equipped at handling such hindsight wisdom cases in your own practice.

ABSTRACT

This session will review how our advanced technology can help us detect the earliest signs of breast cancer, using mammography, tomosynthesis, ultrasound and MRI, but also how positioning and technique can play a huge role in cancer detection. We will examine cases and look at the pattern of how pathology develops in the breast, both malignant and benign. Common image aquisition and interpretation pitfalls will be reviewed as well. The session will also discuss ways of evaluating such cases in our practices to achieve the best patient outcomes, in spite of hindsight wisdom.

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VW46

Wide-angle Digital Breast Tomosynthesis Reading Session: Siemens Healthineers Vendor Workshop

Wednesday, Nov. 28 1:05PM - 2:15PM Room: Booth 5530

Participants

Paula M. Grabler, MD, Oak Park, IL (*Presenter*) Nothing to Disclose
Brandie L. Fagin, MD, Glenview, IL (*Presenter*) Nothing to Disclose

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 challenge you! All cases have been acquired with Siemens Mammomat Inspiration and are displayed on our syngo® Breast Care workstations so you will become familiar with the quality of our HD Tomo images and ease of use of our systems.

VW15

3D ABUS: Hands-on Workshop: GE Vendor Workshop

Wednesday, Nov. 28 1:30PM - 2:30PM Room: Booth 8156

Participants
Susan G. Roux, MD, Carmel Valley, CA (*Presenter*) Nothing to Disclose

Program Information

Peer educator led workshop includes a live Invenia ABUS 2.0 scan station acquisition and hands-on review of clinical cases using the Invenia ABUS Viewer. Learn about the importance of the coronal view and how 3D ABUS screening helps increase cancer detection in women with dense breast tissue. *Registration is required; adding this session to the RSNA calendar tool alone does not secure your seat in this session. Click the link below to register.*

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2018-/agenda-e57e0b47e9aa4f5ba89b1a0da1e829b9.aspx

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VW69

Tomosynthesis Guided Prone Breast Biopsy Solutions in a Community Based Practice: Hologic Vendor Workshop

Wednesday, Nov. 28 1:30PM - 2:30PM Room: Booth 5524

Participants

Harriet B. Borofsky, MD, San Mateo, CA (*Presenter*)

Program Information

Clinical benefits of tomosynthesis guided biopsy which includes a hands-on demonstration of the Affirm® Prone Biopsy System and the Brevera® Breast Biopsy System (Affirm® Prone Biopsy System, Brevera® Breast Biopsy System and Viera™ Portable Breast Ultrasound)

Registration

https://hologicrsna.com

VW47

A Practical Approach to Breast Magnetic Resonance Imaging (MRI) Interpretation: An Interactive Session: Siemens Healthineers Vendor Workshop

Wednesday, Nov. 28 2:30PM - 3:40PM Room: Booth 5530

Participants

Susan Weinstein, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Program Information

This interactive session will include both didactic and hands-on case review at workstations equipped with syngo® MR Brevis. A practical approach to breast MRI interpretation will be discussed as well as utilizing the available sequences and techniques to improve interpretive skills.

SSM01

Breast Imaging (Interventional Techniques and Path Correlation)

Wednesday, Nov. 28 3:00PM - 4:00PM Room: E351

BR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Michael A. Cohen, MD, Atlanta, GA (*Moderator*) Nothing to Disclose
Gary J. Whitman, MD, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events

SSM01-01 Cryoablation as a Primary Treatment of Low-Risk Breast Cancers: An Interim Update of the Ice 3 Trial

Wednesday, Nov. 28 3:00PM - 3:10PM Room: E351

Participants
Kenneth R. Tomkovich, MD, Freehold, NJ (*Presenter*) Consultant, Scion Medical Technologies, LLC;

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ktomkovich@princetonradiology.com

PURPOSE

The Ice 3 Trial is the first of its kind large scale multi center trial in the world to assess image guided cryoablation as a primary treatment for breast cancer without surgical lumpectomy. We report updated interim results and important imaging findings.

METHOD AND MATERIALS

This HIPPA compliant and IRB approved trial seeks enrollment of between 150 and 200 patients for cryoablation of low risk carcinoma of the breast. The study is limited to female patients ages 60 and over with biopsy proven primary, unifocal cancer. Cancers must measure 1.5cm or less with tumor prognostic panels that are ER+/PR+ or ER+/PR-and HER 2-. All patients underwent ultrasound guided cryoablation using the IceSense 3 system (IceCure Medical). Following local anesthesia, patients underwent a freeze, thaw, freeze cycle of cryoablation with the goal of a visible ice ball producing at least a 10mm margin of ice around the tumor. Patients will be followed for recurrence with mammography at 6 and 12 months and then annually for 5 years. Additional imaging with MRI or Ultrasound may be utilized as needed but is not a requirement. All patients have the option of post cryoablation chemotherapy, hormone therapy and or radiation therapy as clinically indicated. Patients will not undergo surgical lumpectomy following cryoablation.

RESULTS

A total of 157 patients have been treated with since enrollment began in October 2014 at 17 participating centers across the United States. Patients ranged from 60-90 years of age. Tumor sizes ranged from 3 to 15mm. No serious adverse events were reported. There has been 100% procedural success. All patients have had at least 6 months follow up. 78 patients have had at least 24 months follow up. 24 patients have had at least 36 months follow up. There has been no recurrence in 156/157 patients with at least 6 months follow up (99.4% success rate). Common imaging findings include fat necrosis, scarring and a mammographic "halo" effect.

CONCLUSION

Cryoablation of the breast is safe and well tolerated with a 100% initial procedural success rate. The overall clinical success rate for 157 patients with at least 6 months follow up is 99.4%. Long term results are also promising.

CLINICAL RELEVANCE/APPLICATION

Interim results suggest that cryoablation is a safe and effective primary treatment for women with small low risk breast cancers as an alternative to surgical lumpectomy.

SSM01-02 Do Eligibility Criteria for Ductal Carcinoma in Situ (DCIS) Active Surveillance Trials Identify Patients at Low Risk for Upgrade to Invasive Carcinoma?

Wednesday, Nov. 28 3:10PM - 3:20PM Room: E351

Participants
Manisha Bahl, MD,MPH, Boston, MA (*Presenter*) Nothing to Disclose
Tawakalitu Oseni, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Charmi Vijapura, MD, Iowa City, IA (*Abstract Co-Author*) Nothing to Disclose
Niveditha Pinnamaneni, MD, New York, NY (*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

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PURPOSE

Due to concerns regarding overtreatment of ductal carcinoma in situ (DCIS), randomized controlled trials are currently underway in the United States and Europe to determine the safety and efficacy of active surveillance versus usual care for women with DCIS. The purpose of this study is to determine upgrade rates of DCIS at core needle biopsy to invasive carcinoma at surgical excision among women who meet eligibility criteria for three active surveillance trials.

METHOD AND MATERIALS

In this IRB-approved and HIPAA-compliant study, a retrospective review was performed of consecutive female patients diagnosed with DCIS at vacuum-assisted core needle biopsy from 2007 to 2016. Medical records were reviewed for mode of presentation, imaging findings, core biopsy pathology results, and surgical outcomes. DCIS cases were classified based on eligibility criteria for the COMET, LORD, and LORIS Trials. Of note, eligibility for the LORIS Trial also requires real-time central pathology review with features not routinely reported and thus not captured in this retrospective study.

RESULTS

Over a ten-year period, 1378 patients were diagnosed with unilateral DCIS at core biopsy and 12 were diagnosed with bilateral DCIS, for a total of 1390 patients (mean age 57, range 27-89) with 1402 cases of DCIS. 79.8% (n=1119) were detected on screening mammography. 17.3% of cases (n=243) were low nuclear grade, 47.2% (n=662) were intermediate nuclear grade, 26.2% (n=368) were high nuclear grade, and 9.2% (n=129) were unreported. The overall upgrade rate to invasive disease was 19.1% (268/1402). 485 were eligible for the COMET Trial, 163 for the LORD Trial, and 489 for the LORIS Trial. The rates of upgrade to invasive carcinoma were 12.2% (59/485), 7.4% (12/163), and 12.5% (61/489) for the COMET, LORD, and LORIS Trials, respectively. Of the 69 cases that upgraded to invasive carcinoma, 31.9% (n=22) upgraded to microinvasive disease (less than or equal to 1 mm) and 91.3% (n=63) were node-negative.

CONCLUSION

The upgrade rates for women with DCIS who meet eligibility criteria for active surveillance trials range from 7.4 to 12.5%. Of the upgraded cases, nearly one-third were microinvasive disease and more than 90% were node-negative.

CLINICAL RELEVANCE/APPLICATION

The risk of missing occult invasive carcinoma in women eligible for active surveillance trials ranges from 7.4 to 12.5%, and the majority of these cancers have favorable biologic profiles.

SSM01-03 Role of Vacuum Assisted Excision (VAE) in Managing Ductal Atypia Such as Flat Epithelial Atypia (FEA) and Atypical Intraductal Epithelial Proliferation (AIDP)

Wednesday, Nov. 28 3:20PM - 3:30PM Room: E351

Participants
Nisha Sharma, MBChB, Leeds, United Kingdom (*Presenter*) Nothing to Disclose
Isobel Haigh, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

It is recognised that surgical excision for B3 lesions is considered over treatment and vacuum excision (VAE) is playing a role in managing these lesions.. In Europe and USA ductal atypia is still treated with surgical excision. In the UK ductal atypia is managed with vacuum excision rather than surgical excision.

METHOD AND MATERIALS

Retrospective audit performed from a prospective database of all B3 lesions identified through the Breast Screening Programme. All cases of pure ductal atypia, including AIDP and FEA were identified from April 2009 to March 2016. The mode of biopsy and upgrade rate were recorded and follow up data obtained until March 2018.

RESULTS

268990 women were screened from April 2009 to March 2016, of which 12434 were recalled to assessment (4.6%). 5582 biopsies were performed of which 688 were B3 lesions (12.3%). Ductal atypias (FEA and AIDP) (excluding papilloma and radial scars with ductal atypias) accounted for 39.8% of the biopsies. 69% (190/274) were managed with vacuum assisted excsion (VAE) and annual mammographic follow-up or routine screening surveillance. 3% (7/190) developed a cancer during surveillance period, of which 4 were in the same quadrant. 13% (35/274) were upgraded to malignancy following VAE and were treated with therapeutic surgery. 2 developed further cancer on surveillance in the same breast. 8% (21/274) had a vacuum excision and a surgical biopsy due to radiological or pathological concern and 14/21 was benign and 7/21 upgraded to malignancy. One case developed cancer in the contralateral breast on cancer follow up. 8% (22/274) had a surgical diagnostic biopsy instead of vacuum excision and 13/22 were benign and 9/22 were upgraded to malignancy. 2% (6/274) did not go on to have either vacuum excision or surgery due to co-morbidities. 2 developed cancer on surveillance. 12/274 (4%) developed malignancy during surveillance period of which 8/274 were in the same breast.

CONCLUSION

Our study shows that managing ductal atypia with vacuum assisted excision (VAE) is a safe alternative to surgical excision as a primary intervention but multidisciplinary review is important to determine if further surgery is required. Vacuum excision allowed 13% of our women to have a therapeutic surgery as preoperative diagnosis of malignancy was made and 69% avoided surgery altogether.

CLINICAL RELEVANCE/APPLICATION

Vacuum assisted excision is a safe alternative to surgical biopsy in managing ductal atypias

SSM01-04 Papillary Breast Lesions Without Atypia Diagnosed by Core Biopsy: Should They Be Surgically Excised?

Wednesday, Nov. 28 3:30PM - 3:40PM Room: E351

Participants
Sarah Dhundass, MD, Saint Cloud, France (*Presenter*) Nothing to Disclose
Pascal Cherel, Saint Cloud, France (*Abstract Co-Author*) Nothing to Disclose
Adriana Langer, MD, Saint Cloud, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the upgrade rate of benign papilloma without atypia diagnosed after core needle biopsy (CNB) or Vacuum assisted biopsy (VAB) in order to determine whether they should require surgical excision or not.

METHOD AND MATERIALS

Histological results of 15615 biopsy procedures were reviewed from January 2001 to December 2014 in our institution. Sampling methods included large gauge VAB by ultrasonographic (US) or stereotaxic guidance and US guided 14G CNB. A total of 179 papillary lesions without atypia that were diagnosed in 159 women were included: 121 had surgical excision following initial detection and 58 underwent imaging surveillance. Initial histological results were compared to the histological results after surgery or to the follow up findings. Statistical analysis was performed to evaluate the association of clinical and radiological variables with the upgrade rate to malignancy.

RESULTS

After exclusion of patients lost to follow up, 158 lesions have been analyzed. 90 were diagnosed by VAB and 68 by CNB. Surgical excision revealed 7 malignant lesions (6 DCIS and 1 carcinoma). The upgrade rate to malignancy was 4.4%. Among the 42 followed up patients, two necessitated secondary surgery, one of them corresponded to a malignant lesion (45 months after biopsy). The median follow-up period was 30 months (6-93). The upgrade rate was statistically higher in the group diagnosed with CNB 8.9% vs 1.1% in the VAB group ($p=0.042$). Age, history of cancer, size of the lesion, ultrasound and mammographic findings including BIRADS category were not associated with underestimation of malignancy ($p>0.05$).

CONCLUSION

Papilloma without atypia detected with VAB could not require surgery (upgrade rate 1.1%) if the excision is complete but should be radiologically followed up at least 5 years to screen for potential biopsy site changes. Papilloma without atypia diagnosed with CNB require surgical excision as the risk of coexisting carcinoma is significantly higher (8.9% in our study)

CLINICAL RELEVANCE/APPLICATION

Papilloma without atypia diagnosed with vacuum assisted biopsy can be radiologically followed up given the low rate of underestimation.

SSM01-05 Follow-Up Outcomes of BI-RADS Category 3 Solid Nodules Identified on Screening and Diagnostic Breast Ultrasound

Wednesday, Nov. 28 3:40PM - 3:50PM Room: E351

Awards
Student Travel Stipend Award

Participants
Joanna Marie D. Choa, MD, Taguig, Philippines (*Presenter*) Nothing to Disclose
Anna Lyn C. Egwolf, MD, Taguig, Philippines (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Our study aims to determine significant difference in BI-RADS category from initial imaging to its subsequent follow-up and the minimum length of time that the BI-RADS category will change for solid nodules. Our study also wants to assess the characteristics and growth pattern of BI-RADS category 3 solid nodules.

METHOD AND MATERIALS

We did a retrospective cohort study reviewing patient reports across a 10-year follow-up period. All solid nodules with at least 2 follow-up ultrasound imaging within a minimum of 22 months were included. Patients were segregated into 2 groups by age: one group below 40 years old and another group age 40 years old and above. Mammogram results were not viewed. Patients with known carcinoma and those with other lesions having a higher BI-RADS assessment in either breast were excluded. Nodule size, characteristics, and BI-RADS score for each follow-up were obtained. We employed ANOVA for repeated measures for statistical analysis.

RESULTS

A total of 511 nodules (5.1% of identified solid nodules) were included and showed no significant difference in BI-RADS scores over the course of 2 follow-ups, regardless of age. Significant change was identified at the sixth and seventh follow-ups with downgrading of BI-RADS scores to 2. Significant changes in size between the second and third follow-up and comparing the first with the third follow-up were appreciated in patients 40 years old and above. Patients in this study were also found out to have an average interval between follow-up imaging of 14.39 months. The minimum length of time for a BI-RADS category 3 solid nodule to become category 4 on follow-up was approximately 1 year (354 days). Only 1 out of the total 511 nodules turned out malignant, 44 months after initial imaging.

CONCLUSION

There is no significant change between BI-RADS scores of solid nodules regardless of age within a 2-year follow-up period. The minimum time for change in BI-RADS from 3 to 4 is about 1 year. Low patient compliance to BI-RADS category 3 follow-up guidelines should be taken into consideration in formulating institutional protocols in the management of these solid nodules.

CLINICAL RELEVANCE/APPLICATION

Patient compliance to follow-up recommendations of BI-RADS category 3 solid nodules is very low, hence can be re-classified as category 2 and follow an annual schedule of follow-up imaging. Only 1 out of 511 nodules turned out malignant after 44 months (~0.2%, low turn-out rate).

SSM01-06 Comparison of Upright Digital Breast Tomosynthesis-Guided Vacuum-Assisted Biopsy with Conventional Prone Stereotactic Vacuum-Assisted Biopsy

Wednesday, Nov. 28 3:50PM - 4:00PM Room: E351

Participants
Mary Maunglay, MD, Pontiac, MI (*Abstract Co-Author*) Nothing to Disclose
Manisha Bahl, MD,MPH, Boston, MA (*Presenter*) Nothing to Disclose
Helen Anne D'Alessandro, 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

For information about this presentation, contact:

mbahl1@mgh.harvard.edu

PURPOSE

Breast imaging practices are rapidly transitioning from digital 2D mammography (DM) to digital breast tomosynthesis (DBT), but there is limited research on the clinical performance of DBT-guided vacuum-assisted breast biopsy (VABB). The purpose of this study was to compare the performance of upright DBT VABB to that of conventional prone stereotactic (PS) VABB.

METHOD AND MATERIALS

In this IRB-approved and HIPAA-compliant study, a retrospective review was performed of consecutive patients who underwent PS VABB from August 2014 to December 2015 (PS VABB group) and DBT VABB from February 2016 to June 2017 (DBT VABB group). Tissue sampling methods and materials (9-gauge needles) were the same for PS VABB and DBT VABB. Student's *t*-tests and chi-square tests were used to compare the following variables between the PS VABB and DBT VABB groups: sampling success, procedure times, exposures, lesion types, histologic results, and complications.

RESULTS

Over a 17-month period before the introduction of DBT VABB, 444 PS VABBs in 410 patients (mean age 57, range 32-84) were performed (PS VABB group). Over a 17-month period after complete integration of DBT VABB, 709 DBT VABBs in 682 patients (mean age 58, range 23-90) were performed (DBT VABB group). Technical success was achieved for more lesions with DBT VABB than PS VABB (98.4% [698/709] vs 93.2% [414/444], $p<0.001$). Mean procedure time was shorter with DBT VABB (12 vs 28 minutes, $p<0.001$), and significantly fewer exposures were acquired with DBT VABB (3 vs 11, $p<0.001$). A higher percentage of lesions biopsied with DBT VABB were non-calcified lesions (eg, architectural distortion, asymmetry, and mass) (29.5% [206/698] with DBT VABB vs 3.1% [13/414] with PS VABB, $p<0.001$). There were no differences in the distribution of histologic results (benign, high-risk, or malignant) ($p=0.94$). No major complications were observed in either group. Two patients in the DBT VABB group (2/682, 0.3%) experienced self-limited vasovagal symptoms.

CONCLUSION

DBT VABB has higher technical success than PS VABB and can be performed in less than half the time and with less than one third of the radiation. In addition, more distortions and asymmetries are amenable to biopsy with DBT VABB.

CLINICAL RELEVANCE/APPLICATION

Clinical performance of DBT VABB is superior to PS VABB. DBT VABB can replace PS VABB for routine use in patients with suspicious findings identified on DBT alone and on conventional DM.

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SSM02

Science Session with Keynote: Breast Imaging (Risk-Based Screening: Should We Do It?)

Wednesday, Nov. 28 3:00PM - 4:00PM Room: E350

AI BR SQ

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Elizabeth A. Morris, MD, New York, NY (*Moderator*) Nothing to Disclose
Daniel B. Kopans, MD, Waban, MA (*Moderator*) Royalties, Cook Group Incorporated; Research Consultant, Deep Health; Scientific Advisory Board, Dart, Inc

Sub-Events

SSM02-01 Breast Keynote Speaker: Risk Based Screening

Wednesday, Nov. 28 3:00PM - 3:10PM Room: E350

Participants
Elizabeth A. Morris, MD, New York, NY (*Presenter*) Nothing to Disclose

SSM02-02 Risk-Based Screening Mammography for Women Age <40: Outcomes from the National Mammography Database

Wednesday, Nov. 28 3:10PM - 3:20PM Room: E350

Participants
Cindy S. Lee, MD, Garden City, NY (*Presenter*) Nothing to Disclose
Heidi Ashih, PhD, Reston, VA (*Abstract Co-Author*) Nothing to Disclose
Debapriya Sengupta, MBBS,MPH, Reston, VA (*Abstract Co-Author*) Nothing to Disclose
Edward A. Sickles, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Margarita L. Zuley, MD, Pittsburgh, PA (*Abstract Co-Author*) Investigator, Hologic, Inc
Etta D. Pisano, MD, Charleston, SC (*Abstract Co-Author*) Researcher, Freenome Holdings Inc; Researcher, Real Imaging Ltd; Researcher, Therapixel; Researcher, DeepHealth, Inc; Researcher, ToDos

For information about this presentation, contact:

Cindy.Lee3@nyumc.org

PURPOSE

There is insufficient large-scale evidence supporting screening mammography in women <40 years with risk factors. This study compares risk-based screening of women ages 30-39 versus women age 40-49 with no known risk factors, using screening mammography performance metrics from the National Mammography Database (NMD).

METHOD AND MATERIALS

This HIPAA compliant and IRB approved study analyzed data from 150 mammography facilities in 31 states in the NMD. The NMD collects clinical practice data including self-reported patient demographics, clinical findings, screening mammography interpretation and biopsy results. Patients were stratified by 5-year age intervals and specific risk factors for breast cancer: family history of breast cancer (any first degree relative regardless of age), personal history of breast cancer and breast density of heterogeneously or extremely dense (C or D). Prior mammograms were identified by patient date of birth and facility-assigned identification number. Four performance metrics for screening mammography were calculated for each age and risk group: recall rate, cancer detection rate, and positive predictive values for biopsy recommended (PPV2) and biopsy performed (PPV3).

RESULTS

5,772,730 screening mammograms were performed between January 2008 and December 2015 in 2,647,315 women. Overall, mean cancer detection rate was 3.7 per 1000 (95% CI: 3.65-3.75), recall rate was 9.8% (9.8-9.8%), PPV2 was 20.1% (19.9-20.4%), and PPV3 was 28.2% (27.0-28.5%). Overall, women age 30-34 and 35-39 had similar cancer detection rates, recall rates and PPVs, with the presence of the three evaluated risk factors associated with significantly higher cancer detection rates. Moreover, compared to a population currently recommended for screening mammography in the USA (age 40-44 with no known risk factors), incidence screening (at least one prior screening examination) of women ages 30-39 with tthe three evauated risk factors has similar cancer detection rates and recall rates.

CONCLUSION

Women ages 30-39 with 3 specific risk factors should benefit by starting screening at age 30 instead of the age 40 start recommended for average-risk women.

CLINICAL RELEVANCE/APPLICATION

Women

SSM02-03 A Deep-Learning Breast Cancer Risk Prediction Network: Trained on the Population-based Swedish CSAW Data

Wednesday, Nov. 28 3:20PM - 3:30PM Room: E350

Participants
Fredrik Strand, MD,PhD, Stockholm, Sweden (*Presenter*) Nothing to Disclose
Yue Liu, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose
Kevin Smith, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose
Hossein Azizpour, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose
Karin H. Dembrower, MD, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose
Peter Lindholm, MD, PhD, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

fredrik.strand@ki.se

PURPOSE

Almost half of breast cancer diagnoses among women attending mammographic screening are interval cancers or large screen-detected cancers. To enable more effective individualized screening, accurate risk prediction is paramount. In this study, we examine how our trained deep learning network compares with mammographic density in risk prediction based on negative screening mammograms.

METHOD AND MATERIALS

The Swedish cohort of screen-age women (CSAW) contains over 500,000 women linked to the cancer registry and to an image database. Our deep learning network was trained on negative mammograms from incident cases from one uptake area 2008 to 2011. The test set consisted of cases from 2013 and 2014. In each set, we included a random sample of concurrent non-overlapping controls. The input was each negative mammogram downscaled as well as full-resolution central crops, age at mammography and selected DICOM parameters. The prediction output is called deep learning risk score (DLR). For comparison, mammographic density was calculated using the validated LIBRA software. Logistic regression models were fitted to examine odds ratios.

RESULTS

The training set consisted of 3167 negative mammograms from women with subsequent breast cancer and 125,683 mammograms from healthy women. The test set consisted of negative mammograms from 752 screening rounds of 326 women with subsequent breast cancer and 6728 rounds of 2065 healthy women. AUC was higher for DLR (0.63; 95%CI: 0.61 to 0.66) than for density (0.57; 95%CI: 0.54 to 0.60) and for age-adjusted density (0.58; 95%CI: 0.56 to 0.61). The proportion of cases were 10.1% in the top quintile and 2.5% in the bottom quintile of DLR. The top-to-bottom quintile odds ratio was 4.37 (95%CI: 3.01 to 6.45) and 1.69 (95%CI: 1.23 to 2.32) for DLR and age-adjusted density respectively.

CONCLUSION

We have demonstrated that it is possible to train a deep learning network on negative screening mammograms from subsequent breast cancer cases, and produce risk predictions with reasonable accuracy and ability to identify women at elevated risk.

CLINICAL RELEVANCE/APPLICATION

After external validation, our network may be used in individualizing breast cancer screening.

SSM02-04 Potential Role of Convolutional Neural Network based Algorithms in Patient Selection for DCIS Observation Trials

Wednesday, Nov. 28 3:30PM - 3:40PM Room: E350

Participants
Simukayi Mutasa, MD, New York, NY (*Presenter*) Nothing to Disclose
Peter Chang, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Jenika Karcich, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Eduardo Pascual Van Sant, BS, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Mary Q. Sun, MD, Manhasset, NY (*Abstract Co-Author*) Nothing to Disclose
Michael Z. Liu, MS, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Sachin Jambawalikar, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Richard S. Ha, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

s.mutasa@columbia.edu

PURPOSE

Minimizing over-diagnoses and treatment of Ductal Carcinoma in Situ (DCIS) has led to clinical trials of observing patients with DCIS instead of surgery. Despite careful selection for 'low risk' DCIS patients, there is evidence of occult invasive cancers in a significant number of these patients. We investigated the feasibility of utilizing convolutional neural networks (CNN) for predicting patients with pure DCIS versus DCIS with invasion using mammographic images.

METHOD AND MATERIALS

An IRB-approved retrospective study was performed. 246 unique images from 123 patients were used for our CNN algorithm. 164 images in 82 patients diagnosed with DCIS by stereotactic-guided biopsy of calcifications without any upgrade at the time of surgical excision (pure DCIS group). 82 images in 41 patients with mammographic calcifications yielding occult invasive carcinoma as the final upgraded diagnosis on surgery (occult invasive group). Two standard mammographic magnification views (CC and ML/LM) of the calcifications were used for analysis. Calcifications were segmented using an open source software platform 3D Slicer and resized to fit a 128x128 pixel bounding box. A 15 hidden layer topology based on residual convolutions was used to implement the

neural network. A class balanced holdout set with 40 patients was used for testing. 5-fold cross validation was utilized with cases randomly separated into a training set [80%] and validation set [20%].

RESULTS

The CNN algorithm for predicting patients with pure DCIS achieved an overall validation accuracy of 74.6% (95%CI, ± 5) with area under the ROC curve of 0.71 (95% CI, ±0.04), specificity of 49.4% (95% CI, ± 6%) and sensitivity of 91.6% (95% CI, ± 5%).

CONCLUSION

It's feasible to apply a CNN to distinguish pure DCIS from DCIS with invasion using mammographic images. A larger dataset will likely improve our prediction model and could potentially be useful in appropriate patient selection for observation trials.

CLINICAL RELEVANCE/APPLICATION

Convolutional neural networks have demonstrated strong performance in various image classification tasks and may potentially be used in appropriate patient selection for DCIS observation trials.

SSM02-05 The Effect of Screening Modality and Race on BI-RADS Breast Density in a Large Urban Screening Cohort

Wednesday, Nov. 28 3:40PM - 3:50PM Room: E350

Participants
Aimilia Gastounioti, Philadelphia, PA (*Presenter*) Nothing to Disclose
Anne Marie McCarthy, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Lauren Pantalone, BS, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Marie Synnestvedt, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Despina Kontos, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Emily F. Conant, MD, Philadelphia, PA (*Abstract Co-Author*) Grant, Hologic, Inc; Consultant, Hologic, Inc; Grant, iCAD, Inc; Consultant, iCAD, Inc; Speaker, iiCME

For information about this presentation, contact:

aimilia.gastounioti@uphs.upenn.edu

PURPOSE

Increased breast density is an independent breast cancer risk factor and also limits the sensitivity and specificity of mammography. We investigated the effect of screening mammography modality and race on BI-RADS breast density assessments, accounting for age and body-mass index (BMI).

METHOD AND MATERIALS

We retrospectively analyzed data from 24,740 individual women (45% White, 55% Black) who underwent screening from September 2010 through February 2017 at our institution. 15,147 women (55%) had repeated screening studies (N = 60,774 studies). Over this time period, three screening modalities were used: digital mammography alone (DM; N = 8,936); digital breast tomosynthesis (DBT) with DM (DM/DBT, N = 30,786); and synthetic 2D with DBT (s2D/DBT, N = 21,052). BI-RADS density classifications ranging from lower (fatty or scattered) to higher (heterogeneous or extremely dense) density were extracted from screening reports. Random-effects ordered logistic regression (panel variable: individual woman) was performed to estimate the odds of being assigned to higher BI-RADS density by each modality, adjusted for race, age, BMI and radiologist. The interaction of modality and race on density was tested in the model, and analyses were stratified by race.

RESULTS

Women screened with DBT had significantly lower odds of high density compared to those screened with DM alone (DM/DBT vs. DM: OR = 0.62, $p < .0001$; s2D/DBT vs. DM: OR = 0.48, $p < .0001$). Lower odds of high density were also observed in s2D/DBT compared to DM/DBT (OR = 0.76, $p < .0001$). There was a significant interaction of modality and race on breast density ($p = .0003$). All differences by modality maintained statistical significance in analyses stratified by race, with lower ORs for black (DM/DBT vs. DM: OR = 0.61; s2D/DBT vs DM: OR = 0.40; s2D/DBT vs. DM/DBT: OR = 0.67) than for white women (DM/DBT vs. DM: OR = 0.65; s2D/DBT vs. DM: OR = 0.58; s2D/DBT vs. DM/DBT: OR = 0.89).

CONCLUSION

Screening mammography modality has a significant effect on BI-RADS density assessment with an overall trend of assigning lower density with DBT and s2D/DBT screening versus DM alone. Furthermore, this effect seems to be more prominent in black than in white women.

CLINICAL RELEVANCE/APPLICATION

Our findings have direct implications for personalized screening since breast density assignments, which often drive recommendations for supplemental screening, may vary greatly by modality and race.

SSM02-06 Breast Keynote Speaker: Risk Based Screening

Wednesday, Nov. 28 3:50PM - 4:00PM Room: E350

Participants
Daniel B. Kopans, MD, Waban, MA (*Presenter*) Royalties, Cook Group Incorporated; Research Consultant, Deep Health; Scientific Advisory Board, Dart, Inc

VW16

Invenia ABUS 2.0 - Live Scanning Demo: GE Vendor Workshop

Wednesday, Nov. 28 3:00PM - 3:30PM Room: Booth 8156

Participants
Doug Whisler, Sunnyvale, CA (*Presenter*)

Program Information

This thirty minute session will cover the latest technological advancements in ABUS design and performance. Attendees will learn how improvements in workflow and image quality have the potential to increase cancer detection in women with dense breast tissue. *Registration is required; adding this session to the RSNA calendar tool alone does not secure your seat in this session. Click the link below to register.*

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2018-/agenda-e57e0b47e9aa4f5ba89b1a0da1e829b9.aspx

VW70

True Patient Comfort: Genius™ 3D Mammography™ exam and SmartCurve™ Breast Stabilization System: Hologic Vendor Workshop

Wednesday, Nov. 28 3:00PM - 4:00PM Room: Booth 5524

Program Information

A clinical perspective on the implementation of Genius™ 3D Mammography™ exam and the SmartCurve™ Breast Stabilization System without compromising image quality, exam time, dose or workflow. This session includes clinical feedback and tips to increase patient comfort. (Genius™ 3D Mammography™, SmartCurve™ Breast Stabilization System)

Registration

https://hologicrsna.com

VW17

Invenia ABUS 2.0 - Live Scanning Demo: GE Vendor Workshop

Wednesday, Nov. 28 3:30PM - 4:00PM Room: Booth 8156

Participants
Doug Whisler, Sunnyvale, CA (*Presenter*)

Program Information

This thirty minute session will cover the latest technological advancements in ABUS design and performance. Attendees will learn how improvements in workflow and image quality have the potential to increase cancer detection in women with dense breast tissue. *Registration is required; adding this session to the RSNA calendar tool alone does not secure your seat in this session. Click the link below to register.*

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2018-/agenda-e57e0b47e9aa4f5ba89b1a0da1e829b9.aspx

VW48

Automated Breast Volume Scanner (ABVS) Physician Training Workshop: An Interactive Learning Experience: Siemens Healthineers Vendor Workshop

Wednesday, Nov. 28 3:50PM - 5:00PM Room: Booth 5530

Participants

Ingolf Karst, MD, Chicago, IL (*Presenter*) Nothing to Disclose

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 unique coronal plane while providing practical approaches to interpretation of 3D automated breast ultrasound.

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ED001-TH

Breast Thursday Case of the Day

Thursday, Nov. 29 7:00AM - 11:59PM Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Jessica H. Porembka, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Amy M. Fowler, MD, PhD, Madison, WI (*Abstract Co-Author*) Research support, General Electric Company
Susan O. Holley, MD, PhD, Raleigh, NC (*Abstract Co-Author*) Nothing to Disclose
Alexander B. Sevrukov, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Chandni Bhimani, DO, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Catherine A. Young, MD, JD, Saint Louis, MO (*Abstract Co-Author*) Research support, Hologic, Inc
Cheryl R. Herman, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Michelle V. Lee, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Mai A. Elezaby, MD, Madison, WI (*Abstract Co-Author*) Research Grant, Exact Sciences Corporation
Lonie R. Salkowski, MD,PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Roberta M. Strigel, MD, Madison, WI (*Abstract Co-Author*) Research support, General Electric Company
Ryan W. Woods, MD, MPH, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Urvi A. Tailor, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Lindsay Compton, MD, Dallas, TX (*Abstract Co-Author*) Researcher, QT Ultrasound, LLC
Ramapriya Ganti, MD, Dallas, TX (*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.

MSES51

Essentials of Breast Imaging

Thursday, Nov. 29 8:30AM - 10:00AM Room: S406B

BR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Sub-Events

MSES51A Missed Lesions in Mammography: How to Improve Performance

Participants
Athina Vourtsi, MD, Athens, Greece (*Presenter*) Consultant, General Electric Company; Educator, ABUS

LEARNING OBJECTIVES

1) Identify the most common factors that may lead to missed breast cancers. 2) Apply the appropriate steps when interpreting mammography. 3) Enhance skills in order to avoid the possibility of missing a suspicious lesion.

MSES51B Update on Ductal Carcinoma in Situ

Participants
Cecilia L. Mercado, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the imaging characteristics of ductal carcinoma in situ as detected on various imaging modalities. 2) Identify the risk factors for the development of ductal carcinoma in situ. 3) Discuss the various treatment recommendations for ductal carcinoma in situ as supported by the recent multiple randomized controlled trials.

MSES51C Management of Non-simple Breast Cysts

Participants
A. Thomas Stavros, MD, San Antonio, TX (*Presenter*) Advisor, Devicor Medical Products, Inc Advisor, General Electric Company Advisor, SonoCine, Inc Owner, Ikonopedia, LLC Medical Director, Seno Medical Instruments, Inc

For information about this presentation, contact:

atstavros@gmail.com

LEARNING OBJECTIVES

1) To understand the histologic bases for the appearances of cysts that are not simple. 2) To know the differences between 'suspicious' complex cystic and solid masses and non-suspicious benign complicated cysts. 3) To be aware of ancillary ultrasound modality and dynamic maneuver contributions to distinguishing suspicious from non-suspicious non-simple cysts. 4) To know when to use interventional procedures and which to use. 5) To know how pre-test probability (screening vs. diagnosis) affects interpretation and when to apply the rule of multiplicity.

ABSTRACT

As a general rule, most non-simple breast cysts are part of the benign fibrocystic spectrum and have little risk of being malignant. Malignant breast cysts are uncommon and cystic malignancies usually look more like necrotic or hemorrhagic solid masses than benign appearing cysts. Nevertheless, needs a systematic approach to evaluation of non-simple breast cysts in order not to miss the uncommon cystic malignancy. We present an algorithmic approach to evaluating non-simple breast cysts that is derived from the mammographic and solid mass algorithms, where we look for suspicious features first. If there are no suspicious findings, we then look for definitively benign findings. If we cannot find benign findings, we look for probably benign features, and failing that, classify the lesion as suspicious and obtain histology. We show the histologic basis for echogenic cyst fluid and a variety of benign and malignant excrescences that cause a cyst to appear to be non-simple. We discuss the difference between complicated cysts and complex cystic and solid masses in appearances and risk. We show how Doppler can help us assess complex cystic and solid masses and complex clustered microcysts. We discuss the need for histologic rather than cytologic assessment of suspicious cystic breast masses. We show the appearances of acutely and chronically inflamed cysts before and after aspiration, how Doppler can help this assessment, and how these appearances differ from those of malignant cysts, and the need for gram stain and culture, but not cytology. We present a variety of definitively benign appearances for non-simple breast cysts such as scintillating echoes, fat fluid-levels, fluid-debris levels, milk of calcium, calcium oxalate crystals, and skin cysts, and present maneuvers to improve their assessment. We also discuss the complicated cyst that has fluid so echogenic that it simulates a solid nodule, such as a fibroadenoma, and a variety of methods of further evaluating such cysts, including shear wave and strain elastography and aspiration. Finally, we discuss the rule of multiplicity and how multiple similar appearing non-simple cysts can be downgraded to BI-RADS 2, especially during supplemental screening ultrasound for women with dense breasts on mammography.

Active Handout:A. Thomas Stavros

http://abstract.rsna.org/uploads/2018/18000959/06 BUS of cysts that MSES51C.pdf

MSES51D Breast Anatomy and Physiology

Participants
Ellen B. Mendelson, MD,MA, Chicago, IL (*Presenter*) Advisory Board, Delphinus Medical Technologies, Inc; Speaker, Siemens AG; Advisory Board, Seno Medical Instruments, Inc; ; ;

LEARNING OBJECTIVES

1) Describe the anatomic composition of the adult breast. 2) Correlate physiology with specific pathologic occurrences in young, pregnant, and lactating women. 3) Assess the value of whole breast US in management of bilateral benign-appearing masses.

RC615

Advanced Breast Imaging Technologies

Thursday, Nov. 29 8:30AM - 10:00AM Room: E451A

BR MR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Maxine S. Jochelson, MD, New York, NY (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

jochelsm@mskcc.org

LEARNING OBJECTIVES

I will put my learning objectives in under my course itself and presume the other 2 presenters will do the same. Don't think there needs to be a separate learning objective for the moderator?

Sub-Events

RC615A PET and PET/MRI

Participants
Amy M. Fowler, MD, PhD, Madison, WI (*Presenter*) Research support, General Electric Company

For information about this presentation, contact:

afowler@uwhealth.org

LEARNING OBJECTIVES

1) Describe current approaches for performing breast PET imaging. 2) Assess diagnostic performance of breast PET imaging for extent of disease and therapy response evaluation. 3) Examine potential uses of PET/MRI for breast imaging.

RC615B Molecular Breast Imaging

Participants
Carrie B. Hruska, PhD, Rochester, MN (*Presenter*) Institutional license agreement, CMR Naviscan Corporation

For information about this presentation, contact:

hruska.carrie@mayo.edu

LEARNING OBJECTIVES

1) Describe MBI instrumentation and clinical protocol for low-dose imaging. 2) Assess performance of MBI in screening of women with dense breasts. 3) Examine the potential role of MBI as an imaging biomarker of breast cancer risk.

RC615C Contrast Enhanced Mammography & Tomosynthesis

Participants
Maxine S. Jochelson, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The utility of tomosynthesis in the screening setting. 2) The technique and risks of Contrast Enhanced Mammography. 3) Potential uses for Contrast Enhanced Mammography in the screening and diagnostic setting.

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MSRT52

ASRT@RSNA 2018: The Missed Breast Cancer - Causes and Cures

Thursday, Nov. 29 9:15AM - 10:15AM Room: N230B

BR OI

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Michael N. Linver, MD, Albuquerque, NM (*Presenter*) Medical Advisory Board, Solis; Scientific Advisory Board, Real Imaging Ltd; Scientific Advisory Board, Seno Medical Instruments, Inc

For information about this presentation, contact:

mammomike@aol.com

LEARNING OBJECTIVES

1) Identify the major biological features of breast cancers which cause some cancers to be missed on mammography. 2) Identify the technical issues which cause some breast cancers to be missed on mammography. 3) Apply various strategies to prevent breast cancers from being missed on mammography.

ABSTRACT

This session will cover the major reasons that breast cancers are sometimes missed on mammography. Emphasis will be placed on the biological factors of breast cancers that the radiologist cannot control, and the technical factors related to the process of obtaining the images that the radiologist can and should control. For all of these issues, strategies will be offered to prevent missing cancers on mammography.

SSQ01

Breast Imaging (Abbreviated MRI, Ultrafast Imaging and Artificial Intelligence)

Thursday, Nov. 29 10:30AM - 12:00PM Room: E450A

AI BR MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Christiane K. Kuhl, MD, Aachen, Germany (*Moderator*) Nothing to Disclose
Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Moderator*) Researcher, Siemens AG ; Researcher, Seno Medical Instruments, Inc; Researcher, Identification Solutions, Inc; Researcher, Micrima Limited; Researcher, Medtronic plc; Scientific Advisor, ScreenPoint Medical BV; Scientific Advisor, Transonic Imaging, Inc; Stockholder, Transonic Imaging, Inc

Sub-Events

SSQ01-01 Assessing the Accuracy of an Abbreviated Breast MRI Protocol Compared to a Full MRI Protocol in Women with a Personal History of Breast Cancer

Thursday, Nov. 29 10:30AM - 10:40AM Room: E450A

Participants
Jennifer Gillman, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Emily F. Conant, MD, Philadelphia, PA (*Abstract Co-Author*) Grant, Hologic, Inc; Consultant, Hologic, Inc; Grant, iCAD, Inc; Consultant, iCAD, Inc; Speaker, iiCME
Ari Borthakur, PhD,MBA, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Elizabeth S. McDonald, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Alice Chong, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Susan Weinstein, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Women with a personal history of breast cancer have an elevated lifetime risk for a second breast cancer. However, the current American Cancer Society guidelines do not recommend MRI screening in this population. Multiple studies have demonstrated that the sensitivity of Abbreviated breast MRI (AB-MRI) is similar to full diagnostic protocols (FDP-MRI). In this study, we retrospectively evaluate the use of surveillance AB-MRI in women with a personal history of breast cancer.

METHOD AND MATERIALS

An IRB approved and HIPAA compliant reader study was performed on 398 consecutive women with a personal history of breast cancer who underwent full protocol clinical breast MRIs from 9/13-12/15. There were 14 cancers detected (3.8%). An enriched reader study was performed consisting of 68 cases including the 14 cancer cases. Non-cancer cases had at least 1 year of follow-up. Interpretations from a limited image set simulating an AB-MR protocol (T2, pre, and post contrast) were compared with interpretations of the FDP-MRI clinical study.

RESULTS

The AB-MR interpretations were compared with those from the full, clinical protocol. The sensitivity (SN), specificity(SP), positive predictive value (PPV), and the negative predictive value (NPV) for the simulated AB-MR vs the FDP-MRI interpretations were: SN - 50% vs 71%, SP - 96% vs 77%, PPV- 74% vs 43%, NPV - 88% vs. 91%. The mean difference between reader 1 and reader 2 was 0.29 with 95% confidence interval: [-0.33, 0.90]. There were significantly fewer false positives with AB-MRI than FDP-MRI, but more false negatives were observed with AB-MRI.

CONCLUSION

Our preliminary results show higher specificity at the expense of sensitivity in our simulated AB-MRI reads compared to FDP-MRI in women with a history of breast cancer. Further evaluation is warranted.

CLINICAL RELEVANCE/APPLICATION

A simulated AB-MRI protocol resulted in fewer false positive exams than with a full, clinical MR protocol in women with a personal history of breast cancer, however, more research is needed.

SSQ01-02 Abbreviated Breast MRI : 'Ultrafast' DISCO Acquisition for Lesion Characterization

Thursday, Nov. 29 10:40AM - 10:50AM Room: E450A

Awards
Student Travel Stipend Award

Participants
Audrey Milon, MD, Paris, France (*Presenter*) Nothing to Disclose
Isabelle Thomassin-Naggara, MD, Paris, France (*Abstract Co-Author*) Speakers Bureau, General Electric Company
Julie Poujol, PhD, Vandoeuvre-les-Nancy, France (*Abstract Co-Author*) Nothing to Disclose
Asma Bekhouche, Paris, France (*Abstract Co-Author*) Nothing to Disclose

Saskia Vande Perre, Paris, France (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The purpose of our study was to evaluate the diagnostic performance of a dynamic acquisition over-sampling the first minute after contrast administration in an abbreviated dynamic-contrast-enhanced (DCE) breast-MRI.

METHOD AND MATERIALS

153 women were retrospectively consecutively included between July 2016 and March 2017, regardless of indication. All these women had a full breast- MRI protocol, including a DISCO ultrafast acquisition with 7 phases, and an enhanced lesion histologically proven (age= 55 (28-88)). Two readers analyzed 179 lesions (73 benign, 5 B3, 101 malignant lesions) with BIRADS classification for each protocol: an abbreviated protocol (T1-weighted, T2-wheigthed, DISCO, T1-fat suppressed VIBRANT 2mn after contrast administration) and a standard full protocol with late post-contrast phases. Then readers studied DISCO's early enhancement curve with the following semi-quantitative parameters: Wash-In Rate (WIR), Maximal Slope Increase (MSI), Enhancement Amplitude (EA), and Time of Half Rising (THS). Heterogeneity was also assessed using Standard Deviation (STD) at the different DISCO phases.

RESULTS

176/179 (98%) lesions were detected by the abbreviated protocol regarding to the full protocol : 122 mass and 57 non-mass-like enhancement or foci (medium size : 18mm). The 3 undetected lesions were benign. Malignant lesions showed a WIR, a MSI a EA higher, a THS shorter and were more heterogeneous at all DISCO phases than benign lesions ($p<0.01$). In the group of masses with benign morphology (n= 42), THS was shorter for the malignant lesions (39.1 sec) than for the benign lesions (44.6 sec) ($p=0.01$).

CONCLUSION

Including an additional ultrafast-scan in an abbreviated breast-DCE-MRI protocol enables the early enhancement study that is useful for lesion characterization and is time efficient.

CLINICAL RELEVANCE/APPLICATION

DCE-abbreviated breast-MRI with ultrafast-scan is efficient for lesion detection and characterization; so might be considered as a screening tool in intermediate-risk women.

SSQ01-03 Ultrafast Breast DCE-MRI in the Evaluation of Tumor Size: Potential Utility in Moderate to Marked Background Parenchymal Enhancement

Thursday, Nov. 29 10:50AM - 11:00AM Room: E450A

Participants
Sooyeon Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
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Rihyeon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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Min Sun Bae, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Su Hyun Lee, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung Min Chang, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, General Electric Company
Woo Kyung Moon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Ultrafast breast DCE-MRI allows imaging of early kinetics within the first 30 seconds after contrast injection, when the background parenchymal enhancement (BPE) is minimal. This study was performed to explore the clinical utility of ultrafast MRI focusing on tumor size evaluation according to the level of BPE.

METHOD AND MATERIALS

A total of 360 consecutive women (median age, 54 years; range, 26 - 82 years) with 361 tumors (49 DCIS and 312 invasive) who underwent both the ultrafast and conventional breast MRI before surgery were included. Ultrafast MR images were obtained using TWIST or 4D-TRAK sequence (temporal resolution, 4.5 sec; voxel size, 1.1×1.1×1.0 mm3, TR/TE 4.1/1.3 ms). Then, conventional DCE-MR images were obtained using 3D FLASH sequence (temporal resolution, 90sec; voxel size, 0.8×0.8×1.0 mm3, TR/TE 4.7/1.7 ms). Tumor size was independently measured on each scan, respectively. Agreement between tumor sizes on MRI and those on surgical histopathology was assessed using the intraclass correlation coefficient (ICC) analysis.

RESULTS

The ICC on ultrafast MRI was comparable to that on conventional MRI (ICC = 0.657 vs. 0.634, P =.598). For conventional MRI, the ICC was lower in women with moderate to marked BPE (ICC = 0.568) than in women with minimal to mild BPE (ICC = 0.650) with borderline significance (P =.080). However, no difference was found on ultrafast MRI (ICC = 0.625 for moderate to marked vs. 0.663 for minimal to mild BPE, P =.385). In women with moderate to marked BPE, the ICC was slightly higher on ultrafast MRI than that on conventional MRI, although the difference was not statistically significant (ICC = 0.625 vs. 0.568, P = .236). No difference was found for the ICC according to the age, menopausal status, family history, histologic type, ER positivity, HER2 positivity, and lesion type on MRI (mass vs. non-mass enhancement) (All P >.05).

CONCLUSION

In women with moderate to marked BPE, tumor size measurement might be more accurate on ultrafast MRI than on conventional MRI.

CLINICAL RELEVANCE/APPLICATION

In women with moderate to marked BPE, ultrafast MRI can be applied for more accurate evaluation of tumor extent.

SSQ01-04 Maximum Slope as a Kinetic Parameter Based on Ultrafast Dynamic Contrast-Enhanced MRI of the Breast Using K-Space Weighted Imaging Contrast

Thursday, Nov. 29 11:00AM - 11:10AM Room: E450A

Participants
Akane Ohashi, Kyoto-hu, Japan (*Presenter*) Nothing to Disclose
Masako Y. Kataoka, MD, PhD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Shotaro Kanao, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Mami Iima, MD, PhD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Makiko Kawai, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Natsuko Onishi, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Yuta Urushibata, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Katsutoshi Murata, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Elisabeth Weiland, Erlangen, Germany (*Abstract Co-Author*) Employee, Siemens AG
Masakazu Toi, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Kaori Togashi, MD, PhD, Kyoto, Japan (*Abstract Co-Author*) Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Nihon Medi-Physics Co, Ltd; Research Grant, Canon Medical Systems Corporation

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PURPOSE

To investigate the diagnostic performance and inter-reader agreement of the maximum slope (MS) in breast malignant from benign lesions obtained by ultrafast dynamic contrast-enhanced magnetic resonance imaging (DCE MRI). Comparison with washout index (WI) was performed with the focus on discrepant cases.

METHOD AND MATERIALS

In total, 141 enhancing lesions (89 malignant, 52 benign) were included. Ultrafast DCE MRI sequences were acquired using a k-space-weighted imaging contrast (KWIC) sequence, obtained 0 to 1 min after gadolinium injection (3.75 s/frame; 16 frames) and followed by standard DCE MRI. The MS was calculated its percentage relative enhancement per second (%/s). The inter-reader agreement of MS values by two radiologists were evaluated using intra-class correlation coefficients (ICC). As a semi-quantitative parameter for conventional DCE MRI, washout index (WI: signal intensity [SI] delay - SI early) / SI pre × 100 (%) was calculated. The diagnostic performance (malignant/ benign differentiation) of the MS and WI was compared using ROC analysis.

RESULTS

Intra-class correlation coefficients (ICC) of the reading was 0.98 (95% confidence interval 0.97-0.99) for all, 0.96 (0.95-0.98) for malignant lesions and 0.99 (0.97-0.99) for benign lesions. The average MS was 25.4%/s (standard deviation: SD, 11.2 %/s) for malignant lesions and 11.8%/s (SD, 10.7 %/s) for benign lesions. The AUC of the MS (ICC: 0.98) was almost same as that of the WI (0.83 vs. 0.82, respectively; P = 0.80). Using the optimal cut-off points determined by the Youden index (>9.76% /s for the MS and <-23 % for the WI), MS tended to have higher sensitivity (92.1%) and specificity (65.4%) compared with WI (91.1% and 61.5%, respectively). False positive cases based on MS were FA (n=5) and intraductal papilloma (n=1), while false positive cases based on WI were fibrocystic change (n=6), intraductal papilloma (n=2) and flat epitherial atypia.

CONCLUSION

The overall diagnostic performance of MS in breast lesion was similar to the conventional kinetic parameter, with AUC of over 0.8. Excellent ICC was obtained. MS helped to reduce false positive in fibrocystic change, while FA tended to be false positive on MS.

CLINICAL RELEVANCE/APPLICATION

Our results suggest that maximum slope can be an alternative kinetic parameter to conventional kinetic curve, potentially shorten scan time, with excellent inter-reader agreement.

SSQ01-05 Combination of an Ultrafast TWIST VIBE Dixon Sequence Protocol and Diffusion-Weighted Imaging to a Highly Accurate Clinically Applicable Classification Tool for Suspicious Masses in Breast MRI

Thursday, Nov. 29 11:10AM - 11:20AM Room: E450A

Participants
Stephan Ellmann, MD, Erlangen, Germany (*Presenter*) Nothing to Disclose
Sandra Peter, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
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Michael Uder, MD, Erlangen, Germany (*Abstract Co-Author*) Speakers Bureau, Bracco Group Speakers Bureau, Siemens AG Speakers Bureau, Bayer AG Research Grant, Siemens AG

PURPOSE

To develop a statistical model for classification of suspicious masses in breast MRI when using TWIST VIBE Dixon (TVD) dynamic sequences in combination with diffusion-weighted imaging (DWI) and compare it to a model based on a combination of conventional dynamic contrast enhancement (DCE) and DWI. As ultrafast TVD sequences offer the potential to shorten breast MRI protocols, diagnostic accuracy might be hampered due to reduced kinetic information. A special focus of this study was thus to maintain high diagnostic accuracy in lesion classification.

METHOD AND MATERIALS

65 patients underwent clinically indicated breast MRI between 02/2014 and 04/2015, with 83 reported lesions (60 malignant, 23 benign). Inclusion criteria were suspicion of breast cancer or pre-therapeutic staging. Patients with non-mass-enhancements only were excluded. The protocol consisted of our institute's standard protocol complemented by an ultrafast TVD sequence. The apparent diffusion coefficient (ADC) and the peak enhancement of the TVD sequences were used to calculate a generalized linear model (GLM) for prediction of malignancy. A second model was calculated using ADC and the curve type derived from the conventional DCE sequence for the sake of comparison. Generalizability was ensured by applying leave-one-out cross validations. For easy application of the GLMs in clinical workflows, nomograms were created.

RESULTS

The GLM based on peak enhancement of the ultrafast TVD sequences and ADC performed comparably accurate to the model based on conventional DCE and ADC (Sensitivity 93.3% vs. 93.3%, specificity 91.3% vs. 87.0%, positive predictive value 96.6% vs. 94.9%, negative predictive value 84.0% vs. 83.3%; no significant differences).

CONCLUSION

This study presents a method to integrate ultrafast TVD sequences into a breast MRI protocol and reduce examination time while maintaining diagnostic accuracy. A GLM based on the combination of TVD-derived peak enhancement and ADC provides high diagnostic accuracy. The GLM can easily be applied in clinical routine using the supplied nomograms.

CLINICAL RELEVANCE/APPLICATION

One limiting factor hampering the comprehensive application of breast MRI is time. This study presents a breast MRI protocol with less than 5 minutes duration along with a classification scheme reaching high diagnostic accuracy. Use of this protocol could improve patient throughput and strenghten the role of breast MRI in screening.

SSQ01-06 Ultrafast Dynamic Contrast-Enhanced MRI for Detection of Invasive Components in Cases of Breast Ductal Carcinoma in Situ by Biopsy

Thursday, Nov. 29 11:20AM - 11:30AM Room: E450A

Participants
Naoko Mori, MD, PhD, Sendai, Japan (*Presenter*) Nothing to Disclose
Hiroyuki Abe, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Shunji Mugikura, MD, PhD, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To evaluate whether ultrafast dynamic contrast-enhanced (DCE) MRI could identify invasive components in cases with ductal carcinoma in situ (DCIS) diagnosed by percutaneous biopsy.

METHOD AND MATERIALS

Fifty-three consecutive women with 53 lesions diagnosed with DCIS by biopsy underwent IRB-approved ultrafast DCE-MRI including a pre- and 18 post-contrast ultrafast 3D bilateral scans using a 3T system. Ultrafast 3D bilateral scans were acquired with temporal resolution of 3 seconds per image. We evaluated the heterogeneity of enhancement in a target lesion using model-based analysis. Regions of interest (ROIs) were placed where the strongest and weakest signal increases were found in ultrafast DCE-MRI to obtain kinetic curves of maximum and minimum enhancement, respectively. The kinetic curve obtained from ultrafast DCE-MRI was analyzed using an empirical mathematical model: $\Delta S(t)=A*(1-e-at)$. Where A is the upper limit of the signal intensity, a (min-1) is the rate of signal increase. The initial slope of the kinetic curve is given by 'A*a'. Amax, Amin, amax, amin, A*amax, and A*amin were obtained from ROIs for maximum and minimum enhancement, respectively. We obtained the following derivations for diagnostic parameters showing heterogeneity of enhancement: A difference=Amax - Amin; a difference= amax -amin; A*a difference= A*amax - A*amin.

RESULTS

Surgical specimens revealed 32 lesions with pure DCIS and the remaining 21 lesions with DCIS with invasive components (DCIS-IC). The A difference for DCIS-IC (132±235) was significantly higher than that of pure DCIS (49±34) ($p = 0.013$). No significant difference was found for a difference and A*a difference ($p = 0.24$ and 0.46, respectively). Receiver operating curve analysis revealed that the area under the curve of A difference was 0.70. The most effective threshold for A difference was 68, and the sensitivity, specificity, positive predictive value and negative predictive value were 62% (13/21), 72% (23/32), 59% (13/22), and 74% (23/31), respectively.

CONCLUSION

The A difference could suggest the presence of invasive components in cases with DCIS diagnosed by biopsy.

CLINICAL RELEVANCE/APPLICATION

The A difference showing the heterogeneity of enhancement of lesions in ultrafast DCE-MRI might suggest the presence of invasive components in cases of DCIS by biopsy.

SSQ01-07 Ultrafast Dynamic Contrast Enhanced Breast MRI in Differentiating between Subcentimeter Carcinomas and Benign Lesions: Quantitative versus Qualitative Assessments

Thursday, Nov. 29 11:30AM - 11:40AM Room: E450A

Participants
Natsuko Onishi, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose
Meredith Sadinski, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Peter Gibbs, BSC,PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

Katherine M. Gallagher, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
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Theodore M. Hunt, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Danny F. Martinez, BSC,MSc, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Amita Shukla-Dave, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
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Elizabeth J. Sutton, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Ultrafast dynamic contrast enhanced (UF-DCE) breast MRI, characterized by high temporal and spatial resolution, enables image acquisition at multiple time points starting simultaneously with the beginning of contrast injection. In a preliminary study comparing several quantitative parameters calculated from UF-DCE MRI, we determined bolus arrival time (BAT) and maximum slope (MS) were most useful in the differentiation between subcentimeter carcinomas and benign lesions. This study aims to compare the performance of these parameters with qualitative assessments of UF-DCE MRI.

METHOD AND MATERIALS

We identified female patients between February-October 2017 with a: 1) UF-DCE MRI as part of hybrid protocol with conventional DCE MRI performed with a 3.0T MRI with a 16-ch coil and 2) biopsy proven BI-RADS 4-6 lesion. UF-DCE MRI were acquired continuously 15 times during the approximately 60 sec (temporal resolution, 3.0-4.3 sec) starting simultaneously with the beginning of contrast injection. BAT and MS were computationally calculated based on 3D volumetric segmentation. Qualitative assessments were visually performed by a reader, identifying the time from scan start to the beginning of lesion enhancement (vBAT) and evaluating the degree of enhancement relative to background parenchymal enhancement (vE) by a 4-point grading scale from 'prominent' to 'indistinguishable'. Wilcoxon signed-rank test or Pearson's chi-squared test were used for the statistical analyses. P value <0.05 was considered satistically significant. The diagnostic performance was evaluated using areas under the receiver operating characteristic curve (AUC).

RESULTS

In total, 77 subcentimeter lesions (carcinomas, 33 [43%]; benign lesions, 44 [57%]) were analyzed. BAT, MS and vBAT presented significant difference between carcinomas and benign lesions (p=0.0004, p<.0001, p=0.0063), while vE did not (p=0.0607). AUCs of BAT (0.737) and MS (0.790) were higher than those of vBAT (0.683) and vE (0.605).

CONCLUSION

Quantitative assessments of UF-DCE MRI presented higher performance than qualitative assessments in differentiating between subcentimeter carcinomas and benign lesions.

CLINICAL RELEVANCE/APPLICATION

There is no standardized way to evaluate ultrafast DCE breast MRI. Although diagnostic utility of some quantitative parameters is known, little is known about the performance of qualitative assessment, especially for subcentimeter lesions.

SSQ01-08 Comparison of Machine Learning Based Measurement and Visual Assessment of Fibroglandular Tissue and Background Parenchymal Enhancement in Breast MR Imaging: A Preliminary Study

Thursday, Nov. 29 11:40AM - 11:50AM Room: E450A

Participants
Heeyoung Chung, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
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Yoonho Nam, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ga-Eun Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To design and validate a machine learning model for the measurement of fibroglandular tissue (FGT) and background parenchymal enhancement (BPE) in breast MR imaging, and compare with estimation of radiologist according to BI-RADS categories.

METHOD AND MATERIALS

195 women (mean age, 54.9 years; range 30 - 86 years) who were diagnosed with invasive breast cancer and underwent preoperative breast MR, between January and December 2017 were enrolled in this study. Two radiologists independently assessed the categories of FGT and BPE of contralateral breast, using with axial precontrast, early dynamic contrast enhancement T1-weighted image, and subtraction image between them. In case of discordance, two radiologists reached consensus. Machine learning model was designed to measure the volume of whole breast, FGT and BPE, using nonnegative matrix factorization (NMF). In this study, 50 and 145 samples were assigned to train and valid, respectively. Areas under the receiver operating characteristic curve was used to assess model performance of predicting dense breast (FGT category c, d) and prominent BPE (BPE category c, d). Correlation between the visual assessment of radiologist and machine learning based measurement was assessed using Spearman correlation analysis.

RESULTS

With the machine learning model, AUC of prediction of dense breast were 0.971 (0.880-0.998) in training set and 0.902 (0.784-0.968) in validation set. AUC of prediction of prominent BPE were 0.959 (0.912-0.985) in training set and 0.819 (0.746-0.848) in validation set (P < .001). Correlation between machine learning based measurement and visual assessment by radiologist was r = 0.871 of FGT, and r = 0.523 of BPE, respectively (P < .001).

CONCLUSION

Machine learning model showed reliable predictive power for FGT and BPE assessment and close correlation with FGT assessment by radiologist.

CLINICAL RELEVANCE/APPLICATION

FGT and BPE are known as risk factors for breast cancer and are associated with poor prognosis. Machine learning can provide quantitative and objective information of FGT and BPE volume in breast MR imaging and can be helpful to predict patient's prognosis.

SSQ01-09 Deep Learning of Breast MRI Tumor Volume Improves Tumor Proliferation Marker Ki-67 Estimation

Thursday, Nov. 29 11:50AM - 12:00PM Room: E450A

Participants
Dooman Arefan, PhD, Pittsburgh, PA (*Presenter*) Nothing to Disclose
Aly A. Mohamed, PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Hong Peng, MD, Xiangtan, China (*Abstract Co-Author*) Nothing to Disclose
Wendie A. Berg, MD, PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Jules H. Sumkin, DO, Pittsburgh, PA (*Abstract Co-Author*) Research Grant, Hologic, Inc; Research Grant, General Electric Company
Shandong Wu, PhD, MSc, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Ki-67 is a commonly used immunohistochemistry marker for cellular proliferation in invasive tumors. A few recent studies showed some association between Ki-67 and DCE-MR imaging features. We performed an investigation to compare effects of a 3D deep learning approach versus conventional radiomic features in deriving breast DCE-MRI information to predict Ki-67 rate.

METHOD AND MATERIALS

In an IRB-approved retrospective study of 141 patients, we identified 141 breast DCE-MRI scans (2011-2016) at our institution. All patients have the Ki-67 proliferation rates measured that are further categorized into High vs Low category according to a clinically defined threshold of 14. Breast tumor volume were automatically segmented in 3D space from the first post-contrast breast MR sequence images. From the segmented 3D tumor volume, we extracted 30 common radiomic features, including morphological and contrast enhancement kinetic characteristics of the tumor volume; those features were fed to a logistic least absolute shrinkage and selection operator (LASSO) regression model to predict High vs Low Ki-67 categories. Also, a 3D convolutional neural network (CNN) deep learning model was used to perform the same prediction but directly using the original image of the segmented 3D tumor volume (i.e., here no any pre-defined imaging features extracted nor used). We performed 10-fold cross-validation for both logistic regression and deep learning model evaluation and used average AUC as the metric of model classification accuracy.

RESULTS

There are 102 and 39 patients in the High and Low Ki-67 category, respectively. The average of the Ki-67 was 28.05%±21.63. The AUC of the logistic regression model was 0.74 (95% CI: 0.73-0.75) for 4 LASSO-selected top ranked radiomic features (1 morphological and 3 contrast-enhancement related), while the 3D deep learning model achieved an AUC of 0.80 (95% CI: 0.75-0.85).

CONCLUSION

In this study, the 3D CNN deep learning-based approach that automatically identifies and organizes hierarchical imaging features for predicting Ki-67 outperformed the LASSO regression model coupled with pre-defined radiomic features.

CLINICAL RELEVANCE/APPLICATION

Deep learning of breast DCE-MRI tumor volume using CNN models may improve interpretation on the association between radiological images and the immunohistochemistry tumor proliferation marker Ki-67.

VW18

Invenia ABUS 2.0 - Live Scanning Demo: GE Vendor Workshop

Thursday, Nov. 29 10:30AM - 11:00AM Room: Booth 8156

Participants
Doug Whisler, Sunnyvale, CA (*Presenter*)

Program Information

This thirty minute session will cover the latest technological advancements in ABUS design and performance. Attendees will learn how improvements in workflow and image quality have the potential to increase cancer detection in women with dense breast tissue. *Registration is required; adding this session to the RSNA calendar tool alone does not secure your seat in this session. Click the link below to register.*

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2018-/agenda-e57e0b47e9aa4f5ba89b1a0da1e829b9.aspx

VW49

Wide-angle Digital Breast Tomosynthesis and Contrast Enhanced Mammography Self-guided Reading Sessions: Siemens Healthineers Vendor Workshop

Thursday, Nov. 29 10:30AM - 5:00PM Room: Booth 5530

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 and contrast enhanced mammography cases presented as problem cases with a solution enables you to develop and test your reading skills.

VW50

Automated Breast Volume Scanner (ABVS) Self-guided Reading Sessions: Siemens Healthineers Vendor Workshop

Thursday, Nov. 29 10:30AM - 5:00PM Room: Booth 5530

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.

VW19

Invenia ABUS 2.0 - Live Scanning Demo: GE Vendor Workshop

Thursday, Nov. 29 11:00AM - 11:30AM Room: Booth 8156

Participants
Doug Whisler, Sunnyvale, CA (*Presenter*)

Program Information

This thirty minute session will cover the latest technological advancements in ABUS design and performance. Attendees will learn how improvements in workflow and image quality have the potential to increase cancer detection in women with dense breast tissue. *Registration is required; adding this session to the RSNA calendar tool alone does not secure your seat in this session. Click the link below to register.*

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2018-/agenda-e57e0b47e9aa4f5ba89b1a0da1e829b9.aspx

VW20

Invenia ABUS 2.0 - Live Scanning Demo: GE Vendor Workshop

Thursday, Nov. 29 11:30AM - 12:00PM Room: Booth 8156

Participants
Doug Whisler, Sunnyvale, CA (*Presenter*)

Program Information

This thirty minute session will cover the latest technological advancements in ABUS design and performance. Attendees will learn how improvements in workflow and image quality have the potential to increase cancer detection in women with dense breast tissue. *Registration is required; adding this session to the RSNA calendar tool alone does not secure your seat in this session. Click the link below to register.*

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2018-/agenda-e57e0b47e9aa4f5ba89b1a0da1e829b9.aspx

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

ML53

Machine Learning Theater: State-of-the-art Deep Learning for Breast Cancer Screening: Presented by Kheiron Medical Technologies

Thursday, Nov. 29 12:00PM - 12:20PM Room: Machine Learning Showcase North Hall

Participants

Tobias Rijken, London, United Kingdom (*Presenter*) Stockholder, Kheiron Medical Technologies Ltd

Program Information

Kheiron is at the cutting edge of deep learning technology for breast cancer screening. This session will cover our multi-site clinical trial, and how we have achieved state-of-the-art results using deep learning technology. In addition, we will discuss: - data processing at scale - deep learning infrastructures - the future of breast screening empowered by deep learning.

BRS-THA

Breast Thursday Poster Discussions

Thursday, Nov. 29 12:15PM - 12:45PM Room: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

Participants
Victoria L. Mango, MD, New York, NY (*Moderator*) Nothing to Disclose

Sub-Events

BR010-EB-THA Imaging Findings of Breast Implant Complications: What Has Changed with Latest-Generation Implants?

Hardcopy Backboard

Participants
Vinicius C. Felipe SR, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Marilia M. Azevedo, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Almir Bitencourt, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Juliana A. Souza, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

- Earlier-generation implants have high rates of complications, such as contracture and rupture. Latest-generation implants reduced the number of complications by modifying its composition (cohesive silicone gel) and shell structure (stronger with textured surface). Thereby, imaging aspects of breast implants complications has also changed. - Some breast implant complications became less frequent with latest-generation implants, including displacement, rotation, capsular contracture and rupture. Besides, classical imaging signs of breast implant rupture, such as 'teardrop' or 'keyhole', 'salad oil' and 'linguini' signs, may not be seen on modern implants. Because of the semisolid consistence of these implants, silicone gel does not mix with water / saline content, and thus, rupture looks more likely as a 'fracture' on imaging methods. - Some complications that were rarely seen before became more frequent after the use of latest-generation textured implants, such as late seroma, silicone-induced granuloma of the breast implant capsule and breast implant associated anaplastic large cell lymphoma.

TABLE OF CONTENTS/OUTLINE

Introduction breast implant types complications of latest generation implants implant rupture late seroma silicone-induced granuloma breast implant associated anaplastic large cell lymphoma.

BR268-SD-THA2 Prediction of Axillary Response by Monitoring with Ultrasound and MRI During and After Neoadjuvant Chemotherapy in Breast Cancer Patients

Station #2

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PURPOSE

To investigate whether monitoring with ultrasound (US) and MR imaging can predict axillary response in breast cancer patients after neoadjuvant chemotherapy (NAC).

METHOD AND MATERIALS

A total of 131 breast cancer patients with clinically positive axillary lymph node (LN) who underwent NAC and subsequent surgery from January 2012 to August 2017 were enrolled. They had US and 3T MR examinations for breast and axilla before, during, and after NAC. After reviewing US and MR images obtained at three different times, the number, size, shape, presence of hilum, and cortical thickness of axillary LNs as well as index tumor size were noted. According to LN status after surgery, imaging features were analyzed by using independent t-test, the Fisher exact test, multiple logistic regression analysis, and ROC analysis.

RESULTS

Of 131 patients, 60 (45.8%) had positive LNs after surgery. All US and MR features of LN before NAC showed no difference in LN status. There was significant difference in transverse diameter, cortical thickness and its % change, and tumor size and its % change during NAC and cortical thickness after NAC at US ($P<0.003$), and transverse diameter, cortical thickness and its % change,

hilum, and tumor size and its % change during and after NAC at MR (P<0.03). On multivariate analysis, cortical thickness at US during NAC (odd ratio [OR], 1.8; 95% CI, 1.2-2.6; P=0.005) and tumor size at US (OR, 1.06; 95% CI, 1.0-1.1]; P=0.038) and MR(OR, 1.04; 95% CI, 1.007-1.079; P=0.019) after NAC were independently associated with positive LN. The area under the ROC curve for predicting LN status was 0.741, 0.639, and 0.692 for cortical thickness at US during NAC and index tumor size on US and MR after NAC, respectively.

CONCLUSION

The US cortical thickness of axillary LNs during NAC and the index tumor size on US and MR after NAC can be useful to predict axillary response in breast cancer patients.

CLINICAL RELEVANCE/APPLICATION

Monitoring morphologic features of axillary LNs and index tumor by US and MR imaging can help making treatment decision in breast cancer patients receiving NAC.

BR275-SD-THA3 "Virtual" Full-Dose (VFD) Technology: Radiation Dose Reduction in Digital Breast Tomosynthesis (DBT) by Means of Neural Network Convolution (NNC) Deep Learning

Station #3

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TEACHING POINTS

1) To understand the basics of a deep-learning-based "virtual" full-dose technology. 2) To demonstrate and compare the image quality of our VFD images generated from quarter- and half-dose acquisitions to that of real clinical full-dose images in DBT. 3) To understand the clinical utility of VFD technology for reducing radiation dose in DBT.

TABLE OF CONTENTS/OUTLINE

Content OrganizationA. Radiation dose issues with DBT breast cancer screeningB. Basics of VFD technology for reducing radiation doseC. Quantitative evaluation: Image quality vs. radiation dose reductionD. Blinded observer rating study with 35 breast radiologists: virtual vs. real imagesE. Benefits and limitations of our radiation dose reduction technology for DBT This exhibit presents1) Details on our deep-learning-based VFD technology that converted 25% dose images of cadaver phantoms to VFD images, retaining the image quality equivalent to 119% dose images and achieving a 79% dose reduction. 2) The image quality of VFD images of clinical cases was equivalent to that of real full-dose images. Our technology significantly reduced noise in half-dose images, while preserving tissue and lesions. 3) Blinded observer rating study of 51 clinical cases: 60% of 35 radiologists preferred our VFD images over real full-dose images or could not distinguish between the two.

PDF UPLOAD

http://abstract.rsna.org/uploads/2018/18004421/18004421_8gfq.pdf

BR270-SD-THA4 Cognitive Bias in Screening Mammography

Station #4

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PURPOSE

Gambler's fallacy and reverse gambler's fallacy are logical missteps based on the mistaken premise that previous outcomes of a random event will affect future outcomes. Our purpose is to determine how significantly such a bias affects the reading of screening mammograms, and specifically, to determine if recalling of one examination affects the likelihood of recalling subsequent examinations.

METHOD AND MATERIALS

Over 70000+ screening digital mammographic results from two separate enterprises including 22 different radiologists over a span of less than 5 years were obtained. Exams after the implementation of tomosynthesis were excluded. The data was anonymized, but each radiologist was assigned a number. Exams were batched into different time frames (5 minutes, 10 minutes, 30 minutes, and 1 hour). Runs of exams were analyzed to determine if recalling a case would significantly impact the recall of subsequent cases.

RESULTS

Initial results demonstrated that the probability of recalling a case after a recent recall was significantly lower than the probability of recalling any single case alone. However, after excluding the first study there was no significant difference between the relative recall rates. Curiously, batching exams and aggregating results demonstrated that the recall rate for the first position of each batch

was statistically higher than the recall rate for all other examinations in a batch at an aggregate level for all time frames. Additionally, using a 5 minute batch time, the results were statistically significant for all radiologists individually. Statistical significance was achieved for the majority of all radiologists at all other batching time frames.

CONCLUSION

We found that radiologists do not suffer from the general premise of gambler's fallacy. Assuming no artifactual bias, however we found that they appear to be primed to recall the first case in a series. This may represent an unknown cognitive bias in screening mammography.

CLINICAL RELEVANCE/APPLICATION

Sensitivity of the first examination of any batch of screening digital mammographic examinations is expected to be higher on average than other examinations and may reflect the only non-biased result.

BR271-SD-THA5 Imaging Features Associated with Pathological Complete Response in HER2 Positive Breast Cancer after Neoadjuvant Chemotherapy with Dual Blockade

Station #5

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PURPOSE

In human epidermal growth factor receptor 2 (HER2)-positive breast cancer, the incorporation of dual HER2-blockade to neoadjuvant chemotherapy (NAC) has been shown to induce a higher rate of pathologic complete response (pCR). The purpose of this study was to investigate associations between imaging features and pCR in HER2-positive breast cancer after NAC plus dual blockade.

METHOD AND MATERIALS

This retrospective study was approved by the institutional review board. We evaluated 73 consecutive patients (mean age, 50 ± 9.99 years) with HER2-positive breast cancer who underwent NAC plus dual blockade with trastuzumab and pertuzumab between April 2016 and March 2018. All patients had mammography, ultrasound, and MR imaging prior to NAC. pCR following NAC was defined as the absence of residual invasive cancer in the breast and ipsilateral lymph nodes (ypT0/is, ypN0). Clinicopathological and initial imaging features before NAC were assessed and compared according to the pathological response after surgery.

RESULTS

Of 73 patients, 41 (56.2%) showed pCR and the remaining 32 (43.8%) showed non-pCR. Segmental distribution of calcification on mammography (odds ratio [OR], 13.57; $P = 0.027$), parallel orientation on ultrasound (OR, 4.03; $P = 0.007$), and the presence of intratumoral high signal intensity on T2-weighted MR images (OR, 2.81; $P = 0.037$) were significantly associated with pCR. Progesterone receptor-negative tumors (OR, 6.33; $P = 0.004$) were significantly associated with pCR. The presence of mammographic calcification with or without a mass, associated nonmass enhancement on MR images, fine pleomorphic or fine linear branching calcification morphology on mammography, and higher tumor infiltrating lymphocytes level were more common in the pCR group, although these did not reach statistical significance.

CONCLUSION

Several imaging features showed association with pCR in HER2-positive breast cancer after NAC with dual blockade treatment.

CLINICAL RELEVANCE/APPLICATION

Our results may help differentiate patients who can benefit from adding dual blockade in HER2-positive breast cancer and determine treatment.

BR272-SD-THA6 Comparison between Abbreviated Protocol (AB-MR) and Full Diagnostic Protocol (FD-MR) in the Characterization of Lesions Detected by Breast MRI: A Multi-reader Study

Station #6

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PURPOSE

Abbreviated breast MRI (AB-MR) has been shown to offer equivalent diagnostic accuracy compared with the respective full-diagnostic MRI (FD-MR) in a screening setting. We compared the diagnostic performance of AB-MR and FD-MR in the characterization of lesions detected by MRI.

METHOD AND MATERIALS

A cohort of 111 biopsy-proven cases (34 malignant, 77 benign; median lesion size 1.2cm, range 0.3-6.6cm) identified at contralateral breast MRI screening during the preoperative evaluation of newly diagnosed breast cancer patients between January 2011 and August 2016 was used for the reader study. Three blinded radiologists independently classified the likelihood of malignancy and BI-RADS final assessment category for imaging data sets, i.e., AB-MR and FD-MR with 1-week interval. AB-MR consisted of fat saturated pre-contrast, first post-contrast (90 sec) T1WI, and maximum-intensity projection (MIP) reconstruction images. FD-MR consisted of T2WI, fat saturated pre-contrast, and five post-contrast T1WI series. Sensitivity, specificity, and areas under the receiver operating characteristic (AUC) curve in distinguishing benign from malignant lesions were compared between both protocols.

RESULTS

Sensitivity of AB-MR was slightly lower than that of FD-MR in all readers (82.4% [28/34] vs. 85.3% [29/34] in reader 1, P>.999; 82.4% [28/34] vs. 100% [34/34] in reader 2, P= not applicable; 58.8% [20/34] vs. 82.4% [28/34] in reader 3, P=.077). Specificity of AB-MR was higher than that of FD-MR (41.6% [32/77] vs. 36.4% [28/77], P=.503; 39.0% [30/77] vs. 19.5% [15/77], P=.001; 74.0% [57/77] vs. 37.7% [29/77], P<.001), although statistical significance was only found for specificity differences in two readers. AUC of AB-MR was comparable to that of FD-MR in all readers (0.706 vs. 0.705, P=.981; 0.700 vs. 0.685, P=.765; 0.738 vs. 0.698, P=.542).

CONCLUSION

Compared with FD-MR, AB-MR missed one, six, or eight of 34 cancers for each reader in the characterization of lesions detected by MRI, although overall performances were similar in both protocols.

CLINICAL RELEVANCE/APPLICATION

Due to the limited characterization performance, AB-MR cannot replace FD-MR in a diagnostic setting.

BR211-ED-THA7 Easily Seen, Difficult Diagnosis: Spectrum of Lesions Involving the Nipple

Station #7

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TEACHING POINTS

To review the different causes of nipple lesions, both benign and malignant. To illustrate imaging findings of lesions involving the nipple in different techniques, including mammogram, US and MR, providing clinical images and pathologic correlation. To discuss the appropriate management of these lesions, emphasizing pitfalls, diagnostic difficulties and differential diagnosis.

TABLE OF CONTENTS/OUTLINE

Apart from breast cancers extending to the nipple, different lesions may appear in this area. From 2009 to 2016, 90 nipple biopsies were performed at our Institution. We review nipple anatomy, as well as clinical and radiological imaging and pathology of the different entities. We also analize special considerations of this challenging region for diagnosis, interventional procedures and treatment. We present: Congenital: accesory nipple; Dermal lesions: Epidermal inclusion cyst, fibroepithelial polips, dermatitis, melanoma and benign melanocytic nevus; Paget´s disease; Inflammatory lesions: galactophoritis, abscess; Nipple Tumors: adenoma of the nipple; Breast lesions: papiloma, ductal carcinoma.

BR212-ED-THA8 Systematic Approach to Lesions Involving Nipple-Areolar Complex Using MRI

Station #8

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TEACHING POINTS

The nipple-areolar complex (NAC) is located at the unique crossroad between skin and mammary duct. Therefore, wide variety of lesions originated from skin or mammary duct can grow there, making their diagnosis challenging. Some parenchymal lesions invade to the NAC. Identifying locations of NAC lesions in relation to anatomy and knowing typical progression pattern is crucial in diagnosis and surgical planning. Lesions involving NAC may be continuous to the parenchymal component, which is often overlooked. MRI is an ideal tool to examine NAC involvement and associated underlying parenchymal disease by obtaining cross-sectional imaging with excellent tissue contrast.In this exhibit, we 1. review the anatomical structure of NAC and underlying parenchyma, 2. illustrate the location of NAC lesions, 3. classify NAC lesions based on their location, and 4. propose systematic approach to lesions involving NAC based on cross-sectional information on MRI.

TABLE OF CONTENTS/OUTLINE

1. Anatomy of NAC in relation to the ductal system of the breast parenchyma. 2. Classifications of lesions involving NAC based on their location. 3. Case presentations, including nipple adenoma, Paget's disease, DCIS with intraductal spread, Pagetoid spread, invasive cancer invading skin and nipple. 4. Systematic approach to lesions involving NAC.

BR213-ED-THA9 Preoperative Freehand Breast MRI Needle/Hookwire Localization of Lesions in Hard to Reach Locations Where Grid Techniques Fail: Indications, Techniques, and Pitfalls

Station #9

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TEACHING POINTS

To review indications for freehand MRI needle/hookwire localization in hard to reach locations where standard MRI grid techniques may fail (examples: far posterior lesions, implants) To describe/demonstrate the step-by-step freehand MRI needle/hookwire localization method To discuss potential pitfalls of each localization step

TABLE OF CONTENTS/OUTLINE

Indications for freehand MRI localization where grid techniques may fail Freehand MRI localization technique: A step-by-step approach with examples Freehand localization technique pitfalls

BR214-ED-THA10 Intraoperative Use of 3D Printed Breast Models in the Setting of Breast Cancer

Station #10

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TEACHING POINTS

1) 3D printed breast models allow accurate depiction of breast cancer extent by providing detailed relationships between the tumor, chest wall, skin, nipple and surrounding blood vessels. 2) Intraoperative manipulation of 3D printed models complements the information provided by concurrent breast imaging studies. 3) 3D printed breast models are useful in personalized patient education regarding their disease and surgical management. 4) 3D printed breast models support multidisciplinary management of breast cancer by enhancing surgical planning and execution.

TABLE OF CONTENTS/OUTLINE

We will present a pictorial essay of our experience in 3D printed breast models in the setting of multidisciplinary breast cancer practice. 1) Review of imaging features of breast cancer cases in which a 3D printed breast model was requested 2) Preoperative image guided localization correlating with the findings depicted in the 3D printed breast model and other breast imaging studies 3) Intraoperative utilization and manipulation of 3D printed breast model during oncoplastic breast surgery.

BR215-ED-THA11 Non-mass Findings on Breast Ultrasound (US): Detection, Differential, Diagnosis

Station #11

Awards
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TEACHING POINTS

The term 'nonmass finding' on ultrasound (US) is not part of current BI-RADS terminology, but is increasingly being used in the radiology literature. Despite the current lack of a standardized approach to classification and evaluation of nonmass US findings, recognition of this US finding can improve sonographic detection and correlation of mammographic and MRI lesions to help guide biopsy. The purpose of this exhibit is to: 1) Review the various proposed classifications systems for nonmass US findings 2) Provide imaging features of nonmass enhancement to help radiologists identify this sonographic finding 3) Demonstrate the wide range of

benign and malignant entities that may manifest as a nonmass finding 4) Correlate breast MRI and mammographic findings that may present as sonographic nonmass findings

TABLE OF CONTENTS/OUTLINE

1) Review the definitions and various proposed classification systems for non-mass US findings described in the radiology literature 2) Illustrate the sonographic features of non-mass findings, any associated findings, and imaging techniques to detect non-mass findings 3) Correlate sonographic nonmass findings with mammographic and breast MRI lesions to aid in biopsy and diagnosis 3) Review benign and malignant etiologies for non-mass US findings through a rich pictorial review of illustrative cases

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 EducatorCatherine S. Giess, MD - 2017 Honored Educator

BR210-ED-THA12 Genetic Testing for Hereditary Breast and Ovarian Cancer: A Primer for Radiologists

Station #12

Awards
Certificate of Merit
Identified for RadioGraphics

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TEACHING POINTS

Explain the criteria for genetic risk evaluation that qualifies a patient to undergo genetic testing. Discuss the process of genetic counseling, the different types of genetic testing used, and the implications of positive genetic results. Review the radiology findings and imaging appearances of breast cancer typically associated with each mutation.

TABLE OF CONTENTS/OUTLINE

Breast imagers are often the first to initiate the conversation about genetic counseling with patients who have premenopausal breast cancer or a strong family history of breast and ovarian cancer. Commercial genetic testing panels have gained popularity and become more affordable in recent years. Therefore, it is imperative for radiologists to be able to provide counseling and to identify which patients should be referred to genetic testing. Understanding of various breast cancer risk assessment tools such as Gail and Tyrer-Cuzick models; and recognizing unique clinical presentations, specific imaging appearances, and genetic pedigree patterns related to each mutation permits prompt identification of patients and their family members who carry mutations. The genetic test results enable appropriate patient-specific screening that allows improvement of overall survival via early detection and timely treatment.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
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BRS-THB

Breast Thursday Poster Discussions

Thursday, Nov. 29 12:45PM - 1:15PM Room: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

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Sub-Events

BR273-SD-THB1 Fully Automated Breast Lesion Segmentation on DCE-MRI Using a Convolutional Neural Network for Radiomic Analysis

Station #1

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PURPOSE

To validate the accuracy of the automated segmentation of breast tumors using a fully convolutional neural network (CNN) developed by our group. The goal is to create an automated DCE-MRI breast lesion segmentation system to be able to be utilized in further radiomics studies in breast cancer, such as predicting sentinel lymph node metastases.

METHOD AND MATERIALS

This retrospective study was approved by the local IRB. A total of 316 DCE-MRI scans of breast cancer patients acquired on a 1.5T MRI scanner were collected. We trained a CNN on a GPU server to automatically segment DCE-MRI breast lesions. Two radiologists participated in this study. A total of 197 DCE-MRI scans were used for training the lesion segmentation neural network, these were all drawn by radiologist 1. The network was then tested on a separate set of 119 DCE-MRI scans, using ROIs drawn by both radiologists. Dice indices among the two radiologists' hand drawn ROIs and those generated by the automated network were calculated.

RESULTS

On patient level, the mean Dice indices between ROIs were 0.64 (radiologist 1 vs 2), 0.60 (CNN vs radiologist 1), and 0.62 (CNN vs radiologist 2). In order to reduce the effect of very small lesions on Dice index, the ROIs of all patients were grouped together; the corresponding Dice indices were 0.64, 0.71 and 0.67. A Dice index of 0.7 is generally considered to have excellent agreement between two segmentations in this condition . Comparing these two Dice indices indicates that the network segments lesions with similar error rates to inter-human reader differences.

CONCLUSION

The proposed neural network-based automated breast lesion segmentation shows significant agreement compared to the labor-intensive manual segmentation. The next step is to apply this in a task-based radiomic analysis to provide potential biomarkers and guide clinical decisions for breast cancer patients.

CLINICAL RELEVANCE/APPLICATION

To determine whether such a fully automated neural network based segmentation could be employed for developing and implementing radiomics pipelines.

BR274-SD-THB2 Comparison of Results from Three Different Density Assessment Methods on Mammographic Density (MD) in Screening Patients Receiving Vitamin D (Vit D): Results of CALGB 70806 (Alliance)

Station #2

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PURPOSE

To compare the different methods used for assessing MD in this screening population receiving Vit D for its breast cancer prevention properties, in CALGB 70806, a randomized phase II trial.

METHOD AND MATERIALS

Premenopausal women randomized to receive either 2000IU of Vit D or placebo for 12 months had mammogram at baseline and at 12 months. MD was determined by Clinical Breast Imaging Reporting and Data System (BI-RADS), the semiautomatic software Cumulus 6.0 (University of Toronto, Toronto, Canada), and fully automated method by the Laboratory for Individualized Breast Radiodensity Assessment (LIBRA, by Computational Breast Imaging Group at University of Pennsylvania). Blinded central review of all submitted mammograms was performed. Eligible women were premenopausal, age <55, with at least 25% dense breast tissue. Kappa statics were used to measure agreement between local and central MD readings using BI-RADS. MD measurements were compared using Wilcoxon rank-sum test.

RESULTS

300 women from 41 US centers were accrued from 2011 to 2013. 150 women received Vit D and 150 placebo. Mean age was 42.6 years with 14% Hispanic, 12% African American, and 74% Caucasian. 72% of participants completed treatment; the rest withdrew. As previously reported, 1 year Vitamin D therapy did not significantly change MD (p=0.7048). Sub-analysis demonstrated moderate agreement between local and central MD readings using BI-RADs classification at baseline and at 12 months, with Kappa coefficients of 0.48 and 0.41 respectively. Increased MD from Cumulus and LIBRA were noted in heterogeneously dense and dense BI-RADs cases (p <0.0001). When the readings for CC view was compared to MLO view, CC views showed slightly higher readings at baseline and at 12 months (p=0.05 and 0.02 respectively). Cumulus readings were consistently higher than LIBRA readings (table 1, P <0.0001).

CONCLUSION

The subjective method of BI-RADS, semi-automated method CUMULUS, and automated method LIBRA were in agreement for the majority of cases, with least variability noted from LIBRA than the other two methods.

CLINICAL RELEVANCE/APPLICATION

The automated method is more reliable and reproducible than the semi-automated or BI-RADs method for assessing breast density. Support: UG1CA189823, U24CA196171. ClinicalTrials.gov Identifier: NCT01224678

BR269-SD-THB3 Comparison Between Radiation Dose of 2D Digital versus Digital Tomosynthesis Guided Stereotactic Breast Biopsies: Tomosynthesis Wins!

Station #3

Participants
Tali Amir, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Bruno Barufaldi, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Samantha P. Zuckerman, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Andrew D. Maidment, PhD, Philadelphia, PA (*Abstract Co-Author*) Research support, Hologic, Inc; Research support, Barco nv; Research support, Analogic Corporation; Spouse, Employee, Real-Time Tomography, LLC; Spouse, Stockholder, Real-Time Tomography, LLC; Scientific Advisory Board, Real-Time Tomography, LLC;
Emily F. Conant, MD, Philadelphia, PA (*Abstract Co-Author*) Grant, Hologic, Inc; Consultant, Hologic, Inc; Grant, iCAD, Inc; Consultant, iCAD, Inc; Speaker, iiCME

PURPOSE

To compare radiation dose of digital breast tomosynthesis (DBT) versus digital mammographic (DM) guided breast biopsies

METHOD AND MATERIALS

We replaced a prone DM stereotactic biopsy (bx) unit with a prone dual mode, DM-DBT bx unit in 8/2017. All bxs performed 8/2016 to 1/2017 and 8/2017 to 1/2018 were retrospectively reviewed. The bxd finding, guidance modality (DM vs DBT), and Digital Imaging and Communications in Medicine (DICOM) header data were recorded. Image metadata was extracted from the DICOM header and stored into a client-side Structured Query Language (SQL) database. The average glandular dose (AGD) per image and study were computed and stratified by modality and finding type.

RESULTS

25 DM guided bxs (24 calcifications,1 asymmetry) were performed on the DM unit between 8/2016 and 1/2017. The AGD per image was 2.63 mGy (SD 1.16). The AGD per procedure was 28.77 mGy (SD 14.34) and average image number was 10.92. 97 DM/DBT guided bxs (80 calcifications, 13 architectural distortions, 2 asymmetries, 2 masses) were performed on the DM-DBT unit from 8/2017 -1/2018. The AGD per image was 2.40 mGy (SD 1.09); DM AGD was 2.32 mGy (SD 1.11) while DBT AGD was 2.46 mGy (SD 0.95). The AGD per procedure was 18.18 (SD 13.66); DBT guided bxs had an AGD of 12.43 mGy (SD 9.08) while DM guided bxs had an AGD of 21.20 mGy (SD 14.18). The average image number for DM bxs was 9.14 compared with 5.05 for DBT bxs. There was a 26% dose reduction for DM bxs on the dual mode unit compared to the DM only unit, due to a 12.7% reduced AGD per image (p<0.0001). When assessing DBT compared with DM guided bxs on the dual unit, the DBT AGD was 36% lower than DM (p=0.0304), despite a 13% increase in dose per individual DBT acquisition compared to a single DM view.

CONCLUSION

Significant dose reduction is achieved for mammographically guided bxs with newer equipment functioning with higher efficiency. In addition, for bxs performed on a dual mode unit, use of DBT guidance can significantly reduce dose compared to using DM guidance. This lower dose is due to a lower number of acquisitions in DBT guided bxs and because a single DBT acquisitions has a lower AGD than DM stereo pairs.

CLINICAL RELEVANCE/APPLICATION

Newer, more efficient biopsy equipment and the use of DBT guidance can reduce the total radiation dose of mammographically guided biopsy procedures.

BR276-SD-THB4 Comparative the Average Glandular Dose between Digital Breast Tomosynthesis (DBT) and Full-Field Digital Mammography (FFDM): Correlation with Breast Thickness and Density

Station #4

Participants
Chanjuan Wen, Guangzhou, China (*Presenter*) Nothing to Disclose
Weimin Xu, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Hui Zeng, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Zilong He, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Weiguo Chen, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To compare the average glandular dose (AGD) between single-view digital breast tomosynthesis (DBT) and single-view full-field digital mammography (FFDM), and to evaluate the correlation of AGD with breast thickness and density.

METHOD AND MATERIALS

A total of 318 female patients who underwent both DBT and FFDM (DBT and FFDM were performed in the same compression thickness in each breast) were included. 636 DBT images of unilateral breast mediolateral oblique (MLO) view and 636 FFDM images of unilateral breast mediolateral oblique (MLO) view were analyzed. Mammographic breast density was determined according to BI-RADS breast density grading, and breast thickness and AGD per exposure in MLO views retrieved from DICOM headers were recorded. Breast thickness were divided into the following four groups: <= 30cm, 31 ~ 45cm, 46 ~ 60cm and > 60cm. The statistical analyses used variance analysis and Pearson's correlation for parametric tests.

RESULTS

(1) The AGD of DBT had a weak negative correlation with breast density (correlation coefficient =-0.305, P<0.001), decreased as the breast density increased. The AGD of FFDM did not change significantly with breast density increased (correlation coefficient =-0.027, P=0.501). (2) Breast thickness was significantly associated with AGDs, and both AGDs of FFDM and DBT increased with increased breast thickness (correlation coefficient =0.771 and 0.935, respectively, all P<0.001). (3) When breast density was >75% and breast thickness was >60cm, the AGD of DBT was lower than that of FFDM, and the difference was statistical significant (P = 0.031).

CONCLUSION

The AGD of DBT increased with breast thickness increased and decreased with breast density. For thick and dense breast, the radiation dose of DBT was lower than that of FFDM.

CLINICAL RELEVANCE/APPLICATION

In this study, we evaluated the AGD of MLO FFDM and DBT according to breast density and thickness.

BR277-SD-THB5 Fate of a BI-RADS 3 Lesion: An Analysis of the Characteristics, Follow Up, Diagnostic Workup, and Cancer Rate of Probably Benign Lesions Seen at Breast MRI

Station #5

Participants
Margaret J. Wong, MD,MENG, Palo Alto, CA (*Presenter*) Nothing to Disclose
Rupa Patel, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Wendy B. Demartini, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Julia Todderud, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Debra M. Ikeda, MD, Stanford, CA (*Abstract Co-Author*) Scientific Advisory Board, Grail, Inc; Reviewer, Siemens AG

PURPOSE

Our purpose was to evaluate the patient and imaging characteristics, follow-up frequency and timing, and rate of malignancy for breast MRI examinations assessed as BI-RADS Category 3.

METHOD AND MATERIALS

From 4235 consecutive screening and diagnostic breast MRI examinations performed from May 2011 through December 2014, we retrospectively identified examinations assessed as BI-RADS Category 3. For the study examinations, we collected patient characteristics and breast MRI BI-RADS descriptors, follow-up frequency and timing, and biopsy outcomes. Benign versus malignant outcome was determined by biopsy and/or imaging follow-up for two years. We calculated the frequencies of patient and imaging characteristics, and the rates of follow-up compliance and of malignancy.

RESULTS

From 4235 consecutive breast MRI examinations in the study interval, 3.9% (167/4235) were assessed as BI-RADS Category 3. 88% (147/167) examinations were in patients designated at high risk for breast cancer. The most frequency MRI features associated with BI-RADS Category 3 were minimal background parenchymal enhancement (50%, 83/167), lesion type mass (38%, 64/167), and lesion type focus/foci (39%, 65/167). Masses were most commonly oval (50%, 32/64) and circumscribed (39%, 25/64). Initial kinetics were most commonly medium (39%, 65/167), and late kinetics were most commonly persistent (60%, 100/167). The follow-up compliance rate was 75% (125/167) with an average time to follow up of 14.1 months. Out of the 125 MRI examinations with adequate follow up, 21 lesions were biopsied (17%, 21/125) showing two cancers (1.6%, one IDC and one DCIS), six high-risk lesions (4.8%; three papillomas, one ALH, one ADH, one low-grade spindle cell tumor) and 13 benign findings.

CONCLUSION

Breast MRI BI-RADS Category 3 was used in 3.9% of examinations, and the recommended follow-up occurred in 75%. The rate of malignancy was 1.6% which is comparable to that for mammography, despite the higher risk MRI patient population.

CLINICAL RELEVANCE/APPLICATION

The BI-RADS MRI category 3 assessment category is not well established, largely due to variations in hardware, field strengths, and pulse sequences between sites. Our analysis provides insight into what MRI characteristics warrant a BI-RADS 3 assessment. Understanding this BI-RADS category is especially important to reduce unnecessary biopsies of probably benign lesions that can be safely followed with short term follow up imaging.

BR216-ED-THB6 Superficial Breast Lesions That We Need to Know

Station #6

Participants
Marisela L. Curros, MD, Adrogue, Argentina (*Presenter*) Nothing to Disclose
Valeria Vidales, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Daniela E. Simbler, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Norma I. Pona, MD, CABA, Argentina (*Abstract Co-Author*) Nothing to Disclose
Felix Vigovich, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Adriana Garcia, MD, Banfield, Argentina (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

-To recognize the radiological features of the lesion that helps to identify its localization between the dermis, the subcutaneous fat and the parenchyma. -To describe differential diagnosis and its classification in BI RADS system. -To emphasize in diagnostic difficulties.

TABLE OF CONTENTS/OUTLINE

-Description of the anatomy of the superficial breast. -Description of different types of lesions that could be found in the breast skin and the superficial breast parenchyma. -US and mammographic: principal findings and its correlations. -Sample cases.

BR217-ED-THB7 Mammographic Evaluation of Calcifications: Atlas for Residents

Station #7

Awards
Identified for RadioGraphics

Participants
Yesenia Bermudez Cano, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Veronica Gonzalez, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Karina Pesce, Capital Federal, Argentina (*Abstract Co-Author*) Nothing to Disclose
Victoria Ardiles, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Maria Jose Chico, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Pamela I. Causa Andrieu, MD, La Plata, Argentina (*Presenter*) Nothing to Disclose

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TEACHING POINTS

1. Review the mammographic descriptors for breast calcifications, taking like reference the fifth edition of the BIRADS. 2. Analyze of morphology and distribution of breast microcalcifications on mammography, thus aiding in their classification and management of breast lesions. 3. Demonstrate the imaging features of calcifications and correlate with the histopathology obtained by Stereotactic Large Core Needle Biopsy

TABLE OF CONTENTS/OUTLINE

Table of Contents: 1. Introduction 2. Images features: - Calcification descriptors - Distribution - Location - Associated findings - Change, if previous films are compared - Use of microcalcification descriptors in BI-RADS 5th edition to stratify risk of malignancy 3. Microcalcification in breast lesions: radio-pathologic correlation 4. Pseudocalcifications: Artifact 5. Management - Management of microcalcifications that develop at the lumpectomy site after breast-conserving therapy 6. Conclusion.

BR218-ED-THB8 Contrast Enhanced Mammography: Where Does It Fail?

Station #8

Participants
Ignacio Gonzalez de la Huebra Rodriguez, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose
Alejandra Garcia Baizan, MD, Pamplona, Spain (*Abstract Co-Author*) Nothing to Disclose
Ana Ezponda, MD, Pamplona, Spain (*Abstract Co-Author*) Nothing to Disclose
Marta Calvo-Imirizaldu, MD, Pamplona, Spain (*Abstract Co-Author*) Nothing to Disclose
Arlette Elizalde, Pamplona, Spain (*Abstract Co-Author*) Nothing to Disclose
Luis Pina, MD, PhD, San Sebastian, Spain (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The purpose of this exhibit is: 1. To review the strengths, weaknesses and indications of Contrast Enhanced Mammography (CEM)2

The purpose of this exhibit is: 1. To review the strengths, weaknesses and indications of Contrast Enhanced Mammography (CEM)2. To show the features of breast tumors that were missed by CEM.

TABLE OF CONTENTS/OUTLINE

Description of the technique: -What is double energy?Intravenous administration of iodinated contrast medium (mammography becomes a morpho-functional technique).Indications of CEM -Problem solving technique. -Screening of intermediate risk patients. -Preoperative staging of breast cancer. -Patients not suitable for MRI.Contraindications of CEM: -Allergy to iodinated contrast medium. -Renal insufficiency.Limitations of CEM -Evaluation of microcalcificationes. -Women with breast ImplantsFalse Negative cases: -Lesions out of the field of view (peripherically located). -Pathology: More misses in DCIS than in invasive cancers. -Breast density: More misses in dense patterns . -Imaging features: More misses in architectural distortions than masses. -Size: More misses in small cancers (<10mm).False Positive cases: -Fibroadenoma -Papilloma -Fat necrosis -Sclerosing adenosis

BR219-ED-THB9 MRI Biopsy Radiology/Pathology Concordance: A Rapid Review of Common Pathologic Entities

Station #9

Participants
Marina Mohallem Fonseca, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Raman Verma, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
Leslie Lamb, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jean M. Seely, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

This exhibit will: 1)Identify common benign and malignant pathologies diagnosed by MRI biopsy using an image rich review. 2)Outline practical tips when assessing radiologic and pathologic concordance and the need for re-biopsy. 3)Provide an algorithm for management of indeterminate lesions on MRI.

TABLE OF CONTENTS/OUTLINE

Breast MRI is routinely used in the screening and diagnostic settings, in conjunction with mammographic and sonographic assessment. An indeterminate lesion on MRI, occult on conventional imaging, may require an MRI-guided biopsy for definitive histopathologic analysis. Lesions biopsied under MRI guidance are frequently benign; however, there is variable and often overlapping appearance of both benign and malignant etiologies, often rendering the concordance assessment difficult. Lesions including the following will be illustrated, with all cases having follow-up imaging or surgical excision: 1)Benign (fibroadenoma, fibrocystic change, pseudoangiomatous stromal hyperplasia, fat necrosis, mastitis) 2)High risk (lobular carcinoma in-situ, atypical ductal hyperplasia, radial scar, papilloma) 3)Malignant (invasive ductal and lobular, ductal carcinoma in-situ) A summary based on the literature will outline strategies to determine appropriate imaging modalities with which to further evaluate an MRI-detected indeterminate lesion.

BR011-EB-THB Contrast Enhanced Spectral Mammography (CESM). The 'What, When and How' Guide to Using it in a Symptomatic Tertiary Referral Center

Hardcopy Backboard

Participants
Rosanna Frost, MBBS,FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Ruxandra Pietrosanu, MD,FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sultana Hasso, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Konstantia Diana Stavrou, MBBS, BSC, London, United Kingdom (*Presenter*) Nothing to Disclose

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TEACHING POINTS

The purpose of the exhibit to to outline: 1 Why to use CESM? 2 When to utilize CESM in clinical practice. 3 How to interpret CESM

TABLE OF CONTENTS/OUTLINE

Why do we use it? CESM is an evolving breast imaging technique, which combines standard full - field digital mammography (FFDM) with an intravenous iodinated contrast medium to detect areas of increased angiogenesis. The technique is well tolerated by patients, quick and cost effective whilst being highly sensitive comparable to CEMRI. When do we use it? The local staging of patients under the age of 40 with a biopsy proven breast cancer who have not undergone a diagnositic mammogram due to their age. The local staging of patients who have an indication for CEMRI but have a contraindication to MRI . Monitoring response to neoadjuvant chemotherapy. We are currently conducting an ongoing study to demonstrate that CESM can be used as an alternative to MRI for monitoring reponse during neoadjuvant chemotherapy. Annual monitoring of breast cancer patients who are at high risk or who have dense breasts (birads 4-5). Current ongoing study. How to interpret it? Assessment of normal backgound enhancement. Artefacts. The characteristics of benign vs malignanat mass lesions. Non mass enhancement. Non enhancing malignanat calcification. Chest wall and retroareolar lesions. Our experience over the last three years.

BR007-EB-THB What Radiologists Should Know to Avoid Mistakes in Screening Breast US

Hardcopy Backboard

Participants
Jin Hwa Lee, MD, Busan, Korea, Republic Of (*Presenter*) Nothing to Disclose
Eun Cho, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Mi Park, MD, PhD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The purpose of this exhibit is To review the reasons for False-Negative and False-Positive in screening breast US To learn how to reduce missed cancer and unnecessary recall or biopsy in screening breast US

TABLE OF CONTENTS/OUTLINE

Reasons for False-Negative Technical errors; high-resolution US equipment, adjustment of US settings, optimal scanning technique Perception errors; isoechoic lesions, deeply located lesions in large breasts, peripherally located lesions, subareolar lesions, US tissue composition; background echotexture Interpretation errors; misinterpretation of margin, multiple distracting lesions Correlation errors; mammographic correlation, MRI correlation, clinical correlation (Symptomatic vs Asymptomatic, Patients' own risk factors, past history (underlying extramammary disease) Reasons for False-Positive Inherent factor of US Technical errors Large numbers of category 3 lesions

MSCB51

Case-based Review of Breast (Interactive Session)

Thursday, Nov. 29 1:30PM - 3:00PM Room: N228

BR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Jiyon Lee, MD, New York, NY (*Director*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify appropriate application of multi-modality breast imaging for routine screening, supplemental screening, and diagnostic indications. 2) Select appropriate methods for image-guided percutaneous biopsy and perform post-biopsy radiologic-pathologic correlation for next management recommendation. 3) Review appropriateness criteria and performance benchmarks, and guidelines for ongoing breast imaging audits as they apply. 4) Appreciate the range of reassuringly common and sometimes not-so common among the international faculty's portrayal of their piece of the globe.

ABSTRACT

Title: *Managing expectations in breast imaging around the world. "Best" versus sufficient?* Abstract: Our case-based review course will use the interactive audience response system (ARS) to walk and skip through the fundamentals of breast imaging. We will present how we use mammography, ultrasound, and MRI in daily screening and diagnostic scenarios, along with reminders of the overarching principles of BI-RADS lexicon for effective communication, and ACR appropriateness criteria and performance metrics as applicable or adapted around the world. Our international faculty (sessions 1 and 2) will also add depth, and the fun added dimensions of how breast imaging works around the world. Varying breast cancer statistics, possible innate ethnic variations, differing cultural expectations and socioeconomic context can and do impact how we carry out our discretionary work. Such interesting details will inform the narrative of the speakers' case scenarios, while the core diagnostic radiology skills aim to be constant, and teachable. The focus is using lots of cases to demonstrate breast imaging now and evolving. Please join us for smart fun!

Active Handout:Jiyon Lee

http://abstract.rsna.org/uploads/2018/18001608/MSCB51 52.pdf

Sub-Events

MSCB51A Tomosynthesis: Evolving Appreciation of the Better Mammogram

Participants
Jiyon Lee, MD, New York, NY (*Presenter*) Nothing to Disclose

MSCB51B From Andes to Patagonia: Breast Imaging in Argentina

Participants
Daniel E. Lehrer, MD, CABA, Argentina (*Presenter*) Speaker, Hologic, Inc; Institutional research agreement, Siemens AG

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LEARNING OBJECTIVES

1) Identify appropriate application of multi-modality breast imaging for routine screening, supplemental screening, and diagnostic indications. 2) Improve basic knowledge and skills relevant to clinical practice. 3) Recommend the appropriate technique and avoid mistakes, incorporating others' clinical experiences.

ABSTRACT

We show cases from different parts of the country, with different realities and possibilities. This cases include a wide range of sophistication, from the optimization of the basic knowledge to the ones that require the latest technologies. You can realize that Tolstoy´s: Paint your village and you will paint the whole world is true for breast imaging.

Active Handout:Daniel E. Lehrer

http://abstract.rsna.org/uploads/2018/18001610/RSNA_Argentina MSCB51B.pdf

MSCB51C The Many 'Faces' of DCIS

Participants
Ana P. Lourenco, MD, Providence, RI (*Presenter*) Nothing to Disclose

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alourenco@lifespan.org

LEARNING OBJECTIVES

1) Detect the varied appearances of DCIS on mammography, ultrasound, and MRI. 2) Compare how imaging findings may predict pathology.

ABSTRACT

This case-based session will showcase the various appearances of DCIS on mammography, ultrasound and MRI, highlighting how certain imaging findings may predict pathology. The interactive questions will cover management as well as follow-up recommendations, and illustrate key findings that should be included in imaging reports.

Active Handout:Ana P. Lourenco

http://abstract.rsna.org/uploads/2018/18001611/Handout.Lourenco.DCIS MSCB51C.pdf

MSCB51D Spain Explains the Mundane and the Less So

Participants
Lucia Grana Lopez, MD, Lugo, Spain (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Identify appropriate application of multi-modality breast imaging mainly for supplemental screening, diagnosis and define its interventional indications. 2) Learn about the advantages of ultrasound-guided percutaneous removal of benign breast lesions and when and how to perform this procedure, as we've experienced in our practice. 3) Preview emerging molecular breast dedicated imaging tool, define its possible indications and potential use in clinical routine.

ABSTRACT

My case-based review course will use the interactive audience response system (ARS) to walk and skip through the fundamentals of breast imaging. I will present how we use mammography, ultrasound, and MRI in daily supplemental screening and diagnostic scenarios, along with reminders of the overarching principles of BI-RADS lexicon for effective communication, and ACR appropriateness criteria and performance metrics as applicable.I will try to show how breast imaging works in Spain.

Active Handout:Lucia Grana Lopez

http://abstract.rsna.org/uploads/2018/18001612/Spain explains the mundane MSCB51D.pdf

MSCB52

Case-based Review of Breast (Interactive Session)

Thursday, Nov. 29 3:30PM - 5:00PM Room: N228

BR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Jiyon Lee, MD, New York, NY (*Director*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify appropriate application of multi-modality breast imaging for routine screening, supplemental screening, and diagnostic indications. 2) Select appropriate methods for image-guided percutaneous biopsy and perform post-biopsy radiologic-pathologic correlation for next management recommendation. 3) Review appropriateness criteria and performance benchmarks, and guidelines for ongoing breast imaging audits as they apply. 4) Appreciate the range of reassuringly common and sometimes not-so common among the international faculty's portrayal of their piece of the globe.

ABSTRACT

Title: Managing expectations in breast imaging around the world. "Best" versus sufficient? Abstract: Our case-based review course will use the interactive audience response system (ARS) to walk and skip through the fundamentals of breast imaging. We will present how we use mammography, ultrasound, and MRI in daily screening and diagnostic scenarios, along with reminders of the overarching principles of BI-RADS lexicon for effective communication, and ACR appropriateness criteria and performance metrics as applicable or as adapted around the world. Our international faculty (sessions 1 and 2) will also add depth, and the fun added dimensions of how breast imaging works around the world. Varying breast cancer statistics, possible innate ethnic variations, differing cultural expectations and socioeconomic context can and do impact how we carry out our discretionary work. Such interesting details will inform the narrative of the speakers' case scenarios, while the core diagnostic radiology skills aim to be constant, and teachable. The focus is using lots of cases to demonstrate breast imaging now and evolving. Please join us for smart fun!

Active Handout:Jiyon Lee

http://abstract.rsna.org/uploads/2018/18001613/MSCB51 52.pdf

Sub-Events

MSCB52A Breast Care for 'Challenging' Populations

Participants
Cherie M. Kuzmiak, DO, Chapel Hill, NC (*Presenter*) Research Grant, Delphinus Medical Technologies, Inc

LEARNING OBJECTIVES

1) Describe and discuss how to appropriately image and manage patients with special needs.

Active Handout:Cherie M. Kuzmiak

http://abstract.rsna.org/uploads/2018/18001614/US Prison System Health Care MSCB52A.pdf

MSCB52B Greek Philosophy and Cases to Ponder Personalized Screening

Participants
Athina Vourtsi, MD, Athens, Greece (*Presenter*) Consultant, General Electric Company; Educator, ABUS

LEARNING OBJECTIVES

1) To assess the benefits of DBT, US, and MRI in various screening and diagnostic studies. 2) Identify the applications of multi-modality breast imaging of supplemental screening in women of average, intermediate, and high risk for developing breast cancer. 3) Appreciate some of the Greek life style trends and health care system details with respect to breast cancer detection and clinical management.

Active Handout:Athina Vourtsi

http://abstract.rsna.org/uploads/2018/18001615/RSNA-6. Vourtsis. Greece MSCB52B.pdf

MSCB52C False Positives and False Negatives: How to Minimize the Bunch

Participants
Elizabeth S. McDonald, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define false negative exam and identify common reasons for cancer misses in breast imaging and how to avoid them. 2) Define false positive exam and discuss radiologic signs indicating that breast biopsy is not needed.

MSCB52D J-Start and Breast Density in the Land of the Rising Sun

Participants
Youichi Machida, MD, PhD, Chuo-City, Japan (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Learn how 'dense breasts' are recognized by Japanese women and physicians, and how they will be involved in breast cancer screening in Japan. 2) Learn the low examination rate of breast cancer screening, as well as other problems we are facing in breast cancer care. 3) Learn the results of J-START, and the concept of 'combined assessment guideline', published by Japan Association of Breast Cancer Screening.

Active Handout:Youichi Machida

http://abstract.rsna.org/uploads/2018/18001617/MSCB52D.pdf

RC715

Tomosynthesis

Thursday, Nov. 29 4:30PM - 6:00PM Room: E353C

BR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Margarita L. Zuley, MD, Pittsburgh, PA (*Moderator*) Investigator, Hologic, Inc

Sub-Events

RC715A Use in Screening

Participants
Emily F. Conant, MD, Philadelphia, PA (*Presenter*) Grant, Hologic, Inc; Consultant, Hologic, Inc; Grant, iCAD, Inc; Consultant, iCAD, Inc; Speaker, iiCME

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) Review outcomes from breast cancer screening with digital breast tomosynthesis (DBT). 2) Discuss the implementation of synthetic imaging in DBT screening. 3) Demonstrate case-based examples of pearls and pitfalls in DBT screening.

RC715B Current Trials

Participants
Valentina Iotti, MD, Reggio Emilia, Italy (*Presenter*) Speaker fee and travel grants from GE Healthcare.

For information about this presentation, contact:

valentina.iotti@ausl.re.it

LEARNING OBJECTIVES

1) List the current trials with digital breast tomosynthesis. 2) Compare the different study designs, interventions and setting. 3) Examine the outcomes and potential impact on the future screening and clinical practice with tomosynthesis.

RC715C Use in Diagnostics

Participants
Margarita L. Zuley, MD, Pittsburgh, PA (*Presenter*) Investigator, Hologic, Inc

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zuleyml@upmc.edu

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

RC750

MR Imaging-guided Breast Biopsy (Hands-on)

Thursday, Nov. 29 4:30PM - 6:00PM Room: E260

BR MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Amy L. Kerger, DO, Columbus, OH (*Presenter*) Nothing to Disclose
Rifat A. Wahab, DO, Cincinnati, OH (*Presenter*) Nothing to Disclose
Vandana M. Dialani, MD, Boston, MA (*Presenter*) Nothing to Disclose
Deepa Sheth, MD, Chicago, IL (*Presenter*) Research Grant, Guerbet SA
Lara D. Richmond, MD, Toronto, ON (*Presenter*) Nothing to Disclose
Gary J. Whitman, MD, Houston, TX (*Presenter*) Nothing to Disclose
Kirti M. Kulkarni, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Jill J. Schieda, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
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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) How to problem shoot complicated cases due to lesion location, patient anatomy, etc.

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.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

RC752

US-guided Interventional Breast Procedures (Hands-on)

Thursday, Nov. 29 4:30PM - 6:00PM Room: E264

BR US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Karen S. Johnson, MD, Durham, NC (*Presenter*) Nothing to Disclose
Jocelyn A. Rapelyea, MD, Washington, DC (*Presenter*) Speakers Bureau, General Electric Company; Consultant, Transmed7;
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LEARNING OBJECTIVES

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

ABSTRACT

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

RC815

Radiologist's Value in the Multidisciplinary Team

Friday, Nov. 30 8:30AM - 10:00AM Room: E350

BR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Cherie M. Kuzmiak, DO, Chapel Hill, NC (*Moderator*) Research Grant, Delphinus Medical Technologies, Inc

LEARNING OBJECTIVES

1) Define high-risk lesions. 2) Review radiologic-pathologic features and characteristics of high-risk lesions. 3) Discuss approaches to high-risk lesions with attention to management considerations and controversies. 4) Describe and discuss the imaging features of the major subtypes of invasive breast cancer with integration of pathology. 5) Understand the molecular classification of breast cancer and its impact on patient prognosis. 6) Describe patients' perspectives of breast imaging experiences with a focus on pain, anxiety, and emotional distress relating to abnormal results and biopsy procedures. 7) Define interventions for reducing patients' negative experiences related to abnormal results and biopsy procedures.

Sub-Events

RC815A Management of High Risk Lesions

Participants
Samantha L. Heller, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Define high-risk lesions. 2) Review radiologic-pathologic features and characteristics of high-risk lesions. 3) Discuss approaches to high-risk lesions with attention to management considerations and controversies.

RC815B Imaging Appearance of Cancer Subtypes

Participants
Cherie M. Kuzmiak, DO, Chapel Hill, NC (*Presenter*) Research Grant, Delphinus Medical Technologies, Inc

LEARNING OBJECTIVES

1) Describe and discuss the imaging features of the major subtypes of invasive breast cancer with integration of pathology. 2) Understand the molecular classification of breast cancer and its impact on patient prognosis.

RC815C Improving the Patient's Experience

Participants
Mary S. Soo, MD, Durham, NC (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Describe patients' perspectives of breast imaging experiences with a focus on pain, anxiety, and emotional distress relating to abnormal results and biopsy procedures. 2) Define interventions for reducing patients' negative experiences related to abnormal results and biopsy procedures.

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RC852

Breast Elastography (Hands-on)

Friday, Nov. 30 8:30AM - 10:00AM Room: E264

BR US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 0

Participants
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LEARNING OBJECTIVES

1) To explain the difference between strain and shear wave elastography. 2) To review how to characterize breast lesions as benign or malignant on elastography. 3) To demonstrate how to perform both strain and shear wave elastography for breast imaging.

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/ Richard G. Barr, MD, PhD - 2017 Honored Educator

SST01

Breast Imaging (Multimodality Breast Imaging)

Friday, Nov. 30 10:30AM - 12:00PM Room: E353B

BR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Colleen H. Neal, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose
Debra S. Copit, MD, Wynnewood, PA (*Moderator*) Research funded, Hologic, Inc

Sub-Events

SST01-01 Comparative the Average Glandular Dose between Digital Breast Tomosynthesis (DBT) and Full-Field Digital Mammography (FFDM): Correlation with Breast Thickness and Density

Friday, Nov. 30 10:30AM - 10:40AM Room: E353B

Participants
Chanjuan Wen, Guangzhou, China (*Presenter*) Nothing to Disclose
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Hui Zeng, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To compare the average glandular dose (AGD) between single-view digital breast tomosynthesis (DBT) and single-view full-field digital mammography (FFDM), and to evaluate the correlation of AGD with breast thickness and density.

METHOD AND MATERIALS

A total of 318 female patients who underwent both DBT and FFDM (DBT and FFDM were performed in the same compression thickness in each breast) were included. 636 DBT images of unilateral breast mediolateral oblique (MLO) view and 636 FFDM images of unilateral breast mediolateral oblique (MLO) view were analyzed. Mammographic breast density was determined according to BI-RADS breast density grading, and breast thickness and AGD per exposure in MLO views retrieved from DICOM headers were recorded. Breast thickness were divided into the following four groups: <= 30cm, 31 ~ 45cm, 46 ~ 60cm and > 60cm. The statistical analyses used variance analysis and Pearson's correlation for parametric tests.

RESULTS

(1) The AGD of DBT had a weak negative correlation with breast density (correlation coefficient =-0.305, P<0.001), decreased as the breast density increased. The AGD of FFDM did not change significantly with breast density increased (correlation coefficient =-0.027, P=0.501). (2) Breast thickness was significantly associated with AGDs, and both AGDs of FFDM and DBT increased with increased breast thickness (correlation coefficient =0.771 and 0.935, respectively, all P<0.001). (3) When breast density was >75% and breast thickness was >60cm, the AGD of DBT was lower than that of FFDM, and the difference was statistical significant (P = 0.031).

CONCLUSION

The AGD of DBT increased with breast thickness increased and decreased with breast density. For thick and dense breast, the radiation dose of DBT was lower than that of FFDM.

CLINICAL RELEVANCE/APPLICATION

In this study, we evaluated the AGD of MLO FFDM and DBT according to breast density and thickness.

SST01-02 Accuracy of Molecular Breast Imaging in Patients with Suspicious Calcifications

Friday, Nov. 30 10:40AM - 10:50AM Room: E353B

Participants
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Deborah J. Rhodes, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

Dietlind Wahner-Roedler, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Molecular breast imaging (MBI), which shows uptake of Tc-99m sestamibi in metabolically-active tissue, has been proposed as a tool for determining whether biopsy of mammographically-detected lesions is necessary. Here, our goal was to evaluate the diagnostic accuracy of MBI in patients with suspicious calcifications on mammography.

METHOD AND MATERIALS

Women scheduled to undergo stereotactic biopsy of calcifications detected on 2D mammography were prospectively enrolled to undergo MBI prior to biopsy. MBI was performed with injection of Tc-99m sestamibi and a dedicated gamma camera. A breast radiologist interpreted MBI in conjunction with mammography.

RESULTS

In 71 women studied, 76 discrete areas of calcifications were identified for biopsy, of which pre-biopsy MBI was positive in 17/76 (22%). Of 76 calcification lesions, 24 (32%) were malignant, including 20 DCIS and 4 invasive ductal cancer; MBI was positive in 10/20 (50%) DCIS and 2/4 (50%) invasive cancers. In 21 cancers with calcification morphology of amorphous, coarse heterogeneous, or fine pleomorphic (BI-RADS 4B), MBI was positive in 12/21 (57%), while in three cancers with fine linear or fine linear branching calcifications (BI-RADS 4C), MBI was negative in all 3 (p=0.06). Calcification distribution was more varied for the MBI-positive cancers (0 regional, 7 grouped, 1 linear, 4 segmental) than for the MBI-negative cancers (1 regional, 10 grouped, 1 linear, 0 segmental) (p=0.14). The median pathologic size for MBI-positive cancers was 1.5 cm (range=0.5-3.2 cm) compared to 0.9 cm (range=0.1-2.0 cm) for MBI-negative cancers (p=0.09). Beyond calcification lesions, detection of non-mass focal areas of uptake on MBI led to additional biopsies of 6 sites, of which 2 were malignant (DCIS). The overall positive and negative predictive values of MBI were 61% (14/23) and 81% (48/59), respectively.

CONCLUSION

MBI has insufficient negative predictive value to be used for identifying calcifications in which biopsy could be avoided. However, MBI can reveal additional sites of mammographically-occult disease.

CLINICAL RELEVANCE/APPLICATION

Negative findings on MBI should not be used to avoid biopsy of suspicious calcifications on mammography.

SST01-03 Staging Early Breast Cancer with Simultaneous PET/ MRI: Impact on Management

Friday, Nov. 30 10:50AM - 11:00AM Room: E353B

Participants
Sangeeta Taneja, MD, New Delhi, India (*Presenter*) Nothing to Disclose
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PURPOSE

Breast cancer is a biologically heterogenous disease with certain clinical subtypes having a greater propensity to develop metastasis even at an early stage. In its present state, NCCN recommends 18-F FDG PET CT in patients above clinical stage III disease. There have been reports on PET CT in altering clinical stage in early breast cancer. DCE (Dynamic Contrast-Enhanced) MRI has been shown to detect additional disease in the ipsilateral & contralateral breast. Simultaneous PET/MRI combines 18F-FDG PET & MRI of the whole body & DCE-MRI of the breast in a single examination. This retrospective study evaluates the impact of simultaneous 18F-FDG PET/MRI in pretreatment staging of early breast cancer (Stage I-IIIA).

METHOD AND MATERIALS

The study was approved by institutional ethics committee. 101 patients with histologically proven breast cancer (clinical stage I, IIA, IIB, IIIA) who underwent simultaneous PET/MRI (including DCE MRI breast) were included. Breast lesions, nodes & metastases were evaluated on PET, MRI & PET-MRI for lesion count & diagnostic confidence (DC).

RESULTS

101 index breast lesions were identified on MRI, PET/MRI (Mean DC 4.96) & 99 on PET (Mean DC >=4). MRI detected multifocality in 15 (14.8%), multicentricity in 10 (9.90%) & contralateral unsuspected cancer in 2 patients. PET detected axillary nodal metastases in 12/18 (DC>=4), MRI in 15/18 (DC>=4) and PET/MRI in 15/18 patients. Distant metastases were found in 18 /101 (18 %) on PET (Mean DC score 4.1), MRI (Mean DC score=3.7) & PET/MRI (Mean DC score =4.7) with bone (n =11), lymph nodes (mediastinal; n=2), liver (n=4), brain (n=1) & lung (n=5). The mean metastatic lesion size on MRI was 1.52 ± 0.25 cm (Range: 0.5-5.7cm). PET MRI changed the overall stage in 66 patients (65%, upstaging: 62, downstaging:4) & overall change in management in 29 % of early stage breast cancer patients including 18 patients who were upstaged to stage IV.

CONCLUSION

Simultaneous18F-FDG PET/MRI has the potential to impact the initial staging in early breast cancer for an overall improved patient management.

CLINICAL RELEVANCE/APPLICATION

Simultaneous PET/MRI has the potential to alter the stage and hence the clinical management in patients with early breast cancer thus reducing the morbidity and cost due to inappropriate therapies.

SST01-04 The Gambler's Fallacy in Screening Mammography

Friday, Nov. 30 11:00AM - 11:10AM Room: E353B

Participants
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PURPOSE

It has been documented in multiple settings that the sequence of decisions already made affects future decision-making. One component of this phenomenon is known as the gambler's fallacy: the tendency to underestimate the likelihood of 'streaks' (successive identical decisions) occurring by chance. The purpose of this study was to determine if the gambler's fallacy affects radiologists interpreting screening mammography.

METHOD AND MATERIALS

This was a retrospective, HIPPA compliant IRB approved study. Patients who underwent routine screening mammography in 2014 at our institution were included, with 8,543 total exams, which was sufficient to detect a 1% change in recall rate based on an 80% power calculation with a two-sided 0.05 significance level, for our recall rate of 7%. Data were collected from log books containing the BI-RADS assessments of routine screening mammograms, the order in which the examinations were interpreted, and the number of preceding BI-RADS 0 and BI-RADS 1 or 2 assessments for each exam. If recalled (BI-RADS-0), subsequent diagnostic exam BI-RADS assessment also was recorded. Analysis was performed using Fishers exact test to evaluate whether an increasing number of preceding decisions to not recall (BI-RADS-1 or 2) resulted in an increased number of recalls that did not lead to a cancer diagnosis. False positive was defined as a BI-RADS 0 assessment at screening, followed by a BI-RADS 1, 2 or 3 at diagnostic breast imaging. A true positive was defined as a BI-RADS 0 assessment at screening, followed by a BI-RADS 4 or 5 assessment at diagnostic breast imaging.

RESULTS

Data on 8,543 routine screening exams was collected for the year 2014. An average of 20.9 exams were batch read in each session. 700 exams (8%) were assessed as BI-RADS 0. Of those, 231 (33%) were assigned either BIRADS-4 or 5 at the time of diagnostic imaging. True and false positives were compared, stratified by the number of preceding BI-RADS 1 or 2 assessments in that batch-read session. Exams with a higher number of preceding negative assessments did not have a higher false positive rate.

CONCLUSION

At our academic institution, we did not observe a statistically significant effect of the gambler's fallacy in one year's worth of screening mammography.

CLINICAL RELEVANCE/APPLICATION

We did not detect an effect of the gambler's fallacy in one year's worth of screening mammography at an academic institution.

SST01-05 Outcomes of Ductal Carcinoma in Situ According to Detection Modality: A Multicenter Study Comparing Recurrences Between Mammography and Breast US

Friday, Nov. 30 11:10AM - 11:20AM Room: E353B

Participants
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PURPOSE

To determine whether if disease recurrence and intrinsic characteristics of ductal carcinoma in situ (DCIS) is associated to the imaging method of detection in asymptomatic women who are diagnosed with DCIS.

METHOD AND MATERIALS

This retrospective, multicenter study was conducted at 8 institutions including 844 women who were treated for asymptomatic, pure DCIS who had preoperative mammography and breast ultrasonography (US) available for review. Mean follow up interval after treatment of the 844 women was 91.2 months (standard deviation: 533.3, range: 6.4-180.9 months). Medical records and breast images were reviewed by 8 breast-imaging dedicated radiologists for clinicopathologic information and image analysis. Kaplan-Meier analysis and univariable/multivariable Cox proportion hazard model was used to analyze the recurrence-free survival rates and factors associated with recurrence after DCIS treatment.

RESULTS

Of the 844 women who were treated for DCIS, 25 (3.0%) had developed recurrences. Patients with US-detected DCIS had significantly lower 5- and 10-year recurrence-free survival rates compared to patients with mammography-detected ones (P=0.011). US-detected DCIS had significantly lower 5- and 10-year recurrence-free survival rates compared to mammography-detected ones in patients <50years or with mammographically-dense breasts (P=0.002, and 0.002, respectively). Multivariable analysis showed that US for detection modality (HR: 4.451, 95% CI: 1.530, 12.950, P=0.006) and HER2 positivity (HR: 4.036, 95% CI: 1.438, 11.330, P=0.008) showed significant association to recurrences.

CONCLUSION

US for detection modality and HER2 positivity were factors significantly associated to recurrences in patients treated for asymptomatic DCIS.

CLINICAL RELEVANCE/APPLICATION

Supplementary screening US may enable detection of clinically important DCIS, especially in younger women or mammographically-dense breasts in which mammography has suboptimal performances in detection of DCIS or small invasive cancers.

SST01-06 Do Triple Negative Breast Cancers Have Characteristic Imaging Features According to Androgen Receptor and Vimentin Status?

Friday, Nov. 30 11:20AM - 11:30AM Room: E353B

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PURPOSE

Lehmann et al (Journal of Clinical Investigation, 2011) previously identified six molecular subtypes of triple negative breast cancer (TNBC) through analysis of gene expression profiles; the luminal androgen receptor (LAR) subtype has been shown to have a higher percentage of regional spread to lymph nodes and the mesenchymal (M) subtype, a lower percentage. The purpose of this study is to determine if TNBCs have characteristic imaging features based on androgen receptor (AR) and vimentin (VM) status, which are surrogate immunohistochemical markers for the LAR and M subtypes of TNBC, respectively.

METHOD AND MATERIALS

This study is part of a clinical trial of stage I-III TNBC patients, which is being conducted at a single quaternary care center. A total of 144 patients, who were randomized to the intervention arm of being informed of the results of their molecular characterization including androgen receptor and vimentin status prior to receiving neoadjuvant chemotherapy, were included in this interim imaging analysis. Androgen-receptor-positive tumors (AR+) were defined as having >=15% staining. Vimentin-positive (VM+) tumors were defined as having >=50% staining. Two experienced, fellowship-trained breast radiologists used BIRADS (Breast Imaging Reporting and Data System) lexicon to review and reach consensus on all imaging studies (i.e., mammogram, ultrasound, and breast magnetic resonance imaging) while blinded to the immunohistochemical results. Fisher's exact test was used to assess the association of AR or VM status with imaging features. P values less than 0.05 was considered statistically significant.

RESULTS

Androgen-receptor-positive TNBC was significantly associated with scattered and heterogeneous breast composition on mammography (p=0.04), presenting as a mass with calcifications on mammography (p=0.04), having an irregular shape on ultrasound (p=0.005), and having an irregular margin on MRI (p=0.04). However, vimentin expression in TNBC was not significantly associated with any specific imaging features.

CONCLUSION

TNBCs have characteristic imaging features based on androgen receptor status but not based on vimentin status.

CLINICAL RELEVANCE/APPLICATION

Multimodality breast imaging may help identify LAR TNBC, which has been shown to be a subtype with a higher rate of regional nodal disease and with decreased response to neoadjuvant chemotherapy.

SST01-07 Usefulness of Surveillance MR for Early and Late Recurrent Breast Cancer in Women after Breast-Conservation Therapy

Friday, Nov. 30 11:30AM - 11:40AM Room: E353B

Participants
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Bong Joo Kang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Sung Hun Kim, Su Won, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To investigate the diagnostic performance of mammography, ultrasonography, and breast magnetic resonance imaging (MRI) for early and late recurrences in patients who underwent breast-conservation therapy (BCT) for breast cancer.

METHOD AND MATERIALS

This retrospective study was approved by our institutional review board. Between January 2014 and February 2018, 1312 women with 1951 surveillance breast MR examinations after BCT were studied. We assessed the cancer detection rate of each surveillance MR, mammography and ultrasound.

RESULTS

Of 1951 cases of surveillance postoperative MRI, 59 cases were confirmed as cancer recurrence through biopsy. Nineteen cases of recurrences within 12 months post-BCT were defined as early recurrences while other 40 cases of recurring after 13 months post-BCT were defined as late recurrences. There were no statistically significant differences in patients' demographics between two groups with $p > 0.05$; age at cancer diagnosis, age at recurrence, symptoms, laterality of recurred cancer and intense surveillance. Among 19 patients with early recurrence, 7 cases were detected on mammography (36.8%), 10 on ultrasound (52.6%), and 17 on MRI (89.5%). Of 40 patients with late recurrence, 24 were detected on mammography (60%), 29 on ultrasound (72.5%) and 39 on MRI (97.5%). In both groups, MRI showed significantly higher cancer detection rate than mammography or ultrasound ($p < 0.01$).

CONCLUSION

In breast cancer patients with BCT, regardless of early or late, postoperative MR surveillance showed a significantly higher detection rate for cancer recurrence than mammography or ultrasound.

CLINICAL RELEVANCE/APPLICATION

Postoperative surveillance MR is useful tool for screening early or late cancer recurrence in breast cancer patients with breast conserving therapy.

SST01-08 The Role of Digital Breast Tomosynthesis (DBT) versrus Automated Breast Ultrasound (ABUS) in the Detection and Characterization of the Different Breast Lesions

Friday, Nov. 30 11:40AM - 11:50AM Room: E353B

Participants
Maha H. Helal IV, MD, Cairo, Egypt (*Presenter*) Nothing to Disclose
Sahar Mansour, MD, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose
Lamia Bassam, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose
Reham Hussein, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose
Emad Elgemeie, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

DBT and ABUS are advanced applications of digital mammography and breast ultrasound respectively. We aimed to evaluate the role of DBT versus ABUS in the detection and characterization of breast lesions

METHOD AND MATERIALS

Institutional review board approval was obtained for this prospective study that included 80 patients with 87 breast lesions. Methods of evaluation were digital breast tomosynthesis and automated breast ultrasound. For mammogram acquisition the system acquires a traditional digital mammogram and a tomosynthesis scanning in the same compression in the MLO and CC views. 3D ABUS were done for anteroposterior; lateral and medial acquisitions. Included breast lesions were analyzed regarding size, shape, margin, extension, calcifications and multiplicity. Operative data was the gold standard reference

RESULTS

ABUS showed more accurate measurements of the size of the breast lesions as DBT overestimated 18.8% of masses, on the other hand ABUS over estimated 25% of masses. No size under estimation by both modalities. ABUS was superior to DBT in estimation of the shape of the lesions 87% versus 69.6% for DBT, but both displayed similar values in the evaluation of the margins (65.2%).Tomosynthesis was far better in the detection of calcification in 40 lesions; while automated ultrasound was able to detect calcifications in only 11 lesions of them. Multiplicity was better demonstrated by ABUS that showed an accuracy of 100% compared to 80% by DBT. We found out that the sensitivity of tomosynthesis in detection and characterization of breast masses was 100 %, the specificity was 81.25%, the positive predictive value was 87.5% and the negative predictive value was 100%. On the other hand the sensitivity of automated ultrasound was 100%, the specificity was 75%, the positive predictive value was 84% and the negative predictive value was 100%.

CONCLUSION

DBT and ABUS, both showed near estimation in the detection and characterization of breast lesions. DBT is the modality for calcifications and ABUS is more accurate in the detection of multiplicity.

CLINICAL RELEVANCE/APPLICATION

DBT is considered as an adjunct to digital mammogram to increase the conspicuity of the different breast lesions. ABUS is a revolution in the ultrasound scanning of the breast that can be used as a non-invasive, fast and easy tool of breast imaging in early detection (i.e. screening) and differentiation of breast lesions.

SST01-09 First Description of Molecular Imaging Heterogeneity Profiles for Breast Tumors and Its Clinical Utility

Friday, Nov. 30 11:50AM - 12:00PM Room: E353B

Participants
MIchel Herranz, Santiago de Compostela, Spain (*Presenter*) Nothing to Disclose
Lucia Grana Lopez, MD, Lugo, Spain (*Abstract Co-Author*) Nothing to Disclose
Ines Dominguez, Santiago de Compostela, Spain (*Abstract Co-Author*) Nothing to Disclose
Sonia Argibay, MD, PhD, Santiago de Compostela, Spain (*Abstract Co-Author*) Nothing to Disclose
Manuel Vazquez-Caruncho, MD, Lugo, Spain (*Abstract Co-Author*) Nothing to Disclose
Roberto Garcia Figueiras, MD, PhD, Santiago de Compostela, Spain (*Abstract Co-Author*) Nothing to Disclose
Alvaro Ruibal, MD, PhD, Santiago de Compostela, Spain (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The concept of tumor heterogeneity, also called in Radiology as Tumor Texture, is based on the different areas of tumor uptake, which correspond to different levels of expression, cellularity, hypoxia or other parameters interested in being measured. We want to know if the description of the tumor heterogeneity uses in Radiology has its relation with PET parameters and if any biological characteristics of the breast tumors have a structure-function correlation.

METHOD AND MATERIALS

We have analyzed 1000 consecutive patients with breast cancer in a dedicated breast PET (dbPET). Different parameters have been defined that allow us to find a pattern of Texture and Heterogeneity (TeHe), for this, and following the rules of the radiological descriptions we defined a series of structural templates that cover practically all tumors, a mathematical formula has been defined for this correlation, and a assisted software for tumor shape description has been used to perform 3D categories.

RESULTS

7 different patterns divided into 5 groups for TeHe are described, and classified as: 1: Homogeneous-diffuse, 2: Lobular, 3: Annular and Spindle, 4: Eccentric and Focused; and 5: Speckled. A numerical value has been assigned between 1 and 5 for this classification with 1 being the most homogeneous and 5 being the most heterogeneous. This value is achieved through a mathematical relationship: medSUV/maxSUV: values close to 1 denote a high homogeneity and those close to 0 indicate a high heterogeneity. Process is complicated when tumor geometry becomes part of this heterogeneity. In those cases, some geometric patterns may explain similar values. We have analyzed the clinical utility of this classification and we have found two major uses: i) in the description of the efficiency of neoadjuvant therapy, where changes in TeHe pattern define responders of non-responders and ii) we have found, for the FIRST TIME, a correlation between TeHe patterns and the molecular subtype, crucial fact in the future of imaging based breast cancer diagnosis.

CONCLUSION

Studies of tumor heterogeneity based on metabolism show us different patterns that correlate with molecular subtypes and predict response to treatments.

CLINICAL RELEVANCE/APPLICATION

Tumor Texture and Heterogeneity are becoming, like in conventional radiology, in a new tool for prediction of response to the treatment and in molecular subtype characterization.

SPFR61

Friday Imaging Symposium: Screening with Imaging in 2018: Who Benefits?

Friday, Nov. 30 12:30PM - 3:00PM Room: E350

BR CH GI GU OI

AMA PRA Category 1 Credits ™: 2.50
ARRT Category A+ Credits: 3.00

FDA Discussions may include off-label uses.

Participants
Hebert Alberto Vargas, MD, Cambridge, United Kingdom (*Moderator*) Nothing to Disclose
Dow-Mu Koh, MD,FRCR, Sutton, United Kingdom (*Moderator*) Nothing to Disclose

Sub-Events

SPFR61A Breast Cancer Screening: Lessons Learned from Where it all Started

Participants
Victoria L. Mango, MD, New York, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

mangov@mskcc.org

LEARNING OBJECTIVES

1) Discuss early mammography screening trials for breast cancer. 2) Analayze recent multi-modality breast cancer screening literature. 3) Apply lessons learned from breast cancer screening to future screening for other diseases.

ABSTRACT

N/A

URL

N/A

SPFR61B Emerging CRC Screening Options

Participants
Perry J. Pickhardt, MD, Madison, WI (*Presenter*) Stockholder, SHINE Medical Technologies, Inc; Stockholder, Elucent Medical; Advisor, Bracco Group;

LEARNING OBJECTIVES

1) To Understand the various CRC screening options, with emphasis on newer emerging strategies.

ABSTRACT

N/A

URL

N/A

Honored Educators

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SPFR61C Liver Cancer Screening: Who Benefits?

Participants
Bachir Taouli, MD, New York, NY (*Presenter*) Research Grant, Guerbet SA; Research Grant, Bayer AG

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) Review current guidelines for liver cancer screening, including target population and methods used. 2) Review the limitations of blood markers and ultrasound for liver cancer screening. 3) Review new methods such as abbreviated MRI for liver cancer

screening.

ABSTRACT

Hepatocellular carcinoma (HCC) is the 2nd leading cause of cancer-related death worldwide, and the fastest growing cause of cancer death in the USA. The most important risk factor for HCC is cirrhosis. In this presentation, we will discuss the rationale of HCC screening, the most recent AASLD guidelines for HCC screening and surveillance using ultrasound (US) with or without alpha-fetoprotein (AFP). We will review the current results and limitations of this strategy. We will also review recent developments in the use of abbreviated MRI protocols for HCC screening and surveillance.

SPFR61D Lung Cancer: Should We Be Screening Patients with Other Cancers?

Participants
Michelle S. Ginsberg, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the approach to the inclusion of patients with a previous history of malignancy in lung cancer screening studies. 2) To discuss the need for lung cancer screening in survivors of other cancers.

SPFR61E Prostate Cancer Screening: Will it Ever Happen?

Participants
Harriet C. Thoeny, MD, Bern, Switzerland (*Presenter*) Advisory Board, Guerbet SA

LEARNING OBJECTIVES

1) To identify the disadvantages of the current gold standard of prostate cancer detection. 2) To differentiate significant form insignificant PCa and to understand its impact on management. 3) To assess the prerequisites of mpMRI as a screening tool of prostate cancer detction.

ABSTRACT

Prostate cancer (PCa) is the most frequent malignant tumor in men in Europe and the USA. Up to date systematic transrectal ultrasound guided- (TRUS) biopsy based on a rise in PSA and/or a suspicious digital rectal examinaition is the gold standard in PCa detection. However, this approach is unsatisfactory as it leads to over-and underdiagnosis of PCa. MpMRI is now an integrated part in the workup of PCa in many institutions and MR/TRUS-fuion guided instead of systematic blind biospies are more frequently used leading to a higher detection rate of significant PCa on one hand and a lower detection rate of insignificant PCa on the other hand. The NPV of mpMRI to detect significant PCa is reported between 63-98% depening on patient selection. mpMRI improves PCa detection and might therefore be a valuable tool for PCa screening however, the prerequisities include excellent image quality, a dedicated and experienced radiologist, availabilty of MRI and a short imaging protocol without contrast medium administration to make the healthcare authoritites considering mpMRI as a cost effective screening tool. Furthermore, an improved NPV might reduce the number of unnecessary biopsies in a high number of men and therefore decrease costs for the healthcare system.

SPFR61F Ovarian Cancer Screening: Have We Given Up Yet?

Participants
Andrea G. Rockall, FRCR,MRCP, London, United Kingdom (*Presenter*) Speaker, Guerbet SA

LEARNING OBJECTIVES

1) To know about the results of ovarian cancer screening studies. 2) To understand the possible reasons for failure. 3) To be aware of screening studies in high risk patients.

Honored Educators

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SPFR61G Non-cancer Screening: Should We Screen for Cardiovascular Diseases with Imaging?

Participants
Mathias Prokop, PhD, Nijmegen, Netherlands (*Presenter*) Speakers Bureau, Bracco Group; Speakers Bureau, Bayer AG; Research Grant, Canon Medical Systems Corporation; Speakers Bureau, Canon Medical Systems Corporation; Research Grant, Siemens AG ; Speakers Bureau, Siemens AG ; Departmental spinoff, Thirona; Departmental licence agreement, Varian Medical Systems, Inc; ;

SPFR61H Whole-body Screening for Multiple Cancers: Is a One-Stop-Shop Approach Feasible?

Participants
Giuseppe Petralia, MD, Milan, Italy (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the most appropriate imaging technique for whole-body cancer screening. 2) Arrange a whole-body MRI scanning protocol in their home Institutions. 3) Describe findings observed in a whole-body MRI performed for cancer screening in a Likert scale. 4) Recommend the whole-body MRI for cancer screening to the appropriate population.