Breast Imaging and Interventional

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105TH Scientific Assembly and Annual Meeting
December 1–6 | McCormick Place, Chicago

BR001-EB-X

Seeing More Clearly: Improving Mammography Interpretive Performance through Pictorial Review of Common Causes of False Negative Mammography with Standard 2D Mammography (DM) and 3D Digital Breast Tomosynthesis

All Day Room: BR Community, Learning Center Hardcopy Backboard

Participants
Andrea M. Winter, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Debbie L. Bennett, MD, Saint Louis, MO (*Abstract Co-Author*) Advisory Board, Devicor Medical Products, Inc; Speaker, Hologic, Inc

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TEACHING POINTS

1. Know the most common factors contributing to false negative studies using both digital mammography (DM) and digital breast tomosynthesis (DBT) imaging 2. Define false negative mammogram according to BIRADS audit and understand the difference between a false negative study and a 'missed' cancer. 3. Recognize potential diagnostic pitfalls and methods to avoid the most common reasons for false negative studies.

TABLE OF CONTENTS/OUTLINE

Review the BIRADS audit with attention to definition of a false negative mammogram Distinguish a false negative exam outcome from the term 'missed cancer' Compare common reasons for false negatives seen with 2D mammography (DM) with those seen on digital breast tomosynthesis (DBT) exams Present 5-7 cases illustrating common causes of false negative mammograms, with suggestions for recognizing pitfalls in order to improve mammography performance: True interval cancers with no mammographic finding in retrospect (Fig 1) Previously visible cancers with subtle mammographic findings in retrospect (Fig 2) Cancers obscured by dense breast tissue Presence of other distractors on mammogram (Fig 3) Misinterpreted mammographic finding - common in setting of calcifications. (Fig 4) Mammographic finding not imaged due to poor technique/positioning (Fig 5).

BR002-EB-X

Incidental Breast Findings on Chest CT: When to Worry

All Day Room: BR Community, Learning Center Hardcopy Backboard

Participants
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TEACHING POINTS

Despite the focus of chest computed tomography (CT) is usually the lung or the mediastinum, the entire breasts appear on most of the studies. Radiologist should carefully evaluate this area because a variety of breast tissue abnormalities with significant impact may be encountered. To avoid missing the forest for the trees, radiologists should optimize chest CT interpretation by including the breast. Teaching points: • To give some clues for detecting and assessing incidental breast findings. • To give some clues for distinguishing incidental breast findings that will require further studies.

TABLE OF CONTENTS/OUTLINE

• Explanation of the normal appearance of breast parenchyma on CT and its normal variations, depending on variations in breast density, previous surgical background, history of radiation therapy, etc. • Explanation of possible breast findings sorted by a practical classification based on CT densities: air, fat, fluid, soft tissue, contrast, and metal. • Flowchart of a proposed algorythm for incidental breast findings management.

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BR003-EB-X

Variable Imaging Appearances of Fat Necrosis and Autologous Fat Injections in the Era of Breast Conserving Therapy and Variable Mastectomy Approaches: A Multimodality Approach

All Day Room: BR Community, Learning Center Hardcopy Backboard

Participants
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Debra M. Ikeda, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

To review variable appearances of fat necrosis on mammography, DBT, ultrasound, and MRI after surgery To discuss the role of clinical history, diagnostic approach and management of masses in the setting of prior reconstruction and autologous fat grafting

TABLE OF CONTENTS/OUTLINE

1. Background of fat necrosis and autologous fat grafting - incidence, symptoms and signs 2. Histopathological stages of fat necrosis 3. Examples of characteristic appearance of autologous fat grafting and fat necrosis on mammogram, digital breast tomosynthesis, ultrasound, and MRI 4. Examples of cancer recurrence in the setting of post mastectomy changes 5. Differential diagnosis: Pearls and pitfalls 6. The role of clinical history, diagnostic approach and management of masses in the setting of prior reconstruction and autologous fat grafting

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BR004-EB-X

Complications of Long Standing Diabetes in Breast Radiology: Diagnostic Pearls and Imaging Spectrum of Associated Mastopathy

All Day Room: BR Community, Learning Center Hardcopy Backboard

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TEACHING POINTS

1. To illustrate the variable imaging signs and stages of lymphocytic mastopathy in the setting of chronic diabetes.2. To present a case review demonstrating the range of common and infrequent radiologic and pathologic findings.3. To highlight the increasing role of this phenomenon, with particular reference to its overlap with other pathologies, especially as a mimic of malignancy.

TABLE OF CONTENTS/OUTLINE

• Introduction with regards to the variable imaging spectrum of breast radiology findings in long standing diabetes.• Illustration via Radiologic-pathologic correlation of the breast mastopathy including early and late sonographic findings.• Socioeconomic aspects of diabetes with emphasis on the role of imaging in establishing the correct diagnosis. Highlighting misleading sonographic patterns and its potential for mimicking malignancy. • Tabular collation of information with associated images and observations in breast radiology and discussion of the potential future role of artificial intelligence in supporting the multidisciplinary diagnostic process in combination with radiological-clinical data.• Conclusion

BR100-ED-X

Breast Enlargement: A Radiopathological Pictorial Review and Diagnostic Work-Up

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

-To review different causes of breast enlargement. -To illustrate imaging findings (mammogram, US, MR and CT) of cases of breast enlargement providing clinical images and pathologic correlation. -To analyze management of those lesions, including imaging and interventional procedures and emphasizing pitfalls, diagnostic difficulties and clues for differential diagnosis, and proposing a specific work-up.

TABLE OF CONTENTS/OUTLINE

We present: - Clinical signs and symptoms. Most frequently unilateral , rare bilateral. - Different causes. 1. Mammary origin: Normal variants: Developmental variants, Unilateral breast feeding. Diffuse. Previous radiation. Ginecomastia (males). Direct foreign body substance injection (silicone, hialuronic acid). Mastitis. Tumors. Rapidly growing benign masses: Juvenile fibroadenoma, phyllodes tumor, PASH. Malignancies. Huge malignant tumors (sarcoma, malignant phyllodes tumor, metaplastic carcinoma), Inflammatory carcinoma, Lymphoma. Prostheses related. Rupture, periprosthetic fluid infection, anaplastic B lymphoma. 2. Edema of non-mammary origin: heart failure, superior vena cava syndrome, dermatosis (angioedema), axillary lymphadenopathy. 3. Lesions in adjacent organs. Pectoralis muscle hematoma, tumor (lipoma, sarcoma) - Tips for differential diagnosis. - Diagnostic work-up.

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BR101-ED-X

Demystifying Breast MRI: A Pictorial Review of the ACR BI-RADS MRI Lexicon and Reporting

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

The purposes of this exhibit are: 1. To review and to illustrate the ACR BI-RADS MRI lexicon. 2. To clarify breast MRI interpreting and to provide radiologists with a systematic approach of standardized reporting.

TABLE OF CONTENTS/OUTLINE

1. Clinical information and aquisition parameters 2. BI-RADS MRI lexicon a. Amount of fibroglandular tissue b. Background parenchymal enhancement c. Focus d. Masses e. Non-masses f. Intramammary lymph node g. Skin lesion h. Non-enhancing findings i. Associated features j. Fat containing lesions k. Location of lesions l. Kinetic curve assesment m. Implants 3. Assessment categories and management

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BR102-ED-X

Wireless Localization of Non-Palpable Breast Lesions: Techniques, Limitations, Pitfalls and Solutions

All Day Room: BR Community, Learning Center Digital Education Exhibit

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Nelly Salem, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

To avoid displaced wireless fiducials: avoid stereotactic accordion effects, approach lateral on x-ray grid, measure target/needle tip distance when uncovering near infrared reflectors, avoid pulling back needles when deploying fiducials For displaced fiducials: Discuss case with surgeon with images, plan for excision, mark/photograph patient's skin with target-to-fiducial distances and breast landmarks (nipple, skin, US findings), use checklist to annotate post-localization mammograms with target, correctly/incorrectly placed fiducials

TABLE OF CONTENTS/OUTLINE

Learning Objectives To review wireless localization techniques/limitations To describe reasons for displaced wireless fiducials and methods to avoid displacement To elucidate solutions to guide surgeons to remove targets when wireless fiducials are displaced Background/Teaching Points Methods of Wireless Localization Cases: Wireless Fiducial Placement Wireless Fiducials Displaced during US and Mammography Deployment and Methods to Avoid Displacement Surgical Discussion/Image Annotation Images for Displaced Fiducials (target, breast landmarks/nipple/skin, displaced and correctly placed fiducials) Patient Skin Annotation for Displaced Fiducial/US Target

BR103-ED-X

Endocrinology in Benign Breast Disease: What the Breast Radiologist Needs to Know

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

1. To describe hormonal interactions between breast tissue, the hypothalmus, the pituitary gland, the thyroid gland, the gonads, and the parathyroid glands. 2. To demonstrate how pathological interruptions in the endocrine pathways involved in prolactin secretion, estrogen and androgen secretion, and calcium homeostasis lead to disorders of the breast including galactorrhea, gynecomastia, premature thelarche/precocious puberty, breast pain, and vascular/stromal calcifications. 3. To illustrate breast imaging findings associated with these benign breast conditions.

TABLE OF CONTENTS/OUTLINE

Purpose: Review endocine pathways involved in benign breast disorders. Galctorrhea: Describe and illustrate endocrine basis of galactorrhea. Detailed diagram of prolactin regulation illustrating where in the pathway disorders resulting in galactorrhea occur. Gynecomastia: Describe and illustrate endocrine basis of gynecomastia with pathway diagram of estrogen and androgen regulation in males. Premature thelarche/precocious puberty: Describe and illustrate endocrine pathways involved in normal and premature breast development. Breast pain: Describe and illustrate endocrine pathways involved in breast pain. Secondary hyperparathyroidsim induced breast calcifications: Describe endocrine pathway with detailed diagram. Correlative images for all sections will be included.

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BR104-ED-X

Large Masses in Young Women: A Pictorial Review

All Day Room: BR Community, Learning Center Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS

To review causes of large breast lesions in women under 30 years old, To illustrate clinical presentation, imaging findings (mammogram, US, MR), interventional procedures and pathologic correlation. To emphasize pitfalls, differential diagnosis and management difficulties

TABLE OF CONTENTS/OUTLINE

Breast cancer in young women presents with higher histology grade, positive axillary nodes, hormone receptor negativity, and higher p 53 and Ki-67 expression, which results in rapidly growing masses. We provide a case-based presentation of clinical features, imaging appearance, histologic correlation, and appropriate management of breast lesions in cases of young women presenting with large masses that have a challenging diagnosis. We present: Inflammatory conditions (granulomatous mastitis), benign masses (Pseudoangiomatous Stromal Hyperplasia of the Breast, hamartoma, nodular fasciitis) ,malignant tumors (spindle cell carcinoma, malignant phyllodes tumor, metaplastic and inflammatory carcinoma, lymphoma).

BR105-ED-X

A Delivery from Amazon: Metastases to the Breast

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

The major teaching points of the exhibit are: Metastases to the breast can be encountered in diverse settings of the known primary neoplasms. Evaluation with mammograms and ultrasound provide a background framework for the initial differential diagnoses. More advanced modalities may follow the preliminary imaging assessment and provide further planning for biopsy and management options.

TABLE OF CONTENTS/OUTLINE

The goals of this exhibit are to: 1. Review diverse imaging appearances of common and uncommon metastases to the breast. 2. Discuss the diagnostic and prognostic role of the imaging modalities in evaluation of the secondary neoplastic breast masses. 3. Provide pictorial illustration of differential diagnoses based on clinical presentations. Types of metastatic disease to the breast illustrated in this exhibit: -Adenocarcinoma (colon) -Squamous cell carcinoma (uterine cervix) -Melanoma (cutaneous) -Rhabdomyosarcoma (oropharyngeal) -Renal cell carcinoma -Lymphoma (diffuse large B cell, T cell) -Acute myelogenous leukemia

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BR106-ED-X

Imaging Inflammatory Conditions of the Breast: Radiopathological Pictorial Review

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

To review the spectrum of benign inflammatory lesions of the breast, highlighting clinical, pathological and imaging differences from inflammatory breast cancer.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.To emphasize pitfalls and clues to differential diagnosis.

TABLE OF CONTENTS/OUTLINE

A case-based review will illustrate imaging findings and pathological correlation of challenging cases of inflammatory lesions of the breast.1. Clinical presentation.2. Imaging findings. Mammography, US, MR, interventional procedures. 3. Pathologic entities: Infectious: acute Mastitis (puerperal and non-puerperal),abscess, chronic subareolar abscess and fistulae (Zuska's disease). Idiopathic Granulomatous Mastitis. Plasma Cell Mastitis (Periductal mastitis). Lymphocytic Mastitis (Diabetic Mastopathy). Eosinophilic mastitis. Tuberculous mastitis. Foreign bodies and breast augmentation. Inflammatory carcinoma would also be presented for comparison.4. Differential diagnosis, diagnostic work-up and management of these conditions.

BR107-ED-X

Biomarkers in Breast Imaging

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

To review the definitions and applications of the term 'biomarker'To describe the different known biomarkers in breast cancer, including clinical, pathological, molecular, and imaging biomarkers.To highlight the specific roles of breast imaging biomarkers as well as the integration of breast imaging with related biomarkers

TABLE OF CONTENTS/OUTLINE

In contrast to the traditional approach to breast cancer, personalized medicine aims to provide treatments directly fitting the needs of an individual patient. That is the basis for modern breast care practice in which biomarkers are increasingly employed for decision support. The radiologist's role in breast cancer clinical management and research includes knowledge of imaging but also of the rest of biomarkers. We present: 1. Biomarkers. Definitions and applications of the term. 2. Types of biomarkers in breast cancer. Diagnostic, predictive, prognostic, and monitoring biomarkers. 3. Clinical biomarkers 4. Histological biomarkers. 4. Molecular biomarkers 5. Imaging biomarkers. Description. Integration with other biomarkers.

BR108-ED-X

EQUIP: What, Why and How?

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

Breast imaging centers are having a poor understating of the new MQSA initiative Enhancing Quality Using the Inspection Program (EQUIP). Facilities are subject to citations if they cannot demonstrate clinical image evaluation and corrective action program to address the following EQIP questions: Q1. Does the facility have procedures for corrective action when clinical images are of poor quality? Q2. Does the facility have procedures to ensure that clinical images continue to comply with the clinical image quality standards established by the facility's accreditation body? Q3. Does the facility have a procedure for lead interpreting physician oversight of QA/QC records and corrective actions? The goal of EQUIP is to spot image quality issues early so that corrective action can take place. At the end of this educational exhibit the learner will 1. Understand the origin and significance of EQIP, 2. Be able to assess their institutional preparedness for EQUIP inspection, 3. Understand how to analyze mammographic image quality.

TABLE OF CONTENTS/OUTLINE

Introduction; History of MQSA; Rationale for EQUIP; Standard mammographic image review; Image quality assessment; Procedures for corrective action, addressing Q1; Image quality standards, addressing Q2; Lead interpreting physician responsibilities, addressing Q3; Resources for EQUIP inspection; Conclusion

BR109-ED-X

Imaging the Post Mastectomy and Post Implant Breast: Challenges and Pitfalls

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

1. Illustrate the spectrum of imaging findings in the post mastectomy reconstructed breast 2. Review common and uncommon complications and challenges associated with implants

TABLE OF CONTENTS/OUTLINE

An interactive quiz format will highlight the teaching points, using cases selected from two high volume tertiary breast centers and a large outpatient practice.1. Post mastectomy breast: A wide spectrum of imaging findings of both benign and malignant entities including disease recurrence, lymphoma, epidermal inclusion cyst, alloderm presenting as a palpable lump and fat necrosis will be shown in a case-based format. 2. Post implant breast: Challenging cases in the post implant breast including missed cancers, difficult ultrasound, stereotactic and MR biopsies and strategies for approaching these biopsies, implant complications including rupture, and implant associated anaplastic large cell lymphoma will be demonstrated in a case-based format.

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BR110-ED-X

Rules of Engagement: Implementing Student-Centered Learning in the Breast Imaging Medical Student Elective

All Day Room: BR Community, Learning Center Digital Education Exhibit

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Gary Beck Dallaghan, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Emphasize traditional teaching methods are ineffective, making the case that change is needed. Provide curriculum changes centering student learning in breast imaging. Offer strategies to engage medical students with learning materials in breast imaging.

TABLE OF CONTENTS/OUTLINE

Ø Liaison Committee on Medical Education core competencies for medical students (with their analogy to Accreditation Council for Graduate Medical Education for residents) Ø Breast Imaging medical student elective curriculum Ø Engaging medical students - from the literature Ø Engaging medical students - how we do it

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BR111-ED-X

A Pictorial Review of Electromagnetic Wave Reflector Breast Localization Device Placement Techniques

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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Barbara Konz, RN, Nashville, TN (*Abstract Co-Author*) Nothing to Disclose
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Lucy B. Spalluto, MD, Nashville, TN (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Describe the electromagnetic wave reflector localization device 2. Discuss logistical workflow for placement and excision 3. Present cases depicting placement using multiple imaging modalities for guidance: (a) Ultrasound, (b) Mammographic, and (c) Stereotactic

TABLE OF CONTENTS/OUTLINE

Savi Scout (SS) is a non-radioactive, infrared-activated, electromagnetic wave reflector localization device that can be used to localize non-palpable breast lesions for surgical excision. Outcomes using SS are similar to other localization techniques (wire-guided or radio-active seed localization), including re-excision rates. The device can be placed using multiple imaging modalities several days prior to excision, reducing complex scheduling coordination of localization and surgical excision. This multimedia presentation will include background on the risks and benefits of SS placement. A thorough case-series will be presented with images depicting the standard workflow for SS placement including pearls and pitfalls of placement. Images will depict the process for sonographic, mammographic, and stereotactic guidance: 1. Lesion identification 2. Initial percutaneous biopsy, clip placement and post-procedure mammogram 3. Localization device placement via various imaging modalities (pearls and pitfalls) 4. Surgical excision and specimen radiograph

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BR112-ED-X

Imaging Spectrum of Breast Augmentation in Native and Post-Mastectomy Breast and Common Complications: A Pictorial Review

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

After reading this article, the readers will be able to: 1. Understand the imaging appearance and differences in various common and unusual breast augmentation techniques in the native breasts. 2. Get familiar with imaging features of different types of post mastectomy reconstructions using prosthesis and/or autologous flap. 3. Know the imaging features of some common complications in native as well as post-mastectomy breast augmentation procedures on different modalities.

TABLE OF CONTENTS/OUTLINE

1. Introduction of varieties of breast augmentation. 2. Imaging appearance on various modalities of breast augmentation in the native breasts: (a) Implants: Prosthesis like saline, silicone, double lumen with discussion of complications eg. , bulge, intra and extracapsular rupture (b) Free filler injection using fat, silicone, paraffin, PAAG (c) Implant with free filler injections: Implant + silicone, implant + PAAG (d) some complications in augmentaed native breast. 3. Post mastectomy breast reconstruction (a) Implant (b) Autologous flap reconstruction: TRAM, DIEP, LD and some related complications like recurrent breast Cancer. 4. Conclusion

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BR113-ED-X

Outside the Breast: Findings in the Periphery of Breast Imaging

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

Anatomy review of structures of the breast and breast vicinity important for diagnosis of accessory or incidental findings and for breast cancer detection. Practicing a search pattern for breast imaging to ensure breast cancer as well as non-breast cancers are not missed in the periphery of the images. Quiz: A series of cases depicting rare and common anatomic or non-breast cancer findings.

TABLE OF CONTENTS/OUTLINE

The cases will be presented in a quiz format with associated teaching points included in the answer slides. The list of cases includes: Variant Pectoralis Muscle Sternalis Muscle Chondrosarcoma: A Chest Wall Lesion Presenting as a Breast Mass Poland Syndrome: With Multiple Chest Wall Abnormalities Poland Syndrome: With Breast and Pectoral Hypoplasia Accessory Breast Tissue Accessory Breast Tissue: With Invasive Ductal Carcinoma Accessory Nipple Pectus Excavatum: Normal Variant Pectus Excavatum: Masking a Breast Cancer Sebaceous Cyst Tattoo Calcification

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BR115-ED-X

Dynamic Duo: Imaging the Pregnant and Lactating Patient

All Day Room: BR Community, Learning Center Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS

Describe the physiologic changes of pregnancy and lactation on the breast with a focus on relevant imaging findings across multiple modalities. Address the potential for radiation-induced deterministic effects while placing those risks in context of commonly encountered radiation doses in mammography. Identify common benign and malignant pregnancy-associated breast pathology, associated findings, and relevant workup.

TABLE OF CONTENTS/OUTLINE

Physiologic changes of pregnancy Overview of breast imaging modalities in context of pregnancy and lactation Mammographic radiation doses and dose-related thresholds for fetal deterministic effects Overview of specific pregnancy-associated breast entities and their mammographic/sonographic findings: Hypertrophic fibroadenoma Lactating adenoma Galactocele Mastitis Granulomatous mastitis Bloody nipple discharge Breast infarct Pregnancy-associated breast cancer Non-Hodgkin lymphoma

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BR116-ED-X

The Role of Ultrasound in Predicting the Molecular Subtype of Breast Cancer: A Guide for Trainees and Experts Alike

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

Still being one of the major causes of women death worldwide, the breast cancer defies us with its diverse natural history and variable treatment response. The development of relatively new molecular classification, has led to major improvements in patient outcomes. Even though the 'gold standard' for molecular classifications remains histology and immunohistochemistry (IHC), the ultrasound (US) attempt to predict the cancer' biological behavior is becoming more and more attractive. Moreover, US is a non-invasive, widely available procedure with a constant increasing utility in nowadays' breast cancer diagnosis. GOALS: 1. Review the classification of breast cancer molecular subtypes - IHC vs gene expression profiling. 2. Discuss the implications of different subtypes in daily-basis practice - treatment management, follow-up, survival. 3. Highlight the ultrasound findings for each molecular subtype, correlated with histology and IHC; illustrate discordant cases. 4. Rehearsal with challenging cases, presented in a quiz format.

TABLE OF CONTENTS/OUTLINE

1. Molecular classification of breast cancer 2. Daily-basis practice - why is molecular classification important? 3. Ultrasound findings: Luminal A; Luminal B and Luminal B - like (HER 2 positive); HER 2 positive; Triple Negative 4. Case-based quiz - how good are we?

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BR117-ED-X

Catch Me Before I Go Invasive! The Role of Ultrasound in Depicting Calcified and Non-Calcified DCIS

All Day Room: BR Community, Learning Center Digital Education Exhibit

Awards
Certificate of Merit

Participants
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TEACHING POINTS

The ductal carcinoma in situ (DCIS) is referred more as a spectrum of diseases instead of a single entity. It represents 20% of all detected breast cancers and has an increasing incidence in young women (under 40). While the calcified-type accounts up to 40% of the microcalcifications depicted on mammography (Mx), the non-calcified type might be occult in up to 44% of the Mx exams. Ultrasound (US) helps us decrease the occult Mx rate, is the optimal screening method for the young population and could guide minimally invasive maneuvers for further treatment. Goals: 1.Discuss the histological classification of DCIS along with its implication in creating various ultrasound patterns 2.Highlight the US aspect of DCIS microcalcifications correlated with Mx aspect 3. Emphasize the US aspects of non-calcified DCIS - the role of Doppler, Strain and Share wave elastography in depicting small lesions; explain the 'non-mass' appearance 4. Discuss the occult US DCIS lesions, MRI depicted DCIS and second-look, targeted US 5. Exemplify the major US differentials for both calcified and non-calcified DCIS

TABLE OF CONTENTS/OUTLINE

1. Histological classification: comedo versus non-comedo DCIS; 2. Calcified DCIS on US examination; 3. Non-calcified DCIS on US; 4. Occult or non-occult US DCIS? 5. DCIS differentials - Benign versus malignant

BR118-ED-X

Invasive Lobular Carcinoma, the Great Imitator of the Breast: A Practical Multimodality Diagnostic Guide for Residents

All Day Room: BR Community, Learning Center Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS

Invasive lobular carcinoma(ILC) accounts for 5-15% of the breast cancers and it is the second most encountered type among invasive carcinomas. A high rate for bilateral lesions (6-47%) and multifocality/multicentricity(21%) have been reported, all affecting the ILC overall survival. Not rarely, it might be misdiagnosed on mammography (Mx) and also on ultrasound (US). Hence, we present classic imaging aspects of ILC, together with important diagnostic teaching points. GOALS: 1. Brief review of ILC histology 2. Discuss and illustrate the Mx appearance of ILC: why are there Mx occult lesions? 3. Present various US aspects together with classic findings (Golden Gate, picket fence sign); 4. Exemplify the added diagnostic value of Magnetic Resonance (MRI) - may it change the therapeutic management? 5. Highlight major differential diagnosis: diabetic mastosis, invasive ductal cancer

TABLE OF CONTENTS/OUTLINE

1.ILC Histology 2. ILC on Mx: lack of calcifications; asymmetrical density; architectural distortion; spiculated mass; 3.ILC on US: masses with ill-defined margins; important acoustic shadowing; 4.ILC on MRI: mass and non-mass lesions; kinetic curves; 5.Differential diagnosis - case based examination with proven histology.

BR119-ED-X

Complex Cystic and Solid Masses of the Breast: Friend or Foe?

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

1. Complex cystic and solid masses describe the echo pattern of a broad range of breast masses as seen on US. 2. The differential diagnosis includes both malignant and benign masses. 3. Clinical history can aid in narrowing the differential diagnosis. 4. Mammography and MRI can be helpful adjunct imaging to facilitate diagnosis. 5. Biopsy is often indicated for definitive diagnosis, although short term followup can be a reasonable management option in certain circumstances.

TABLE OF CONTENTS/OUTLINE

1. BIRADS terminology describing complex cystic and solid masses. 2. Review of the imaging appearance of complex cystic and solid masses including: Papillary masses • Papilloma • Papillary carcinoma Benign Masses • Trauma • Pregnancy related • Other Malignant Masses • Invasive carcinomas • Other malignancies 3. Stress the clinical presentation and imaging features that may help distinguish benign from malignant to include correlation with mammography and MRI. 4. Discuss pathology and clinical management options for each diagnosis.

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BR120-ED-X

Looking Beyond Your Limitations: Diagnosing Malignancy in the Augmented Breast

All Day Room: BR Community, Learning Center Digital Education Exhibit

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Certificate of Merit

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TEACHING POINTS

The purpose of this exhibit includes: 1. Knowledge of different types of breast implants and the unique challenges of imaging women after breast augmentation. 2. Review common and uncommon presentations of breast malignancy in patients with breast implants. 3. Familiarize radiologists with the appropriate imaging evaluation of patients with breast implants including re-windowing to look through saline breast implants and the importance of ultrasound in evaluating clinical symptoms. 4. Highlight the use of MRI as a problem-solving tool when biopsy is difficult and to evaluate the extent of disease in patients with breast cancer and breast implants.

TABLE OF CONTENTS/OUTLINE

1. Review types of breast implants. 2. Explain the diagnostic and imaging challenges associated with breast augmentation. Case Based Review: Utilizing a multimodality approach,10 cases that emphasize different points and techniques to prepare the learner for evaluating patients after breast augmentation will be presented. These cases will be chosen to illustrate common and uncommon presentations of malignancy, highlight the importance of a thorough imaging evaluation and clinical exam, demonstrate useful tips and techniques, and discuss the role of breast MRI in problem solving and evaluating for extent of disease.

BR121-ED-X

Problem Solving with Breast MRI

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

Following review of this educational exhibit, the reader will better: • Understand clinical scenarios in which breast MRI is an an effective diagnostic problem solving tool, beyond screening and new diagnosis of breast cancer • Recognize imaging findings and limitations of breast MRI in the setting of neoadjuvant therapy • Differentiate benign and malignant findings following lumpectomy

TABLE OF CONTENTS/OUTLINE

Current Indications for Breast MRI beyond screening and new diagnosis • Assess for residual disease after lumpectomy with positive margins -Expected postoperative findings versus suspicious findings • Surveillance of lumpectomy sight • Evaluating response to neoadjuvant chemotherapy -Potential pitfalls • Axillary metastasis with unknown primary (occult breast cancer detection) • Paget disease • Evaluation of silicone implants

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BR122-ED-X

Contrast-Enhanced Mammography: Current Indications and Future Directions

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

• To demonstrate the main applications of contrast enhanced mammography (CEM). • To understand the strengths of CEM in breast cancer screening.• To learn the basic technique of CEM and how to incorporate it into clinical practice.• To reveal the benefits and disadvantages of this imaging modality in future applications.

TABLE OF CONTENTS/OUTLINE

(1) Introduction (2) Brief overview about the different approaches in CEM and their features in imaging interpretation (temporal subtraction and dual energy technique) (3) Current indications and clinical applications for this imaging modality (eg. clarification of equivocal lesions, cancer evaluation in the dense breast, symptomatic breast evaluation and determining the extent of disease for presurgical planning) (4) Practical application of CEM at our Institution with illustrated clinical examples; (5) Advantages vs. drawbacks of CEM and potential pitfalls elucidation (6) The future applications of CEM in breast evaluation.

BR123-ED-X

The Skinny on Cutaneous Disorders of the Breast

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

· Benign and malignant disorders of the skin can involve the breast and are often encountered in the clinical setting · It can be very challenging to diagnose these conditions on imaging, and acquiring relevant clinical information is key · Case-based examples will be reviewed with corresponding teaching points to provide an overview of these conditions

TABLE OF CONTENTS/OUTLINE

· Review relevant breast anatomy · Provide examples of benign breast skin disorders with relevant teaching points for each diagnosis and some pathologic correlation o Infection (cellulitis and abscess) o Manifestations of systemic disease (including renal failure with Diffuse Dermal Angiomatosis of the breast, Scleroderma, Neurofibromatosis) o Trauma o Post-surgical/breast cancer treatment changes o Application of topical solutions (i.e. silicone cream, zinc oxide cream, deodorant) o Sebaceous cyst o Keloid o Skin calcifications o Accessory nipple · Provide examples of malignant breast skin disorders with relevant teaching points for each diagnosis and some pathologic correlation o Inflammatory breast cancer o Locally invasive breast cancer o Paget disease of the breast o Melanoma and metastatic disease to the breast o Post radiation angiosarcoma o Muir Torre syndrome

BR124-ED-X

Male Breast: Gynecomastia and Beyond

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

The purpose of this exhibit is: 1. To review the main imaging findings of the male breast and its appearance in imaging methods (ultrasonography, mammography and magnetic resonance imaging). 2. To illustrate the imaging findings of the tumor and non-tumor lesions of the male breast.

TABLE OF CONTENTS/OUTLINE

1. Familiarize the radiologists with the male breast non-tumor 2. Familiarize the radiologists with the male breast tumors. 3. The importance of knowledge of male breast lesions in order to avoid unnecessary invasive procedures in non-suspected cases of breast cancer.

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BR125-ED-X

How Identify and Report Breast Gossypiboma: Medicolegal Obligations

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

The purpose of this exhibit is: 1. Familarize radiologist with breats gossypiboma (ultrasound and mammography). 2. To discuss how do report these cases of gossypiboma. 3. To discuss medicolegal obligations of the radiologist to report gossypiboma.

TABLE OF CONTENTS/OUTLINE

1. Imaging technique in patients with suspected breast gossypiboma. 2. How to report breast gossypiboma. 3. Medicolegal obligations of the radiologist.

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BR126-ED-X

Percutaneous Management of Breast Abscesses by US-Guided Catheter Drainage and Daily Aspiration without Sterile Saline Irrigation

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

To show the usefulness of percutaneous management of breast abscesses by US-guided catheter drainage and daily aspiration without sterile saline irrigation. Highlight the importance of instructing the patient to fulfill the treatment. US-weekly follow-up is cheap and helpful to check the abscess status/resolution.

TABLE OF CONTENTS/OUTLINE

Background and goals of this poster Material and method - how do we perform it Outcomes; sample cases Conclusions

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BR127-ED-X

Morphea of the Breast and Its Mimickers

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

The purpose of this exhibit is: 1- To review the clinical and radiologic presentation of Morphea of the breast 2- To discuss the pathology of this rare disease and subsequent clinical and radiopathologic correlation 3- To highlight the mimics through clinical examples

TABLE OF CONTENTS/OUTLINE

Morphea known as localized scleroderma, is a rare, inflammatory disease of the skin, may be idiopathic or may occur as a complication of radiation therapy, an entity known since 1989. It is characterized by two clinical phases: Inflammatory, with erythema and peau-d'orange that may mimic inflammatory breast cancer and/or angioscarcoma and fibrotic, leading to deformity of the breast, mimicking the shrinking breast in locally advanced invasive lobular carcinoma. Unlike locally advanced invasive lobular carcinoma, the fibroglandular tissue in morphea remains intact. The deformity of the breast is due to fibrosis of the skin that ultimately retracts and accounts for the reduction in breast volume.Its diagnosis is, thus, based on punch biopsy of the skin. We will go through pathophysiology of Morphea, review the two clinical phases that determine the clinical symptoms and signs and account for the imaging findings. We will review the literature and present clinical cases of Morphea and its mimics and highlight the way to narrow the diagnosis

BR128-ED-X

Interactive Mammography Outcomes Audit

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

Breast cancer, for the purposes of the medical audit, is defined as DCIS or primary invasive cancer. Goal of screening is to detect minimal cancers which are defined as DCIS of any size or invasive cancer less than 1 cm Metrics used to assess reader sensitivity and specificity for cancer detection are one of the ways we access quality and add value in medicine.

TABLE OF CONTENTS/OUTLINE

Background/Introduction: Why we have the mammography audit Learning objectives: Review the key components of the medical audit for mammography Define the audit data to be calculated Discuss impact of metrics on value and future potential outcomes Describe the mammography audit process Define and review terms for the audit data to be calculated Illustrate with interactive outcomes data calculation case examples Discuss uses of the medical audit data as teaching tool and as a way we add value in medicine

BR129-ED-X

Adding Value: An Easy Guide to the FDA's EQUIP Initiative

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

1) Understand the EQUIP (Enhancing Quality Using the Inspection Program) initiative and the rationale of ongoing facility review for clinical image quality. 2) Describe the 3 new questions added to the annual MQSA inspection process that focus on continuous review of image quality. 3) Learn about the best practices at our institution that comply with EQUIP. 4) Acknowledge the importance of a team-based approach and the need for continued, frequent opportunities for feedback and improvement.

TABLE OF CONTENTS/OUTLINE

1) Summary of the EQUIP initiative and questions added to annual inspection 2) Case-based overview of common violations cited since EQUIP initiative a. Evaluation of positioning and image quality b. Projections obtained and study performed c. Accurate history on intake sheet 3) Policies and practices at our institution that allow us to incorporate EQUIP into routine practice a. Quality standards for technologists and interpreting physicians b. How we detect quality issues, give feedback and implement corrective action in a timely manner c. Our retrospective review process and QA tracking procedure 4) Provide additional feedback and learning opportunities for the technologist beyond what is required by EQUIP

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BR130-ED-X

False Negative Lesions of Breast Cancer: The Variable Features in Previous MRI

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

Despite the excellent contribution of contrast enhanced breast MRI, there are variable MRI-false negative cases. The purpose of this exhibit is to familiarize the reader with a variety of false negative findings of breast cancer on previous MRI and help readers in making an accurate diagnosis. Also, we emphasize that careful and strict application of BI-RADS is necessary as well as an appropriate biopsy.

TABLE OF CONTENTS/OUTLINE

1. Introduction of false negative breast cancer on MRI. 2. Inclusion criteria. 3. Characteristics of missed cancer. 4. Presentation of the missed cancers on previous MRI compared with current MRI. 5. Analyzing the reasons of misinterpretation. 6. Presenting some tips reducing misinterpretation.

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BR131-ED-X

Breast Edema Terminology: To Standardize the Language of T2WI Breast MRI

All Day Room: BR Community, Learning Center Digital Education Exhibit

FDA Discussions may include off-label uses.

Participants
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TEACHING POINTS

Breast edema on T2WI breast MRI is one of important breast MRI findings because recent studies reported that breast edema can contribute breast cancer diagnosis and it is a prognostic biomarker of breast cancer. However, ACR BI-RADS MRI lexicon does not include breast edema terminology now and this situation can cause confusion to use the terminology. To accurately use breast edema terminology is important to standardize the language of T2WI breast MRI for research and clinical setting. We will: 1. Review published research about breast edema on T2WI breast MRI and organize breast edema terminology to standardize the language of T2WI breast MRI. 2. Discuss most effective usage of breast edema terminology based on each pathological finding.

TABLE OF CONTENTS/OUTLINE

1. Introduction: the definition of breast edema 2. Review of breast edema terminology of T2WI breast MRI 3. Diffuse breast edema and focal breast edema 4. 3 types of focal breast edema 5. Relation between breast edema and neoadjuvant chemotherapy efficacy 6. Summary

BR132-ED-X

Contrast Enhanced Mammography versus Dynamic Contrast-Enhanced MRI: Which is Right for Who?

All Day Room: BR Community, Learning Center Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS

Both CESM and MRI have features in common. They both use contrast material to enhance morphology assessment and provide some functional information with comparable sensitivity and specificity. The oververlap between the advantages, limitations and indications of both modalities poses a diagnostic challenge. Therefore, we aim to clarify which modality is more appropriate to be used in four different clinical scenarios namely: detection, diagnosis, local staging and follow up of patients after adequate management.This review would help breast imaging radiologists to understand when to ask for contrast imaging of the breast and how to choose the optimum modality to be able to make the most appropriate diagnosis.

TABLE OF CONTENTS/OUTLINE

1. Technique of CESM and DCE-MRI. 2. Indications of CESM and DCE-MRI. 3. Advantages and limitations of CESM and DCE-MRI. 4. Discuss 4 clinical scenarios: Detection, diagnosis, local staging and follow-up 5. Emphasize which of the two imaging modalities is more appropriate to be used. in each scenario.

BR133-ED-X

Multigene Panels: What are they and How are they used in Breast Cancer?

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

(1) Review the biomarkers (hormone receptors, oncogenes, biologic subtypes, and multigene panels) utilized as current standard practice in breast cancer prognosis and staging.(2) Introduce the evidence behind the integration of multigene panel analysis into select breast cancer staging by example of the OncotypeDx recurrence score model. (3) Understand the basic laboratory techniques used to evaluate the presence or absence of common biomarkers (immunohistochemistry, in situ hybridization, and real-time polymerase chain reaction).(4) Evaluate the future directions of multigene panels and its implications on comprehensive, multidisciplinary care.

TABLE OF CONTENTS/OUTLINE

- Current Biomarkers in Breast Cancer- Throwback to the Lab Bench (Review IHC, ISH, and RT-PCR)- What are Multigene Panels?- Evidence for Multigene Panels: NSABP B-14 & TAILORx Trials- AJCC Recommendations- Future Directions

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BR134-ED-X

Digital Breast Tomosynthesis: An Update on the State of the Technology, Evidence, and Clinical Practice

All Day Room: BR Community, Learning Center Digital Education Exhibit

Awards
Cum Laude
Identified for RadioGraphics

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TEACHING POINTS

Digital Breast Tomosynthesis (DBT) is maturing into its role as the standard of care in mammographic screening. Vendor diversification has promoted further clinical implementation. Continued technical innovations abound in hardware and software, aimed at improving accuracy and reducing radiation dose. Results of prospective trials are emerging with more nuanced information to guide clinical care. We will provide an update on the state of the field by exploring practice guidelines, emerging data, and potential clinical implications via case-based review.

TABLE OF CONTENTS/OUTLINE

1. Intro: a. 2019 FDA approved (4 vendors) b. MQSA National Statistics c. Challenges: Efficiency, Efficacy, Safety, QA 2. Current Screening and Diagnostic Guidelines: a. NCCN version 3.2018 b. ACR Appropriateness Criteria, 2017-2018 c. European Commission (ECIBC) 2019 d. ACR BI-RADS DBT Lexicon Supplement 2019 3. Prospective data: a. PROSPR Trial 2019 b. Norwegian Trial 2018 c. Oslo Trial (OTST) 2019 d. ECOG-ACRIN 1141 trial e. TMIST trial 4. Technical updates: a. DBT i. Wide angle tomography ii. Stationary DBT b. Synthetic mammography (SM) i. Low dose ii. High resolution SM iii. CAD enhanced SM c. CAD/AI i. For SM & 3D stack ii. Deep Learning-based CAD iii. ? Accuracy ? Reading time 5. Clinical implications: Above discussed via cases

BR135-ED-X

Breast Density Included in the Modern Rules of Mammographic Screening

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

Breast density: A hot topic that we shouldn't ignore. After reading this education exhibit the radiologist will know: The FDA proposal for the standardization of breast density information policies for women in the U.S. Why breast density matters? Density notification works better when women know their density. Supplemental screening tools finding cancers missed on mammograms. Global efforts in awareness and education of BD allowing women with dense breasts to be the first to know 'the best kept secret'.

TABLE OF CONTENTS/OUTLINE

The FDA proposed rule adding breast density reporting information to all summary letters sent to patients, after they undergo a mammogram. Meaning of breast density Breast Density (BD) affecting the sensitivity of mammograms and its recognition as a risk factor for breast cancer. Ultrasound and Breast MRI in addition to mammography in the detection of breast cancer in women with dense breasts. Illustrative cases. Disparities in BD awareness and knowledge based on the right of women to receive information and decide what to do about it.

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Digital Breast Tomosynthesis: Where Does It Fail?

All Day Room: BR Community, Learning Center Digital Education Exhibit

FDA Discussions may include off-label uses.

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TEACHING POINTS

The purposes of this exhibit are: 1. To review the weaknesses and failures of Digital Breast Tomosynthesis (DBT). 2. To show the features of breast tumors that are missed by DBT.

TABLE OF CONTENTS/OUTLINE

A. Limitations of DBT as technique: - Lesions out of the field of view (peripherally seated). - Inability to detect lesions completely surrounded by fibroglandular tissue (no perilesional fat). B. Features of missed tumors: - Circumscribed lesions with no spiculations (very aggressive cancers like some triple-negative breast cancers). - Ductal carcinomas in situ with no macroscopic calcifications. - Cancers with the typical architecture of an invasive lobular carcinoma: indian-rows of tumor cells surrounded by normal tissue. C. False positive cases: architectural distorsions and masses. - Radial scars/complex sclerosing lesions. - Sclerosing adenosis. - Some fibroadenomas.

Printed on: 10/29/20

BR137-ED-X

Axillary "Calcifications" - Oh My!

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

Calcifications or pseudo-calcifications in the axilla are relatively uncommon but represent a diverse spectrum of both benign and malignant entities. Localizing the radio-opaque densities to specific anatomic structures in the axilla along with correlation to clinical history narrows the differential diagnosis. Management of axillary 'calcifications' varies depending upon the underlying etiology.

TABLE OF CONTENTS/OUTLINE

Review relevant axillary anatomy. Discuss imaging and management of a variety of benign lesions that may present with pseudo-calcifications, notably: • Antiperspirant • Tattoo ink • Skin ointments such as zinc oxide and calamine lotion • Gold deposits secondary to rheumatoid arthritis • Infection, such as that secondary to histoplasmosis and tuberculosis • Silicone granulomas. 3. Present imaging features and discuss management of malignancies that may present with axillary calcifications including: Primary breast carcinoma. Metastatic disease, namely ovarian and thyroid primaries due to associated psammomatous calcifications.

BR138-ED-X

Spectrum of Imaging Findings in Breast Cancer Recurrence

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

The purpose of this exhibit is: To review the different types of breast cancer recurrence. To illustrate the main imaging features and key findings of breast cancer recurrence in the different techniques. To emphasize differential diagnosis with non-malignant post-radiation and post-surgical changes.

TABLE OF CONTENTS/OUTLINE

Breast cancer is the first cause of cancer-related deaths in the female population. Even when the tumor had received successful treatment and the patient is 'in remission', close follow-up should be continued because of the possibility of recurrence. It is paramount for the radiologist to recognize the different types of breast cancer recurrence (local, regional, metastatic or opposite breast cancer) and to optimize the diagnostic yield combining different imaging techniques (mammography, breast tomosynthesis, ultrasound, and magnetic resonance imaging). To illustrate this review, we provide a wide variety of breast cancer recurrence cases, from patients attended in our radiology department in the last eight years. We review imaging features of the different types of recurrence and its relation with: Initial radiological presentation Histological and immunohistochemical analysis Used surgical technique Post-surgical and post-radiotherapy changes Long-term survival

BR139-ED-X

Is it Breast Cancer? Breast Imaging and Pathology Correlation of Incidental Breast Findings Identified on CT

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

The purpose of this exhibit is:
1. To review multiple incidental breast findings identified on CT and correlated with their imaging appearance on mammography and ultrasound in addition to pathologic diagnosis
2. To describe the differential diagnosis, epidemiology, pathology, and etiology of different incidental breast findings on CT
3. To review the BI-RADS classification of benign and malignant breast findings that may be encountered initially on a chest CT

TABLE OF CONTENTS/OUTLINE

Challenges of distinguishing benign breast findings from malignant findings on chest CT
Role of dedicated breast imaging in distinguishing benign from malignant etiologies
Establish the importance of clinical history related to the breast in addition to medical history i.e. heart failure, end-stage renal disease, prior thoracic radiation, trauma, etc
Expected findings of the postoperative breast:
-Benign etiology; breast implantation or mastopexy
-Malignant etiology; lumpectomy, radiation therapy, and breast reconstruction
Differential diagnoses
Case Examples:
1. Male Breast Cancer (Invasive Ductal Carcinoma)
2. Invasive Ductal Carcinoma (female)
3. Local Breast Cancer Recurrence
4. Benign Glandular Tissue
5. Fibroadenoma

BR140-ED-X

Inflammatory Breast Cancer (IBC): What Radiologists Know and What We Need to Learn

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

1- To describe the classic demographic features, clinical manifestations, major differential diagnoses and histopathological findings of inflammatory breast cancer. 2- To identify the most common mammographic, Ultrasound and Magnetic Resonance imaging findings of inflammatory breast cancer. 3-To discuss the approach for a timely diagnosis and management of inflammatory breast cancer.

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Epidemiology 3. Risk Factors of Inflammatory Breast Cancer 4. Histopathologic definition of Inflammatory Breast Cancer 5. Current clinical diagnosis of inflammatory breast cancer a-Clinical Diagnosis b-Breast Imaging appearance: Mammography, Ultrasound, Magnetic Resonance Imaging 6. Histopathological diagnosis 7. Differential diagnosis 8. Management 9. Conclusion: The role of imaging in the diagnosis and management of IBC is essential. Radiologists, as members of the multidisciplinary breast cancer care team, should be familiar with the imaging features of IBC.

BR141-ED-X

Will You Pass the Test? A Diagnostic Strategy for Breast MRI Interpretation

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

• Provide tips for interpretation of a Breast MRI exam for beginners. • Learn through clinical cases to use the information provided by the different MRI sequences to achieve a correct diagnosis and accurate report using the BIRADS lexicon. • Expose the diagnostic challenge that some patients constitute in everyday practice.

TABLE OF CONTENTS/OUTLINE

Breast MRI currently has an established and definite role as a clinically useful imaging tool. As the role of breast MRI expands, many more radiologists, currently involved in breast imaging but not necessarily experienced in MRI, will become involved with the technique. The purpose of this exhibit is to offer a comprehensive pictorial guide to breast MRI for radiologists in training. Through clinical cases, illustrations and figures, we aim to provide tips and tricks that are potential pitfalls associated with the interpretation of the breast MRI examination. At the end we will expose readers to a series of challenging cases in order to improve their diagnostic accuracy and clinical acumen.

BR142-ED-X

Assessment of Extent of Disease with Breast MRI Pitfalls for Residents

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

• Understand the importance of Breast MRI as an accurate and sensitive diagnostic method for assessment of extent of breast cancer. • Learn a diagnostic algorithm when examining women with breast cancer to give all the information needed for a correct pre-operative planning.

TABLE OF CONTENTS/OUTLINE

Assesment of extent of disease is one of the most important indications for use of breast MRI preoperatively. Of all breast imaging techniques, breast MRI has the greatest sensitivity for the detection of breast cancer. It is for this reason that MR mammography is especially suited to give additional preoperative information about the tumor size and extent, the presence of an extensive intraductal component (EIC), posible multifocality or multicentricity, the presence of contralateral breast cancer and lymph node involvement . This work is a resident primer on, through diferent clinical cases, learning what the surgeon needs to know for preoperative staging for the effective planning of the appropiate stage-dependent treatment strategy.

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The New Era for Breast Cancer Screening: Abbreviated Breast Magnetic Resonance Imaging

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

To review the technical aspects of Abbreviated Breast MRI. To describe on Abbreviated Breast MRI Protocols. To comment on current and future directions on this subject matter

TABLE OF CONTENTS/OUTLINE

Introduction and review of current literature. Description of MRI indications for Breast Cancer Screening. Interpretation algorithms. Illustration with cases from our institution. Conclusions.

BR144-ED-X

A Primer on Machine Learning and Artificial Intelligence Applications in Breast Imaging

All Day Room: BR Community, Learning Center Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS

With the recent exponential growth of computational efficiency, artificial intelligence (AI) has become a hot topic in nearly all technology-related fields, including radiology. The goals of our presentation are to: (1) Review basic concepts of AI, with particular focus on machine learning and deep learning algorithms. (2) Present case-based use of AI to assist in various tasks of clinical breast imaging.

TABLE OF CONTENTS/OUTLINE

This exhibit will present an overview of the fundamental concepts of AI/machine learning, and implementation options for different breast imaging modalities (DM, DBT, MR) and clinical tasks. Basic principles and pitfalls in developing and training a machine learning model will be described including the preparation of image data sets used to initiate training of the algorithm, as well as validation and testing to ensure that the results are robust and reliable. Breast imaging specific application of machine learning and deep learning methods will be reviewed including: screening applications, breast density assessment, reducing the time for breast image reading, breast cancer risk prediction, masking risk estimation, detecting ductal carcinoma in-situ, lesion detection and characterization, treatment response prediction and overall patient prognosis.

BR145-ED-X

Digital Breast Tomosynthesis Guided Interventions: How We Do It

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

DBT is increasingly used because it finds more smaller cancers and there is a lower recall of patients as compared to FFDM. Although dedicated prone stereo tables with DBT capability are available to target DBT seen only lesions, prone tables have limited posterior access and are limited to only performing biopsies. Attachments are available to guide localization or biopsy utilizing DBT. This educational exhibit will provided step by step guide on how to perform image guided interventions utilizing DBT equipment. At the completion of this exhibit the learner will 1. List the steps in performing DBT guided interventions; 2. Discuss differences between stereotactic, upright stereo, and DBT guided biopsy;3. Describe radiology-pathology correlation, and 4. Recognize possible complications and pitfall of DBT guided interventions.

TABLE OF CONTENTS/OUTLINE

Introduction; Qualifications for performing stereotactic biopsy; QC prior to DBT guided procedure; Preparation: image review and patient prep; Procedure tray; Marker clip utilization; Time out; Anesthesia technique; Prone table stereotactic biopsy v. upright stereo biopsy; Single sweep DBT guided biopsy; Specimen radiograph; Correlating DBT visible only with post procedure DBT; DBT guided localization with and without wires; Complications; Pitfalls; Radiology-pathology concordance; Biopsy audit; Conclusion.

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BR146-ED-X

Not Another CESM Poster: Implementation in a Rapid Diagnostic Circuit and Radiopathological Correlation

All Day Room: BR Community, Learning Center Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS

To explain the procedure and technical aspects of contrast enhanced spectral mammography (CESM) and discuss its potential indications. To review the role and potential advantages of the use of CESM in the evaluation of breast abnormalities clinically suspected of malignancy, in a rapid diagnosis context. To suggest a CESM protocol integrated in the diagnostic clinical workflow. To describe and illustrate through cases of our institution the most relevant imaging findings of some important breast lesions with radiopathological correlation.

TABLE OF CONTENTS/OUTLINE

1.Introduction 2.Technical considerations 3.Protocol - Diagnostic protocol: Improving the rapid diagnostic circuit with the added value of the CESM. - Suggested CESM protocol acquisition 4. Potential clinical use/indications 5. Image interpretation - Non-enhancing lesions: illustrative cases - Enhancing lesions: illustrative cases with radiopathological correlation. Benign findings (fibroadenoma, fibroadenomatoid changes, fat necrosis...). Malignant tumors. 6. Advantages, disadvantages and limitations 7. Exploring the future 8. Conclusion

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BR147-ED-X

To Scan or Not to Scan, That is the Question: Role of Breast MRI in Cancer Staging

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

Describe the advantages and disadvantages of breast cancer staging with MRI. Discuss the surgical outcome after breast cancer staging with MRI, and consider whether the treatment plan was modified based on the MRI findings. Depict histological types of breast cancer that have been proven to benefit from breast MRI staging.

TABLE OF CONTENTS/OUTLINE

Introduction and review of current literature. Description of breast MRI indications for cancer staging. Illustration with typical and atypical teaching cases. Discussion of benefits and potential pitfalls of breast MRI in cancer staging.

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BR148-ED-X

Imaging of Breast Pathologies in Pregnancy and Lactation

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

Pregnancy and lactation pose unique challenges to radiologists given the hormonal changes that alter the underlying anatomy and physiology of the breast. This requires deviation from standard algorithms for work-up of breast pathologies. Mammography, the workhorse of breast imaging, yields itself ineffective in pregnant and lactating women due to the increased dense fibroglandular tissue and concerns regarding fetal radiation. Additionally, certain breast pathologies are unique to pregnant and lactating women. It is imperative for radiologists to select the appropriate imaging modality, know about breast pathologies unique to pregnant and lactating women, and be familiar with the treatment options.

TABLE OF CONTENTS/OUTLINE

Review the algorithm for imaging in pregnant or lactating women with 'lumps and bumps.' Review normal sonographic findings during pregnancy and lactation to avoid unnecessary work-up and biopsies. Review imaging appearance of benign, infectious, inflammatory, and malignant breast pathologies in pregnancy and lactation woman. Review how common breast pathologies can have unique complications during pregnancy. Discuss current literature on treatment options available during pregnancy and post-partum period including chemotherapy, breast-conserving surgery, and risks of radiation therapy.

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BR149-ED-X

Implant Associated Complications: Spectrum of Imaging Findings from Benign to Malignant

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

Over 300,000 breast augmentation surgeries and over 100,000 surgical breast reconstructions with implants were performed in this country last year alone. Given the millions of women with implants, many of whom will undergo breast imaging, it is important for radiologists to be familiar with the common types and and location of implants and their appearances on imaging. Radiologists should also recognize common and uncommon implants complications, know the typical time course of occurence, and be familiar with the appropriate imaging evaluation and management of these implant related complications.

TABLE OF CONTENTS/OUTLINE

Background including brief history of breast augmentation. Common types of implants (saline, silicone, dual lumen, 'gummy bear'). Normal imaging findings on mammography, ultrasound, and breast MR. Common and uncommon implant related complications, differential diagnosis, and appropriate management: capsular contracture, migration, herniation/bulge, capsular calcifications, hematoma, infection, capsulitis, fibromatosis. Evaluation of implant rupture: gel bleed, intra and extracapsular silicone implant rupture. Free silicone injections. Breast implant associated anaplastic large cell lymphoma (BIA-ALCL) - background, clinical and imaging findings, and diagnostic work-up.

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BR150-ED-X

How Can Radiologists Help Surgeons in the Assessment of the Axilla? Ultrasound-guided Localization of Axillary Lymph Nodes Using Activated Charcoal Before Neoadjuvant Chemotherapy in Breast Cancer Patients

All Day Room: BR Community, Learning Center Digital Education Exhibit

FDA Discussions may include off-label uses.

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TEACHING POINTS

1. Review the key elements concerning the image findings that radiologists may discover during axillary ultrasound before neoadjuvant chemotherapy (NAC) in breast cancer patients 2. Propose a simple check list for the appropriate use of the technique 3. Discuss the importance of this technique for during axillary surgery

TABLE OF CONTENTS/OUTLINE

The 8th edition of the AJCC asses the importance of the evaluation of a possible complete pathological response in axillary lymph node after NAC, since most of positive lymph nodes, will tend to negativize when the final pathology is analyzed. ACOSOG Z1071 study concluded that for cN1 breast cancer patients that had NAC and afterwards had two or more sentinel node examined, the false negative rate (FNR) was above 10%. Posterior studies showed that clipping the positive lymph node and its preoperative localization reduces the FNR significantly. Identification of the biopsied lymph node is a true challenge during surgery. The use of charcoal suspension for tattooing positive nodes during the biopsy is an effective, cost effective and minimal invasive technique that can avoid placing a clip and the posterior difficulties concerning its localization and it also help surgeons easily identify the biopsied lymph node reducing FNR as well as the surgical time

BR151-ED-X

Get it Off Your Breast: Differential Diagnosis of Superficial Breast Lesions

All Day Room: BR Community, Learning Center Digital Education Exhibit

Awards
Cum Laude

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TEACHING POINTS

Review the anatomy and imaging appearance of skin of the breast Review the imaging findings of breast skin lesions Provide clinical images and pathologic correlation when available Emphasize pitfalls, diagnostic difficulties, differential diagnosis and biopsy indications

TABLE OF CONTENTS/OUTLINE

The anatomy of the breast skin (epidermis, dermis and subcutaneous fat) and the normal appearance of the skin in common breast imaging modalities. Knowledge of the most common differential diagnosis of superficial breast lesions: dermal lesions including epidermal and sebaceous cysts, calcifications and benign tumors; hypodermal lesions for example fat containing lesions, hemangioma, Mondor's disease, and neurogenic tumors; and superficial parenchymal breast lesions such as papilloma, fibroadenoma, and malignancies. Careful analysis of radiological features to determine lesion location in order to make the correct differential diagnosis. Ultrasound criteria indicative of benign dermal lesion: completely intradermal location, a claw of dermis wrapping around the margin of the lesion, and a tract leading from the lesion to the skin surface. Clinical cases with physical examination findings, multimodality imaging approach (ultrasound, mammography and magnetic resonance imaging), and pathologic correlation.

BR152-ED-X

Diffusion-Weighted Imaging (DWI) and ADC Features of Triple Negative Breast Cancer (TNBC) Pre and Post Neoadjuvant Chemotherapy

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

- To review the MRI features of triple negative breast cancer. - To provide the DWI and ADC features of TNBC pre and post neoadjuvant chemotherapy. - To provide a systematic approach for the diagnosis of TNBC with MRI. - To assess the role of DWI and ADC for neoadjuvant chemotherapy (NAC) follow-up.

TABLE OF CONTENTS/OUTLINE

TNBC accounts for 10%-20% of all breast cancers and is a clinical challenge because of its aggressive nature and poor prognosis. At present, cytotoxic chemotherapy is the standard treatment option for these patients. Pathologic complete response (PCR) rates after neoadjuvant chemotherapy have been shown to be higher in triple-negative breast cancers compared with estrogen receptor-positive breast cancers. MRI consistently demonstrates the presence of all TNBC with a higher level of accuracy compared with other tumors sub-types, and provides a reliable baseline for neoadjuvant chemotherapy (NAC) follow-up. Preliminary studies also suggest that MRI may predict complete NAC response in TNBC more sensitively than other methods. We present a collection of cases of TNBC that were diagnosed by US or stereotactic-guided biopsy showing the DWI and ADC features pre and post neoadjuvant chemotherapy.

BR153-ED-X

Beware! It's Not a Malignant Lesion, it's a Charcoal Granuloma: Pictorial Review

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

To describe the imaging features of charcoal granuloma at ultrasound, mammography and its histopathologic correlation. To describe the main differences at imaging between charcoal granuloma and malignant lesions at ultrasound and mammography.

TABLE OF CONTENTS/OUTLINE

Introduction and review of current literature. Keys for a correct interpretation of charcoal granuloma, its imaging features at ultrasound and mammography, its differences with malignant lesions and its histopathologic correlation. Illustration with cases from our institution. Conclusions.

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BR154-ED-X

Clinical and Radiological Approach to Different Causes of Mastitis

All Day Room: BR Community, Learning Center Digital Education Exhibit

FDA Discussions may include off-label uses.

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TEACHING POINTS

1. This exihibit shows an algohythm which can help in reaching the cause of mastitis based on the sono-mammograohy and MRI imaging. 2. The exihibit shows how MRI can help to differentiate the causes of masitis.

TABLE OF CONTENTS/OUTLINE

Different causes of mastitis. How to approach a case with mastitis. Role of MRI in differentiationof the benign and malignant mastitis. Illustrative cases.

Printed on: 10/29/20

BR155-ED-X

Non-Contrast-Enhanced Breast MR Screening for Women with Dense Breasts

All Day Room: BR Community, Learning Center Digital Education Exhibit

FDA Discussions may include off-label uses.

Participants
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TEACHING POINTS

The sensitivity of dense breast mammograms could be about half the near 100% sensitivity of fatty breast mammograms. The current reports show that contrast-enhanced breast MRI (CE MRI) outperforms mammography and ultrasound in all women with any breast cancer risk. Nowadays, abbreviated breast MRI protocols are developed, it is shorter and less costly than CE MRI. However, it still needs an intravenous contrast agent. It is costly, painful, time-consuming, and health concerns. Recent studies reported non-contrast-enhanced breast MRI screening using diffusion-weighted imaging (DWI) and STIR/T2WI might be useful as a supplemental breast cancer screening modality. We will: 1. Review the current status and clinical pathways regarding non-contrast-enhanced breast MRI screening using DWI and STIR/T2WI 2. Discuss and propose non-contrast-enhanced breast MR screening for women with dense breasts.

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Overview of non-contrast-enhanced breast MRI using DWI and STIR/T2WI 3. Detection, diagnosis, and characterization using non-contrast-enhanced breast MRI using DWI and STIR/T2WI 4. Assessment criteria for non-contrast-enhanced breast MR screening 5. Illustrate findings of non-contrast-enhanced breast MRI using DWI and STIR/T2WI with pathological findings 6. Summary

BR156-ED-X

Multiple Wire Localization Used in Oncoplastic Breast-Conserving Surgery

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

Recently, oncoplastic surgery was developed and this kind of surgery is less deforming and allows a resection wide enough to achieve clear margins and a good aesthetic result, with better or the same oncologic control as the older techniques had. Radiologists can help using multiple wire localization to determine the margins of the tumour.

TABLE OF CONTENTS/OUTLINE

Multiple wire localization preceding oncoplastic surgery must be correctly planned and personalize. Tumour size is not an absolute contradiction, although a ratio between tumour to breast and its localizations are key factors. Our experience shows that breast conserving surgery, such as lateral mammoplasty or inverted T as example, combined with multiple wire placing has a great success rate. After planning, every modality imaging can be used to place them. There are special situations, like the need of previous clip marking when the wires must be placed in the axilla. The collocation is verified by the chosen imaging modality and marked the distance to the nipple. After surgery, a specimen mammography must be performed to document complete removal of the lesion or of the marking clips. Multiple bracketing wire localization combined with oncoplastic surgery allowed a conserving management of large breast tumours with good outcome.

BR157-ED-X

Novel Image-Guided Micro-Invasive Percutaneous Treatments of Breast Lesions: Where Do We Stand?

All Day Room: BR Community, Learning Center Digital Education Exhibit

Awards
Identified for RadioGraphics

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TEACHING POINTS

1. Image-guided minimally invasive percutaneous methods are emerging for treatment of early breast cancer and some benign tumor's and carries low cost, low complication rate and high technical success in early stage breast cancer. 2. Radiofrequency ablation (RFA), and cryoablation are superior to other methods. 3. Abnormal enhancement on the initial post-cryoablation MRI related to fat necrosis, for example, can represent a false positive imaging finding that resolves on subsequent MRI. 4. To date, only cryoablation for treatment of fibroadenoma is accepted for clinical use per American Society of Breast Surgeons guidelines with other methods considered under investigation. 5. As minimally invasive treatment becomes more widespread, it is important to become familiar with the procedures, indica tions, imaging features on mammographic (MG), digital breast tomosynthesis (DBT), ultrasound (US) and magnetic resonance imaging (MRI), and outcomes.

TABLE OF CONTENTS/OUTLINE

Classification Cryoablation RFA Microwave ablation High-intensity focused ultrasound (HIFU) Laser ablation Irreversible electroporation Technique Pre-procedure, immediately post-procedure, and follow-up imaging findings on MG, DBT, US, and MRI providing multiple examples Indications, benefits and risks, and current outcomes

BR158-ED-X

Stationary Digital Breast Tomosynthesis: An Alternative Scanning Method

All Day Room: BR Community, Learning Center Digital Education Exhibit

FDA Discussions may include off-label uses.

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TEACHING POINTS

X-ray tube motion can lengthen scan time and/or produce gantry vibration in 3D mammography. Stationary digital breast tomosynthesis (s-DBT) acquires similar data with no mechanical motion. The purpose of this exhibit is to demonstrate system configuration, describe image acquisition, and image interpretation using cases.

TABLE OF CONTENTS/OUTLINE

1. System Configuration and Image Acquisition. -The similarities & differences of sDBT vs. DBT. -Technical aspects of acquiring images. -Artifacts caused by normal breast structures. -Artifacts caused by surgical clips/wires. 2. Image Interpretation. -How to evaluate s-DBT data. -Comparison of s-DBT to prior mammogram. -Become familiar with the appearance of normal tissues with varying breast densities. 3. Sample Cases. -Appearance of normal breast anatomy. -Characteristics of a cyst versus a solid mass. -Appearance of microcalcifications. -Appearance of benign masses. -Appearance of malignant masses. -Other imaging findings associated with disease.

BR159-ED-X

More is Best: Optimising Reader Protocol

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

1. To recognise that best practice mandates that mammogram interpretation is undertaken with all prior images available. 2. To highlight why interpretation with priors improves reader confidence in recall and non-recall rates. 3. To illustrate the subtle signs of malignancy which may only be apparent on review of serial priors, thereby avoiding the pitfall of 'pseudo-stability.'

TABLE OF CONTENTS/OUTLINE

Case-based pictorial review of our experience as a National training centre and screening unit. We demonstrate our new default hanging protocol to facilitate mammographic interpretation. We illustrate cases where the subtle features of malignancy such as increasing asymmetry or progressive microcalcification can be confidently identified. By demonstrating interval stability over serial screens, we show how benign asymmetries or non malignant masses can be dismissed, cases otherwise recalled. Additional benefits include a reduction in radiation dose, unnecessary biopsies, resulting cost implications and importantly, the psychological impact on patients of false positive screening mammograms. The effect of mammographic technique can impact on the appearances of breast tissue including lesion conspicuity. The availability of multiple screens improves reader confidence.

BR160-ED-X

Dreadful Tuberculosis Affecting the Mammary Tissue

All Day Room: BR Community, Learning Center Digital Education Exhibit

FDA Discussions may include off-label uses.

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TEACHING POINTS

Breast tuberculosis can clinically and radiologically mimic carcinoma. MRI helps to differentiate based on the associated features and enhancement pattern.

TABLE OF CONTENTS/OUTLINE

It is rare to have tuberculosis involving the breast, even in the countries which are endemic for tuberculosis with a high number of pulmonary and non-pulmonary cases. Having atypical clinical features, the true diagnosis of the disease remains obscure and is often mistaken for inflammatory carcinoma. MRI aids to differentiate tuberculous mastitis and abscess from inflammatory carcinoma, although there may be a clinical overlap of the symptoms. We observed the absence of diffuse skin thickening, skin oedema, no satellite lesions, no extra-parenchymal spread of disease such as pectoralis infiltration. Most importantly the kinetics showed typically Type I pattern of progressive enhancement with a continuous increase in signal intensity on each successive contrast-enhanced image in tuberculosis, unlike inflammatory carcinoma which typically shows initial rapid enhancement with washout or plateau curves. Our cases had primary breast tuberculosis. The findings were confirmed on histopathology by image-guided biopsy which stated granulomatous disease and positive Acid-Fast bacilli on Ziehl-Neelsen staining.

BR161-ED-X

What We Missed with DBT: Lessons Learnt

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

1. Digital breast tomosynthesis (DBT) is approved as a problem-solving tool in the workup of patients in the screening and symptomatic settings with improved cancer detection rates and reduced recall rates. 2. We are one of the largest regional units using DBT and we highlight the learning curve of subtle DBT abnormalities. 3. We demonstrate potential pitfalls, particularly for subtle asymmetries and distortions, where DBT can be falsely reassuring.

TABLE OF CONTENTS/OUTLINE

As a national training centre and one of the first institutions nationally to adopt DBT, its incorporation into diagnostic workflow has been an effective problem solving and complementary modality to baseline imaging. This is an educational review of screen detected abnormalities assessed with DBT and ultrasound. We demonstrate cases of malignancy where there has been a sign change on subsequent mammography and retrospective review of prior DBT demonstrated a subtle abnormality. We analyse the causes of DBT misinterpretation and highlight strategies to mitigate this. We emphasize that operators should have a low threshold for DBT guided biopsy in indeterminate cases occult on ultrasound and encourage consensus opinion in equivocal cases.

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BR162-ED-X

Preventing Physician Burnout in Breast Imaging: Scope of the Problem and Keys to Success

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

Viewers of this exhibit should be able to identify burnout, particularly as it relates to radiology and mammography and its risk factors. By the end of this presentatiion, viewers will review tips and suggestions identified by the ACR and other literature to avoid burnout.

TABLE OF CONTENTS/OUTLINE

The purpose of this exhibit is : 1. To define burnout in the medical profession. 2. To discuss how burnout pertains to radiologists, and breast imagers in particular. 3. To highlight risk factors for physician burnout and methods to avoid and address those risks. 4. To define and discuss burnout in medical trainees such as medical students, residents and fellows and how to specifically address these groups.

BR163-ED-X

Breast Injectables: The Aunt Minnies and the Head-Scratchers

All Day Room: BR Community, Learning Center Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS

1. A variety of foreign materials may be injected into the breast and can complicate imaging interpretation. 2. When encountering an unusual imaging finding due to an injected material, correlation with clinical history can often aid in diagnostic interpretation and avoid unnecessary biopsy.

TABLE OF CONTENTS/OUTLINE

1. Discuss the imaging features of a variety of injectable materials in the breast on multimodality imaging (mammography, ultrasound and MRI) including, a. Chinese herbal ductal injection b. Baby oil injection c. Fat injection d. Alloderm injection e. Free silicone injection f. Polyacrylamide gel injection 2. Discuss management of suspected injected foreign materials including the role of follow up imaging and biopsy. 3. Discuss the diagnostic imaging challenges posed by the injected foreign material, as it can both obscure normal breast parenchyma and cause soft tissue reaction in the adjacent breast that mimic the appearance of calcifications commonly associated with breast malignancies.

BR164-ED-X

Don't Judge a Pie by Its Crust: Appearances Can Be Deceiving in Breast Imaging

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

The purposes of this exhibit are: 1- Review frequently false positive and false negative results made by non specialists outside of our institution. 2- Illustrate and discuss reasons of misinterpretations in specialists and non specialists daily cases, as also discuss final assessments and recommendations suggested by ACR BI-RADS.

TABLE OF CONTENTS/OUTLINE

1 - Review of external institutional ultrasound and mammographic cases, considered false positive and false negative in our institution. 2 - Background: Breast screening using mammogram is the most effective way to reduce breast cancer mortality. In order to help us to achieve that goal, BI-RADS application is widely used in clinical practice. Despite this, misinterpretations made by non specialists can bring us false positive and negative results, which are relevant bias cited in several articles, leading us to unnecessary biopsies or delaying breast cancer diagnosis. 3 - Illustrate several false positive and false negative exams results, whith BI-RADS application, which were reviewed in our breast cancer institution. 4 - Discuss how to avoid these misinterpretations, using final assessments and recommendations, suggested by ACR BI-RADS.

BR165-ED-X

More Than What Meets the Eye: Benign and Malignant Cutaneous Lesions of the Breast

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

1) Review the clinical, pathologic, and imaging features of benign and malignant cutaneous breast lesions on sonography, mammography, and breast MRI. 2) Review common and atypical imaging presentations and differentiating features of benign and malignant breast lesions, including potential pitfalls and mimics. 3) Distinguish between benign and malignant cutaneous breast lesions utilizing radiographic evidence.

TABLE OF CONTENTS/OUTLINE

We will present a review of benign and malignant cutaneous lesions of the breast using images from our institution to illustrate distinguishing radiographic features alongside clinical and pathologic correlations. 1) Review the clinical, pathological, and radiographic descriptions of common benign cutaneous lesions of the breast including dermal cysts, calcifications, lipomas, eczema, radiation dermatitis, psoriasis, neurofibromatosis 1, and granulomatous reactions. 2) Review the clinical, pathological, and radiographic descriptions of common malignant cutaneous lesions of the breast including mammary Paget's disease, dermal metastasis, inflammatory breast cancer, locally advanced breast cancer, and angiosarcoma. 3) Characteristic imaging findings that can help the radiologist differentiate benign and malignant cutaneous lesions. 4) Common imaging pitfalls and teaching tips will help to navigate challenging cases.

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BR166-ED-X

Can Contrast-Enhanced Spectral Mammography (CESM) Replace MRI Breast as a Tool to Assess Disease Extent in Lobular Breast Carcinomas: Our Experience in a District General Hospital

All Day Room: BR Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

The purpose of this exhibit is: To familiarize the reader to what CESM implies as an emerging modality for breast imaging. To assess the extent of concordance between CESM and MRI Breast to diagnose tumour size and local disease extent (multifocality and multicentricity) in cases with biopsy-proven lobular breast carcinoma. To highlight the benefits and deficits of each technique and establish whether CESM can replace MRI in this particular scenario.

TABLE OF CONTENTS/OUTLINE

1. CESM: introduction, principle, protocol and technique. 2. Review of cases, comparing CESM with MRI in the assessment of disease extent in lobular breast carcinomas. 3. Discussion: Pros and cons of CESM and MRI in evaluation of lobular breast carcinoma. 4. Is CESM adequate and accurate to replace MRI in this scenario? 5. Future directions and summary.

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BR167-ED-X

Integrating Digital Breast Tomosynthesis into a Hybrid Academic-Private Practice

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

1. This exhibit will review indications, techniques, helpful tactics, potential pitfalls and future applications of Digital Breast Tomosynthesis (DBT) with the goal to help radiologists achieve successful integration into their breast imaging practice. 2. This exhibit will provide tips and tricks to promote successful integration of Digital Breast Tomosynthesis into a clinical practice.

TABLE OF CONTENTS/OUTLINE

Digital breast tomosynthesis is a powerful tool in the breast imager's repertoire which has improved cancer detection rates and decreased recall rates and can be integrated effectively and successfully into any breast imaging practice. Based on our experience implementing DBT into our tertiary-care, multi-center institution and satellite community-based practices, we will: 1. Summarize current literature on DBT including its impact on cancer detection rate (sensitivity) and positive predictive value (specificity) 2. Review breast density legislation and impact on screening with DBT 3. Discuss current indications in the screening and diagnostic settings 4. Discuss tips for successful practice implementation of DBT including financial models and reimbursement; daily workflow; radiologist training and learning curve 5. Describe other applications including: DBT-guided interventions and contrast-enhanced tomosynthesis

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BR168-ED-X

Quality Assessment of the BI-RADS 3 Classification and Utility of a BI-RADS 3 Audit

All Day Room: BR Community, Learning Center Digital Education Exhibit

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Sean D. Raj, MD, Dallas, TX (*Presenter*) Nothing to Disclose

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TEACHING POINTS

1. Review the ACR BI-RADS categories and BI-RADS 3 assessment, management, and the likelihood of cancer, as well as potential pitfalls of the BI-RADS 3 classification 2. Review the clinical and imaging features of BI-RADS 3 classified breast lesions on mammography (MG), sonography (US), and breast MRI 3. Review the utility of the BI-RADS 3 classification using a meta-analysis of relevant literature 4. Illustrate how a BI-RADS 3 audit can improve the usage of a BI-RADS 3 classification and demonstrate the over-utilization of BI-RADS 3 as a classification category at a typical breast center

TABLE OF CONTENTS/OUTLINE

1. A brief overview of the ACR lexicon from the fifth edition of the BI-RADS ATLAS 2. Evidence-based characteristic multi-modality imaging appearances of BI-RADS 3 breast lesions 3. Meta-analysis of the usage of the BI-RADS 3 assessment of historically and currently defined probable benign breast lesions 4. Overview of the required data necessary for multi-modality imaging audits and provide a sample analysis using screening benchmarks 5. Demonstrate the utility in improving the usage of BI-RADS 3 classifications using a BI-RADS 3 audit from institutional data

BR169-ED-X

To Be or Not To Be: An Approach to Assessment and Management of BI-RADS Category 3 and 4 Breast Masses

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

1)BI-RADS 3&4 breast masses pose a diagnostic challenge to radiologists in that they cannot be labelled definitely as benign or malignant, with risk of malignancy ranging from >0 to<95% 2)Not all BI-RADS 3 masses are fibroadenomas. Sinister pathologies like mucinous/ medullary carcinomas may masquerade as BI-RADS 3 masses and advance to florid metastases if kept on follow up or lost to follow up. Not all BI-RADS 4 masses are malignant. Benign processes like atypical fibroadenomas/ granulomatous disease may appear as aggressive lesions 3)A novel approach with application of spectral Doppler, 'bidirectional arterial flow', elastography indices and DCE-MRI can increase the confidence of the radiologist in precise categorization of such masses, thus preventing under-diagnosis in BI-RADS 3 masses and excessive biopsies, especially in BI-RADS 4A lesions

TABLE OF CONTENTS/OUTLINE

1)ACR definition and clinical significance of BI-RADS 3&4 breast masses 2)Illustration of imaging findings of mammographically/ sonographically diagnosed BI-RADS 3&4 lesions using elastography, Doppler & MRI with pathologic correlation and management: Colloid carcinoma Medullary carcinoma Lymphoma Infiltrating ductal carcinoma Metastasis Tuberculosis Papilloma Phyllodes tumor Fibroadenoma Atypical cystic fibroadenomas 3)Radiological approach to BI-RADS 3&4 masses

BR170-ED-X

An Educational Perspective: Surveillance Following Breast Conservation Therapy

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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Sean D. Raj, MD, Dallas, TX (*Presenter*) Nothing to Disclose

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TEACHING POINTS

1) Review breast cancer prevalence and clinically indicated conservation therapy management 2) Illustrate common and uncommon findings of breast cancer recurrence following breast conservation therapy 3) Review latest surveillance guidelines as recommended by global organizations (i.e. ASCO, NCCN, ACR, ESMO, and NIHCE-UK.) 4) Evaluate evidence and radiological efficacy of surveillance guidelines for breast cancer recurrence

TABLE OF CONTENTS/OUTLINE

An educational presentation reviewing primary breast cancer, recurrence, and surveillance guidelines for detecting recurrence as explicated by various governing bodies, with pictorial correlations 1) Introduction on breast cancer prevalence and treatments included in breast conservation therapy 2) Post breast conservation therapy findings on follow-up imaging 3) Evidence of recurrence and consistent findings on follow-up imaging 4) Aim and efficacy of surveillance 5) Surveillance imaging modalities and follow-up management guidelines as defined by organizations 6) Radiological evidence based review in support and against current surveillance guidelines 7) Conclusive summary and considerations for further research

Printed on: 10/29/20

BR171-ED-X

Are We Ready to Substitute Synthesized Mammography for Full-Field Digital Mammography?

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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Katja Pinker-Domenig, MD, New York, NY (*Abstract Co-Author*) Speakers Bureau, Siemens AG ; Advisory Board, Merantix Healthcare GmbH
Joao V. Horvat, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The purpose of this exhibit is: - To describe synthesized mammography (SM) technique and its advantages and disadvantages. - To demonstrate how differences in performance of SM and full-field digital mammography (FFDM) may affect outcomes on screening. - To present case examples of SM compared with FFDM. - To review current literature on performances of SM versus FFDM alone or in combination with digital breast tomosynthesis (DBT).

TABLE OF CONTENTS/OUTLINE

- Introduction and technology development of DBT and SM. - DBT and SM technique. - Differences in radiation exposure with DBT plus SM and DBT plus FFDM. - Recall rates and reading times on DBT plus SM, DBT plus FFDM and FFDM alone. - Systematic approach to reading DBT and SM exams. - Case examples of SM and FFDM views with pathologic correlation. - Literature review focusing on performances of SM and FFDM on screening. - Future directions. - Teaching point summary and conclusion.

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BR172-ED-X

Do You Really Know Your Aunt Minnie?

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

The term "Aunt Minnie" was coined by Ed Neuhauser and popularized by Benjamin Felson in the mid 1900s and describes imaging findings that are specific enough to be pathognomonic of a disease. There are numerous "Aunt Minnies" in breast imaging. Knowledge of the most commonly encountered breast imaging "Aunt Minnies" is important for the radiologist in order to increase specificity, narrow the differential diagnosis and ultimately decrease recall rates and subsequent biopsies. The purpose of this exhibit is to define commonly seen "Aunt Minnie" entities in breast imaging by describing the characteristic radiographic findings.

TABLE OF CONTENTS/OUTLINE

Interactive case presentation of various "Aunt Minnies" in breast imaging. 1) The viewer will attempt to identify the characteristic radiologic appearance of the entity and make a diagnosis based on a set of images before the correct answer is revealed. 2) Understand the specific imaging features of commonly seen "Aunt Minnies" in breast imaging. 3) Review diagnostic pearls which aide in reaching the correct diagnosis.

BR173-ED-X

Breast Cancer Recurrence: Diagnostic Guide - What Residents Need to Know About Frequent Imaging Findings and Their Correct Interpretation

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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Maria Jose Chico, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

• To describe imaging findings of locoregional breast cancer recurrence found at follow up testing after treatment has been installed and/or completed. • To review imaging findings at follow up testing in patients with history of breast cancer.

TABLE OF CONTENTS/OUTLINE

Introduction and review of the literature. Interpretation of breast imaging findings at ultrasound, mammograms and MRI. Illustration with cases from our institution. Conclusions.

BR174-ED-X

Multimodality Shakedown of the Retromammary Fat: What is it Smuggling?

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

1. Review relevant normal anatomy including normal retromammary composition and chest wall. 2. Discuss the most common malignant pathologies, briefly highlighting breast cancers and subtypes, and additional relevant pathology. 3. Distinguish benign lesions that may mimic malignancy. 4. Highlight multimodality techniques to both identify and differentiate retromammary findings not included or not visible on mammography.

TABLE OF CONTENTS/OUTLINE

Anatomic Overview Malignant Lesions (Mammography/US/MRI/CT incidentals) • Breast Cancers o Subtypes o Ductal Carcinoma in Situ • Fibromatosis/Plasmacytoma • Metastases Benign Lesions and Potential Mimickers (Mammography/US/MRI) • Normal Fibroglandular Tissue • Lymph Node • Cyst • Sternalis and other accessory muscles • Benign Calcifications Optimizing view of retromammary fat on exams

BR175-ED-X

Prognostic Staging: The New Method for Staging Breast Cancer

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

Recently, AJCC has developed the prognostic stage groups for breast cancer, which integrate biomarkers into the anatomical TNM system. Since prognostic staging reflects prognostic factors, the stage may differ even with the same TNM classification due to the differences in subtype and grade of the breast cancer. The objective of this exhibit is 1. To understand the method of prognostic staging, including the difference from anatomical staging. 2. To understand the prognostic factors in diagnostic imaging and to consider future imaging prognostic staging.

TABLE OF CONTENTS/OUTLINE

a. Introduction AJCC and UICC TNM classification Prognostic factors b. Anatomical staging and prognostic staging The prognostic stage is often reduced in hormone positive breast cancer, while it is often raised in triple negative breast cancer. c. Relationship between prognostic factors and diagnostic imaging Morphological features and subtypes with mammography, ultrasound, and MRI. FDG-PET uptake and subtypes and prognostic factors. d. Representative cases

BR176-ED-X

Expanding the Differential Diagnosis of Malignant Breast Neoplasms: Going from the Ordinary to the Extraordinary - A Multi-Modality Imaging Approach with Histopathology Correlation

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

To provide an overview of usual and unusual malignant breast neoplasms. To illustrate the clinical and imaging key findings that will enable to expand the differential diagnosis of malignant breast neoplasms. To discuss the role of imaging modalities in the evaluation of malignant breast neoplasms.

TABLE OF CONTENTS/OUTLINE

Introduction Epidemiology Clinical features Breast cancer, clinical and imaging key features -Ductal carcinoma in situ -Invasive ductal carcinoma not otherwise specified -Well-differentiated invasive ductal carcinoma; tubular carcinoma, mucinous carcinoma, medullary carcinoma, papillary carcinoma -Inflammatory breast cancer -Invasive lobular carcinoma -Malignant neoplasms of stromal origin: phyllodes tumor, angiosarcoma, osteosarcoma, adenoid cystic carcinoma -Paget disease of the breast -Accessory breast carcinoma -Male breast cancer -Metastatic lesions: non-Hodgkin Lymphoma, metastatic melanoma, metastatic carcinoma, rhabdomyosarcoma, leukemia Imaging modalities advantages and disadvantages -Mammography -Ultrasound -Computed tomography -Magnetic resonance imaging -Tomosynthesis -Contrast enhanced mammography Discussion Conclusion

BR177-ED-X

Young at Breast: Unique Features of Breast Cancer in Young Women

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

To present imaging forms of breast cancer in young women in association with anatomopathological aspects of these tumors by illustrating this exhibit with cases from our radiology department. To familiarize general radiologists with these findings in order to improve the detection of these lesions.

TABLE OF CONTENTS/OUTLINE

Introduction: Despite being a relatively uncommon condition, current statistics indicate an increase in incidence of breast cancer in young women. Materials and methods: This educational exhibit will compile breast cancer radiological findings with illustrative images from our radiology department of women under 35 years old and will present them to general radiologists. Discussion and conclusion: The diagnosis of breast cancer in young women is often delayed resulting in an advanced stage at presentation. Most of the patients look for medical care after presenting a palpable mass and most malignant lesions present themselves as irregular shaped masses on mammogram and ultrasound. Breast cancer is more aggressive in young women and presents many histopathological features associated with an unfavorable prognosis. Ipsilateral breast tumor recurrence after breast-conserving therapy is significantly higher in this age group and boost radiotherapy and chemotherapy should be considered to complete the surgical treatment.

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I've Got this Feeling: A Radiology-Pathology Review of Benign and Malignant Palpable Masses Following Mastectomy

All Day Room: BR Community, Learning Center Digital Education Exhibit

Awards
Cum Laude
Identified for RadioGraphics

Participants
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TEACHING POINTS

1. To showcase the realm of palpable abnormalities seen at the mastectomy scar or reconstructed breast. 2. To understand various patient clinical presentations and symptomatology of benign and malignant abnormalities in the post-mastectomy breast. 3. To recognize imaging features of palpable abnormalities including various benign and recurrent disease in the post-mastectomy breast using a multimodality approach with pathologic correlation. 4. To provide a primer for radiologists in developing a diagnostic approach and understanding course of management for these abnormalities.

TABLE OF CONTENTS/OUTLINE

1. Clinical presentation of palpable abnormalities in patients with mastectomy2. Imaging features and differential diagnoses of common benign palpable abnormalities, including:a. Fat necrosis and fat graftingb. Granuloma (silicone, suture)c. Postsurgical seromad. Infection/abscesse. Amputation neuromaf. Others: Scar tissue, lymph nodes3. Imaging features of various malignant abnormalities, including:a. Recurrent disease of different molecular subtypesb. Other primary malignancyc. Review of common sites for recurrence in the reconstructed breast 4. Review pathology in correlation with radiologic findings5. Discuss diagnostic workup and course of management for various palpable masses in mastectomy patients

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BR179-ED-X

How to Get Away with Breast MRI Guided Biopsy: A Guide for a Good Rad-Path Correlation

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

• Evaluate the outcome of magnetic resonance imaging (MRI)-guided breast biopsy. • Clinical cases from our institution with correlate with pathology results. • Tips to make a good correlation between imaging and pathology results. • Show the impact on management in patient care.

TABLE OF CONTENTS/OUTLINE

• Background: The importance of breast MR imaging in screening and diagnostic settings • Correlate between anatomy and histology of normal breast • Brief description of MR-guided Biopsy: how to do it • Importance of careful radiologic-pathologic correlation for optimal management of the patients on breast imaging • Challenging cases of non cancer breast lesions: - Radial scar - Ductal hyperplasia - Pseudoangiomatosous stromal hyperplasia (PASH) - Intraductal papilloma

BR180-ED-X

Breast MRI: Identification of Malignancy in the Lactating Patient

All Day Room: BR Community, Learning Center Digital Education Exhibit

Awards
Certificate of Merit

Participants
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TEACHING POINTS

The purpose of this exhibit is to: 1. Review the controversy over the use of breast MRI during lactation: a. There is widespread belief that breast MRI is limited by lactational changes b. Multiple studies have in fact shown that malignancy can be distinguished from lactational changes on breast MRI 2. Review the breast MRI findings of normal lactational changes 3. Describe the unique imaging characteristics of breast cancer in relation to normal lactational changes on breast MRI

TABLE OF CONTENTS/OUTLINE

- Briefly review the imaging characteristics of normal lactational changes seen on breast MRI - Imaging cases demonstrating normal lactational changes on breast MRI with corresponding mammography - Review the literature for the perceived limitations of breast MRI during lactation - Review studies which have demonstrated breast MRI's utility in the lactating patient - Describe the imaging features that allow malignancy to be distinguished from normal lactational changes - Imaging cases of malignancy identified in the lactating breast. Each case will have mammographic and sonographic correlations as well as non-lactating breast MRI in the same patient when available.

BR181-ED-X

A-Z of HER 2 Breast Cancer

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

Define HER-2 positive breast cancer Review the histopathological aspects Review the molecular aspects Review the spectrum of findings (mammogram, US and MR) Worse prognostic factors Benefits of targeted terapy

TABLE OF CONTENTS/OUTLINE

HER-2 DEFINITION Molecular aspects of HER-2 positive cancer Histological aspects: Most common high grade CDI. Cinical aspects Tumor stage was more often stage II or III when compared with HER2-negative. Dissemination to viscera an central nervous system. Spectrum of findings: At mammograph, more often displayed a indistinct mass, commonly with pleomorfic calcification clusters, generally in dense breast. At US often correspond to a irregular mass, with indistinct or espiculated margin when compared to HER2 - breast cancer. It can show acustic enhancement in 50% of cases. On MR images, it were more likely to exhibit non-mass lesions, with heterogeneous enhancement that displayed washout kinetics. Multifocality and peritumoral edema is often associated. Adicional disease: HER+ breast cancer has a higher prevalence of multifocal and multicentric disease. It is common involvement of lymph nodes, skin and nipple-areolar complex. Worse prognostic factor: calcifications. Benefits of targeted terapy and types of response

BR182-ED-X

The Word Soup of Artificial Intelligence (AI): Basics of AI for the Breast Imager

All Day Room: BR Community, Learning Center Digital Education Exhibit

Awards
Certificate of Merit

Participants
Sadia Choudhery, MD, Boston, MA (*Presenter*) Former Consultant, Siemens AG; Researcher, Imago Systems, Inc ;

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TEACHING POINTS

1) Understand the word soup of AI: differences between machine learning, artificial intelligence, deep learning, and other AI terminology. 2) Learn the basics of setting up an AI algorithm with an overview of training, validation, and testing datasets. 3) Review examples of how AI has been used in breast imaging and where the future may lie for AI in breast imaging.

TABLE OF CONTENTS/OUTLINE

1) Word Soup of AI a) What is Machine Learning? b) Artificial Intelligence vs Augmented Human Intelligence c) Deep Learning, Classical Machine Learning, and Other AI terminology 2) The Basics of an AI Algorithm a) Datasets: Training, validation, and testing b) Convoluted neural networks (CNN) 3) AI In Breast Imaging a) AI in Mammography, MRI, US: Cancer or Not b) AI for Density c) Future of AI in Breast Imaging: Man vs Machine + Man

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BR183-ED-X

The More the Messier: Diagnostic and Management Challenges in Multiple Papillomatosis of the Breast

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

The purposes of this exhibit are to: 1- review cases of multiple papillomatosis of the breast with and without associated DCIS or invasive cancer in a multimodality approach. 2- present current underestimation rates and associated risk of malignancy. 3- discuss current management options.

TABLE OF CONTENTS/OUTLINE

1 - Background: epidemiology, pathology and clinical findings. 2 - Review cases of multiple papillomatosis of the breast. 3 - Imaging findings with multimodality approach (MRI, ultrasound and mammography). 4 - Discussion of underestimation rates and associated risk of malignancy. 5 - Discussion of current management options.

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BR184-ED-X

Basic Knowledge in Breast Therapies: Improving Radiologists Skills to Keep Them Essential in the AI Era

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

Review patients characteristics that influence in therapeutic decision making Learn about tools used for clinicians to decide which type of treatment best fits patients necessities Comprehend the mechanism of action of the most important drugs utilized for breast cancer Understand how radiologist can have a main role in multidisciplinary approach more than just give a report

TABLE OF CONTENTS/OUTLINE

Detail some patients aspects that influence therapeutic decisions, like molecular characteristics of the tumor, size, nodal involvement and risk factors What is the appropriate imaging workup that need to be done for a breast cancer patient before any therapeutic decision? Based on imaging workup and patient specific characteristics, what are the tools available to decide between adjuvant or neoadjuvant chemotherapy and hormone therapy? Understand the mechanism of action of the most important drugs utilized for breast cancer treatment Important information that radiologists can provide to clinicians when aware of the many aspects that are involved in the treatment of breast cancer patients.

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BR185-ED-X

Breast Imaging in Women with Neurofibromatosis 1 (NF1): What is the Role for Enhanced Screening?

All Day Room: BR Community, Learning Center Digital Education Exhibit

Awards
Certificate of Merit

Participants
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TEACHING POINTS

Recent literature demonstrates that women with NF1 are at increased risk of developing breast cancer with poor prognosis. Based on this evidence, National Comprehensive Cancer Network (NCCN) updated guidelines recommend annual screening mammography at age >=30 as well as possible supplemental screening with MRI in this population. However, there are few studies detailing breast imaging outcomes and findings specific to the NF1 population. Mammography in NF1 women may be particularly challenging because of confounding lesions such as benign dermal and plexiform neurofibromas that may be mistaken for or possibly obscure malignancy. Familiarity with current guidelines and understanding of the limitations of conventional mammography are important for the radiologist both in terms of imaging interpretation and also when making recommendations for high-risk screening examinations.

TABLE OF CONTENTS/OUTLINE

The exhibit will review breast imaging in patients with NF1. Multimodality imaging (2D/3D screening and diagnostic mammography, ultrasound and breast MRI) findings will be reviewed. Pictorial review will include malignancies and methods of detection. Cases will also focus on confounders specific to the NF1 population with pearls and pitfalls for differentiating malignant from benign lesions such as neurofibromas.

Printed on: 10/29/20

BR186-ED-X

Evaluation of Breast Implants by Traditional Methods, Mammography, and Ultrasonography: When Suspicious of Rupture

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
Daniela F. Vieira Vendramini, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Larissa Moyses, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Marco A. Costenaro, 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
Patricia A. De Camargo Teixeira, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Vera Christina C. Ferreira, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Daniela G. Giannotti, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

TEACHING POINTS

The assessment of the integrity of breast implants are frequent indications of breast imaging studies, both mammography and ultrasonography (US) can be used as initial examination in suspected ruptures.Throughout this study, we will review and describe the strengths and limitations of mammography and ultrasonography for evaluation of implant rupture.Recognize the signs that suggest intracapsular rupture of silicone implants in ultrasound and mammography:To identify the findings of free silicone and extracapsular ruptureThe main pitfalls that mimic the findings of intracapsular rupture in these two methods.

TABLE OF CONTENTS/OUTLINE

Schematic drawings and illustrations of how to evaluate implants in ultrasound and mammographyDemonstrate by means of case-based images the classic signs in traditional methods.Illustrate and describe the main pitfalls of these methods

105TH Scientific Assembly and Annual Meeting
December 1–6 | McCormick Place, Chicago
RSNA 2019 SEE POSSIBILITIES TOGETHER

BR187-ED-X

Not Blind Enough: What Radiologists Need to Know to Avoid Over-Reporting Implant Failures Magnetic Resonance Imaging

All Day Room: BR Community, Learning Center Digital Education Exhibit

Participants
Chitrangada Singh, MD, Mumbai, India (*Presenter*) Nothing to Disclose
Urszula Wegner, MD, Norwich, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

chitrangada.singh@gmail.com

TEACHING POINTS

A dozen of educational articles are available describing breast implant failures and complications. However we realised the need to emphasises on the -a) Limits of normalcy when imaging breast implants in the clinics. b)Substantial and balanced guidelines to prevent over-diagnosis as well as missing grave complications like Implant associated B-Cell lymphomas

TABLE OF CONTENTS/OUTLINE

-Introduction to Breast Implants MRI- (including a small table for MRI Breast Reporting tips) -A brief description of the various types of implant failures and normal conditions that can mimic them.-Assessment protocol and flowchart to avoid over-diagnosis of the same -Summary

Printed on: 10/29/20

BR188-ED-X

What the...? in the Breast: A Radiologic-Pathologic Review of Uncommon Breast Pathologies and Their Clinical Implications

All Day Room: BR Community, Learning Center Digital Education Exhibit

FDA Discussions may include off-label uses.

Participants
Melisa Rivera, MD, San Juan, PR (*Abstract Co-Author*) Nothing to Disclose
Kitty Daniel, MS,DO, Miami Beach, FL (*Presenter*) Nothing to Disclose
David T. Wymer, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose
Katrina L. Rabinovich, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose
Stuart Kaplan, MD, Miami Beach, FL (*Abstract Co-Author*) Consultant, Hologic, Inc Consultant, Delphinus Medical Technologies, Inc

TEACHING POINTS

-Review uncommon and rare pathological processes in the breast, including their pathophysiology -Review the imaging appearance on multiple modalities of these processes in the breast, with accompanying findings on histopathology -Review the workup and additional mammographic and radiologic procedures necessary for the clinical management of these patients

TABLE OF CONTENTS/OUTLINE

-Discuss the imaging findings of multiple types of uncommon and rare breast pathologies, including their BIRADS assessment and appropriate initial workup -Discuss the histopathology of these entities and how that contributes to radiologic-pathologic correlation -Discuss the natural history of these processes, including appropriate clinical management and work-up from a radiologic perspective -Discuss appropriate differential diagnoses for these pathologies and how that influences initial work-up

ED001-SU

Breast Sunday Case of the Day

Sunday, Dec. 1 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
Jody C. Hayes, MD, Southlake, TX (*Abstract Co-Author*) Nothing to Disclose
Stephen J. Seiler, MD, Dallas, TX (*Abstract Co-Author*) Consultant, Delphinus Medical Technologies, Inc; Consultant, Seno Medical Instruments, Inc
Natalie G. Stratemeier, MD, Oklahoma City, OK (*Abstract Co-Author*) Nothing to Disclose
Meghan Woughter, MD, Temple, TX (*Abstract Co-Author*) Spouse, Vice President, nThrive, Inc
Oyindamola Akinseye, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Susan O. Holley, MD,PhD, Raleigh, NC (*Abstract Co-Author*) Nothing to Disclose
Ronald J. Dolin, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Dayna Levin, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Shannon Lanzo, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Sean A. Maratto, MD, Philadelphia, PA (*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.

VW01

AI-based Mammography Reading: Self-guided Reading Session: Presented by Siemens Healthineers

Sunday, Dec. 1 10:15AM - 5:00PM Room: North Building, Booth 8563

Program Information

You will learn about the benefits of the AI-based Transpara™* decision-support tool from ScreenPoint Medical. It has been integrated with the advanced visualization software syngo. Breast Care* to support 2D and 3D mammography reading. Together, they provide interactive decision support with an overall exam score to help prioritize reading. * *syngo*.Breast Care VB40 and Transpara™ for 3D are currently under development; they are not for sale in the U.S. Their future availability cannot be guaranteed. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP

https://www.fairorg.de/Siemens-Healthineers/portal/workshop.cfm/rsna19/

Printed on: 10/29/20

VW05

50° Wide-angle Tomosynthesis and Contrast-enhanced Mammography Self-guided Reading Sessions: Presented by Siemens Healthineers

Sunday, Dec. 1 10:15AM - 5:00PM Room: North Building, Booth 8563

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 challenging cases with a solution enables you to develop and test your reading skills. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP

https://www.fairorg.de/Siemens-Healthineers/portal/workshop.cfm/rsna19/

Printed on: 10/29/20

SPAI11

RSNA AI Deep Learning Lab: Beginner Class: Classification Task (Intro)

Sunday, Dec. 1 10:30AM - 12:00PM Room: AI Showcase, North Building, Level 2, Booth 10342

AI BR CH CT GI HN IN MR NR

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

Participants

Bradley J. Erickson, MD, PhD, Rochester, MN (*Presenter*) Board of Directors, VoiceIt Technologies, LLC; Stockholder, VoiceIt Technologies, LLC; Board of Directors, FlowSigma, LLC; Officer, FlowSigma, LLC ; Stockholder, FlowSigma, LLC

Special Information

In order to get the best experience for this session, it is highly recommended that attendees bring a laptop with a keyboard and decent-sized screen. Having a Gmail account will be helpful. Here are instructions for creating and deleting a Gmail account.

ABSTRACT

This class will focus on basic concepts of convolutional neural networks (CNNs) and walk the attendee through a working example. A popular training example is the MNIST data set which consists of hand-written digits. This course will use a data set we created, that we call 'MedNIST', and consists of images of 6 different classes: Chest X-ray, Chest CT, Abdomen CT, Head CT, Head MR and Breast MRI. The task is to identify the image class. This will be used to train attendees on the basic principles and some pitfalls in training a CNN. • Intro to CNNs • Data preparation: DICOM to jpeg, intensity normalization, train vs test • How do we choose the labels? Inconsistencies... Use Fast.AI routines to classify; Validation of results: Are the performance metrics reliable?; 'Extra Credit': if there is time, explore data augmentation options, effect of batch size, training set size.

VW34

AI Deep Learning Radiology Assist in Reviewing ABUS Cases: Presented by GE Healthcare

Sunday, Dec. 1 10:30AM - 11:00AM Room: South Building, Booth 5135

Participants

Kiyoshi Namba, MD, Obihiro, Japan (*Presenter*) Medical Advisor, QView Medical, Inc Medical Advisor, Volpara Health Technologies Limited Educator, General Electric Company

Program Information

This session will provide an introduction to CAD, AI deep-learning software system to assist radiologists in ABUS case review. Topics covered will include: AI efforts in radiologist assist through CAD technology, a review of published literature on CAD performance, how reading times can be improved, QVCAD diagnostic performance, and a demonstration of CAD operating on ABUS cases. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

SPCT10

Best Clinical Trials @ RSNA 2019

Sunday, Dec. 1 10:45AM - 12:15PM Room: E352

BR GI HP MR NM

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

Participants
Udo Hoffmann, MD, Boston, MA (*Moderator*) Research Grant, Kowa Company, Ltd ; Research Grant, Abbott Laboratories; Research Grant, HeartFlow, Inc; Research Grant, AstraZeneca PLC;
David A. Mankoff, MD, PhD, Philadelphia, PA (*Moderator*) 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
Ruth C. Carlos, MD, MS, Ann Arbor, MI (*Moderator*) Editor, Journal of the American College of Radiology; Support, Harvey L. Neiman Health Policy Institute; In-kind support, Reed Elsevier;

Sub-Events

SPCT10A MRI in Addition to Mammography Screening in Women with Extremely Dense Breasts: Primary Outcome of the Randomized DENSE Trial

Participants
Marije F. Bakker, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Grant, Bayer AG; Software support, Volpara Health Technologies Limited
Stephanie V. de Lange, Utrecht, Netherlands (*Presenter*) Research Grant, Bayer AG; Software support, Volpara Health Technologies Limited
Rudolf M. Pijnappel, MD,PhD, Haren, Netherlands (*Abstract Co-Author*) Research Grant, Bayer AG
Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) 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
Claudette E. Loo, MD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Bob Bisschops, Dordrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Marc Lobbes, MD, Maastricht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Mathijn D. De Jong, MD, 's-Hertogenbosch, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Katya M Duvivier, MD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jeroen Veltman, MD, Hengelo, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Wouter B. Veldhuis, MD, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Carla H. van Gils, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Software support, Volpara Health Technologies Limited

ABSTRACT

PURPOSE To evaluate the effect of supplemental MRI for women with extremely dense breasts within a population-based screening program. METHOD AND MATERIALS Between 2011-2015, we randomized 40,373 screening participants (aged 50-75) with a negative screening mammography and extremely dense breasts (ACR category 4 by Volpara software) to (an invitation for) supplemental 3.0-T MRI at 8 sites (intervention arm; n=8,061) or mammography screening only (control arm; n=32,312). The difference in interval cancers after the first (prevalent) screening round, during the two-year screening interval, was investigated by intention-to-treat (ITT) analysis, and by complier-average causal effect (CACE) analysis to account for noncompliance. The performance of the incident screening rounds was investigated as well. RESULTS In the intervention arm, 4,783 (59%) underwent MRI examination. Cancer detection rate was 16.5/1000 screens [95%CI:13.3-20.5]. For this, 9.5% of women were recalled (6.3% with biopsy). Positive predictive values are 17.4% [95%CI:14.2%-21.2%] (recall) and 26.3% [95%CI:21.7%-31.6%] (biopsy). In the intervention arm, cancers were more frequently stage 0-I than in the control arm (82.8% vs 41.6%, p<0.001). With ITT analysis, the interval cancer rate was 4.98/1000 women in the control arm and 2.48/1000 women in the intervention arm, leading to a reduction of 2.50/1000 women [95%CI:0.98-3.71]; p<0.001. With CACE analysis, this reduction was 4.22/1000 women [95%CI:2.01-6.43]. Preliminary results of the incident screening rounds showed that 3,548 women had again undergone (at least one) mammographic screening with a negative result. Supplemental cancer detection rate was 5.3/1000 screens [95%CI:3.4-7.7]. For this, 2.8% [95%CI:2.4%-3.4%] of women were recalled for further diagnostic work-up. At the meeting, results on cost-effectiveness will be presented as well. CONCLUSION Supplemental MRI screening in women with extremely dense breasts results in statistically significantly fewer interval cancers. In subsequent rounds, both the cancer detection rate and the false-positive rate decrease. CLINICAL RELEVANCE/APPLICATION There is a heated debate on the value of supplemental screening in women with dense breasts. The DENSE trial is the first randomized trial on supplemental MRI screening that has been performed in women with dense breasts.

SPCT10B Disscussant for MRI In Addition to Mammography Screening

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

SPCT10C 18F-FDG PET-MR Enterography in Predicting Histological Active Disease in Ulcerative Colitis: A Randomized Controlled Trial Using Nancy Index

Participants
Yan Li, Essen, Germany (*Presenter*) Nothing to Disclose
Benedikt M. Schaarschmidt, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose

Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG
Michael Forsting, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Aydin Demircioglu, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Anna K. Koch, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Ole Martin, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Ken Herrmann, Essen, Germany (*Abstract Co-Author*) Co-founder, SurgicEye GmbH Stockholder, SurgicEye GmbH Consultant, Sofie Biosciences Consultant, Ipsen SA Consultant, Siemens AG Research Grant, Advanced Accelerator Applications SA Research Grant, Ipsen SA
Hendrik Juette, Bochum, Germany (*Abstract Co-Author*) Nothing to Disclose
Andrea Tannapfel, Bochum, Germany (*Abstract Co-Author*) Nothing to Disclose
Jost Langhorst, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

PURPOSE To evaluate the diagnostic performance of PET-MR enterography in detecting histological active inflammation in patients with ulcerative colitis and the impact of bowel purgation on diagnostic accuracies of PET-MR parameters. METHOD AND MATERIALS Fifty patients were enrolled in this randomized controlled trial (clinicaltrials.gov [NCT03781284]). 40 patients were randomized in two study arms, in which bowel purgation was performed either before or after PET-MR enterography. All patients underwent ileocolonoscopy with mucosal biopsies after PET-MR within 24h. Diagnostic performance of MR morphological parameters (MRmorph), diffusion-weighted imaging (DWI) and PET in detecting histological inflammation determined by Nancy index was compared with each other and between study arms. Correlation between PET and histological inflammatory severity was calculated. RESULTS In study arm without previous bowel purgation, SUVmax ratio of bowel segment (relative to SUVmax of the liver) facilitated the highest specificity and diagnostic accuracy compared to MRmorph and DWI. Bowel cleansing led to markedly increased metabolic activity of bowel segments, resulting in significantly reduced specificity of PET compared to study arm without purgation (0.808 vs. 0.966, p = 0.007, respectively). Inter-observer concordance for assessing MRmorph was clearly increased after bowel cleansing (Cohen's κ: 0.847 vs. 0.665, p = 0.013, respectively), though diagnostic performance of MRmorph was not significantly improved. Our findings suggested that the change of metabolic status was mainly associated with the grade of neutrophil infiltrate and less dependent on chronic infiltrate. CONCLUSION PET-MR enterography was an excellent non-invasive diagnostic method in the assessment of ulcerative colitis without the need of previous bowel purgation. CLINICAL RELEVANCE/APPLICATION SUVmaxRatio was a reliable parameter facilitating best diagnostic operating characteristics in predicting histological active disease in patients with ulcerative colitis and no previous bowel purgation was needed for PET-MR.

SPCT10D Discussant for 18F-FDG PET-MR Enterography

Participants
Joel G. Fletcher, MD, Rochester, MN (*Presenter*) Grant, Siemens AG; Consultant, Medtronic plc; Consultant, Takeda Pharmaceutical Company Limited; Grant, Takeda Pharmaceutical Company Limited; ;

SPCT10E Clinical and Cost-Effectiveness Implications of Utilizing Immediate Acute Magnetic Resonance Imaging (MRI) in the Management of Patients with Suspected Scaphoid Fracture and Negative Initial Radiographs: Results from a Randomized Clinical Trial

Participants
Tiago Rua, BSC,MSc, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sanjay Vijayanathan, MBBS, Harrow, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Davina Mak, MBBS, BSC, Middlesex, United Kingdom (*Presenter*) Nothing to Disclose
Alireza Zavareh, MD, FRCR, Bristol, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Amanda Isaac, MBChB, FRCR, Rickmansworth, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Bharti Malhotra, MBA, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Laura Hunter, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Janet Peacock, PhD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
James Shearer, PhD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Vicky J. Goh, MBBCh, Chalfont St Giles, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Paul McCrone, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sam Gidwani, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

PURPOSE Given the limited accuracy of radiographs on presentation to the Emergency Department (ED), the management of suspected scaphoid fractures remains clinically challenging and an economic burden to healthcare systems. This trial evaluated the clinical and cost-effectiveness implications of using immediate Magnetic Resonance Imaging (MRI) as an add-on test during the ED attendance for patients with negative findings on the initial radiographs. METHOD AND MATERIALS A pragmatic, randomized, single-center trial compared the use of immediate MRI for patients presenting to the ED with suspected scaphoid fractures against standard care with radiographs only. Participants' use of health services was estimated from primary care and secondary care databases and questionnaires at baseline, 3 and 6 months post-recruitment. Costs were compared using generalized linear models and combined with quality-adjusted life years (QALYs) to estimate cost-effectiveness. RESULTS A total of 136 participants were recruited based on 1:1 ratio, block randomization methods (mean age 37 years; 57% male; 79% full-time employed). 6.2% (4/65, control group) and 10% (7/67, intervention group) of participants sustained scaphoid fractures (p=0.37). 7.7% (5/65, control group) and 22% (15/67, intervention group) of participants had other fractures diagnosed (p=0.019). The use of MRI increased the diagnostic accuracy both in the diagnosis of scaphoid fracture (100.0% vs 93.8%) and any other fracture (98.5% vs 84.6%). Mean (SD) cost per participant up to 3 months post-recruitment was £542.4 (£855.2) for the control group and £368.4 (£338.6) for the intervention, leading to a cost difference of £174 (95% CI -£30 to £378, p=0.094). The cost difference per participant at 6 months increased to £266 (95% CI £3.3 to £528, p=0.047). The MRI intervention dominated standard care costing less and achieving more QALY gains, presenting a probability of 96% and 100% of being cost-effective at month 3 and 6 considering traditional willingness-to-pay thresholds. CONCLUSION The use of immediate MRI in the management of participants with suspected scaphoid fracture and negative radiographs led to significant cost-savings whilst improving and expediting the pathway's diagnostic accuracy. CLINICAL RELEVANCE/APPLICATION The immediate use of MRI in the management of suspected scaphoid fractures should be included as part of standard of care as an add-on test for patients with negative radiographs.

SPCT10F Discussant for Clinical and Cost-Effectiveness Implications

Participants
Garry E. Gold, MD, Stanford, CA (*Presenter*) Research support, General Electric Company

SPCT10G Imaging-guided Target Volume Reduction in Radiotherapy of Lung Cancer: The Prospective Randomized Multinational PET-Plan Trial

Participants
Tanja Schimek-Jasch, MD, Freiburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Ursula Nestle, MD,PhD, Monchengladbach, Germany (*Presenter*) Nothing to Disclose
Stephanie Kremp, DIPLPHYS, Homburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Andrea Schaefer, PhD, Homburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Andreas Kusters, MD, Krefeld, Germany (*Abstract Co-Author*) Nothing to Disclose
Marco Tosch, MD, Wuppertal, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas Hehr, MD,PhD, Stuttgart, Germany (*Abstract Co-Author*) Nothing to Disclose
Martina Eschmann, Stuttgart, Germany (*Abstract Co-Author*) Nothing to Disclose
Yves-Pierre Bultel, Trier, Germany (*Abstract Co-Author*) Nothing to Disclose
Peter Hass, Magdeburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Jochen Fleckenstein, Homburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Alexander Thieme, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Marcus Stockinger, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Matthias Miederer, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Gabriele Holl, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Rischke, MD, Kirchzarten, Germany (*Abstract Co-Author*) Nothing to Disclose
Sonja Adebahr, MD, Freiburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Eleni Gkika, Freiburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Jochem Koenig, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Anca-Ligia Grosu, Freiburg, Germany (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

PURPOSE Advanced medical imaging offers a chance for target volume reduction in modern radiotherapy, which may lead to more effective local treatments with reduced toxicity and offer the protection of draining lymph nodes and large vessels, possibly of importance for the upcoming combination of radiotherapy and immunotherapy. Locally advanced non-small cell lung cancer (NSCLC) with improvable local control and high toxicity is an excellent model to investigate this topic. METHOD AND MATERIALS In the prospective randomised controlled PET-Plan trial (NCT00697333), patients with inoperable stage II/III NSCLC and an indication for radiochemotherapy were randomized at a 1:1 ratio. In conventional arm A target volumes were informed by FDG-PET and CT plus elective nodal irradiation and in experimental arm B they were solely informed by FDG-PET. In both arms, quality assured isotoxically dose-escalated IMRT or 3D-CRT (60 - 74Gy, 2Gy per fraction) was planned and applied to the respective target volumes along with simultaneous platinum-based chemotherapy. The primary objective was time to locoregional progression (LRP) in terms of non-inferiority of experimental arm B. RESULTS 311 patients were recruited, 205 patients included in the intent to treat (ITT) (A: n=99, B: n=106) and 172 patients in the per protocol (PP) analysis (A: n=84, B: n=88). Median FU time in the PP set was 16 months. Non-inferiority of experimental arm B was confirmed for the pre-specified non-inferiority margin. The risk of LRP was lower in the experimental arm B (2y-LRP 0.20 vs. 0.39; HR=0·57; 95% CI: 0·30-1·06; p=0·039) with no difference between study arms concerning survival (2y-OS 0.57 vs. 0.54), out-field recurrence and toxicity. CONCLUSION In radiochemotherapy for locally advanced NSCLC, PET-Imaging based reduction of radiotherapy target volumes is feasible and may improve local control without increasing toxicity. CLINICAL RELEVANCE/APPLICATION The procedures established in this clinical trial provide a radiotherapy standard for future NSCLC trials including immunotherapy and may furthermore inspire trials on imaging based target volume reduction for other tumor types.

SPCT10H Discussant for Imaging-guided Target Volume Reduction

Participants
Daniel Pryma, MD, Philadelphia, PA (*Presenter*) Research Grant, Siemens AG; Research Grant, 511 Pharma; Research Grant, Progenics Pharmaceuticals, Inc; Research Consultant, Progenics Pharmaceuticals, Inc; Research Consultant, 511 Pharma; Research Consultant, Actinium Pharmaceuticals, Inc; Research Consultant, Nordic Nanovector ASA

SSA01

Breast Imaging (Artificial Intelligence in Screening)

Sunday, Dec. 1 10:45AM - 12:15PM Room: S406A

AI BR

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

Participants
Shandong Wu, PhD, MSc, Philadelphia, PA (*Moderator*) Nothing to Disclose
John M. Lewin, MD, Denver, CO (*Moderator*) Nothing to Disclose

Sub-Events

SSA01-01 Using Deep Learning to Improve Efficiency of Breast Cancer Tomosynthesis Screening

Sunday, Dec. 1 10:45AM - 10:55AM Room: S406A

Participants
Flora Gilboa, Haifa, Israel (*Presenter*) Employee, IBM Corporation
Susan C. Harvey, MD, Lutherville, MD (*Abstract Co-Author*) Consultant, Hologic, Inc; Consultant, IBM Corporation
Lisa A. Mullen, MD, Cockeysville, MD (*Abstract Co-Author*) Nothing to Disclose
Ran Bakalo, MSc, Haifa, Israel (*Abstract Co-Author*) Nothing to Disclose
Ella Barkan, Haifa, Israel (*Abstract Co-Author*) Nothing to Disclose
Yoel Shoshan, Haifa, Israel (*Abstract Co-Author*) Employee, IBM Corporation

For information about this presentation, contact:

flora@il.ibm.com

PURPOSE

Digital breast tomosynthesis (DBT) has higher diagnostic accuracy than 2D digital mammography (MG) and is becoming widely available. However, DBT interpretation time, with 200-400 slices per exam, is significantly longer than MG's. Over 90% of screening exams are normal, so automation is desirable. This study explores using deep learning to filter out a portion of the normal DBT studies, allowing radiologists to focus on the more complex cases and improve their efficiency.

METHOD AND MATERIALS

This study was IRB approved and HIPPA compliant. It comprises 5,000 women who presented for screening DBT between 2013 and 2017. The de-identified data set includes prior exams, reaching 12,500 tomosynthesis screening exams accompanied by clinical information. For ground truth, we gathered 2899 screening exams with biopsy performed within 180 days of the screening exam (1064 malignant, 1835 benign) and normal exams that had 2 years follow up. In addition to breast-level labels indicating benign or malignant findings, we labeled the slice number in which the lesion is seen best, the range of slices that the lesion is seen in and graphical annotation overlaid on the 'best' slice. We developed a binary classifier of normal vs. undecided. We used a deep learning network, RetinaNet, utilizing a Feature Pyramid Network backbone, a proven architecture for detecting objects on different scales. We trained this network using the findings annotations, while customizing several aspects of the architecture to handle DBT inputs.

RESULTS

The target was to filter out a portion of the normal exams (i.e. exams without malignant or benign biopsy) keeping a false negative rate that is equivalent to radiologists. Our network succeeds to filter 37% of the normal exams (i.e. 37% specificity) with 97% sensitivity. The area under the ROC curve was 0.84 for this task.

CONCLUSION

By using one of the largest reported tomosynthesis dataset with biopsy-proven results, our study demonstrates the potential of A.I to reduce interpretation workload.

CLINICAL RELEVANCE/APPLICATION

One important practical issue related to DBT implementation is the longer interpretation time. Reducing the workload of reading normal exams can improve radiologist's efficiency.

SSA01-02 A Fully Representative Breast Cancer Screening Population for Validation of AI Algorithms

Sunday, Dec. 1 10:55AM - 11:05AM Room: S406A

Participants
Karin Dembrower, MD, Stockholm, Sweden (*Presenter*) Nothing to Disclose
Erik Wahlin, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose
Edward M. Azavedo, MD, PhD, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

AI algorithms are being developed for mammographic breast cancer detection and risk estimation. Algorithms should be validated in independent well-curated datasets. There has been a lack of fully representative datasets until now. Our aim was to provide an accessible infrastructure with a dataset representative of a true geographical screening population.

METHOD AND MATERIALS

From a geographically defined screening cohort of women 40 to 74 years old between 2008 and 2016, we included all first incident cancer cases and a random selection of 10,000 healthy controls. Information was linked between the screening register, the cancer register and the PACS. All screening examinations, with two views of each breast, were included. After data curation all information was anonymized and transferred to local storage. Tumors were annotated at pixel-level. Access to the final dataset has currently been offered to one external research group working on AI CAD for tumor detection. Their algorithm provided one prediction score for each examination.

RESULTS

Our case-control dataset included 1,303 cancer cases (10,732 mammograms) and 10,000 healthy controls (116,048 mammograms). The histological origin of cancer was 70% ductal, 10% lobular and 20% mixed or other. There were 36% invasive-only, 11% in situ-only and 53% mixed cancers. Pixel-level annotations were produced for 898 women (1,891 images). The first validated external algorithm was processed in less than 3 days. It showed an AUC of 0.958 (95%CI: 0.954 to 0.962) using the ground truth of pathologically confirmed diagnosis within 12 months of examination. The level of performance was similar for both invasive and in situ cases.

CONCLUSION

Our comprehensive case-control dataset representative of a true breast cancer screening population was used to validate the first external AI CAD algorithm showing very good accuracy. The dataset will remain available for validation of algorithms from further external research groups.

CLINICAL RELEVANCE/APPLICATION

Having access to a comprehensive dataset representative of a true screening population will improve the ability to train and test AI tools that are clinically reliable.

SSA01-03 Increase of Cancer Detection Rate and Reduction of False-Positive Recall in Screening Mammography Using Artificial Intelligence: A Multi-Center Reader Study

Sunday, Dec. 1 11:05AM - 11:15AM Room: S406A

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PURPOSE

To assess feasibility of artificial intelligence (AI) based diagnostic-support software whether it can be used to improve radiologists' diagnostic performance in terms of cancer detection and false-positive recall in breast cancer screening.

METHOD AND MATERIALS

A total of 400 exams of screening mammograms were retrospectively collected from two institutions. For each institution, 100 cancer, 40 benign, and 60 normal exams were collected. All cancer exams were proven by biopsy. Half of the benign exams were proven by biopsy (i.e. recalled benign) while the remainder were proven by at least 2 years of follow-up imaging. 80% of the exams were randomly selected respectively from each category and each institution (e.g., 16 recalled benign for each institution). All exams were 4-view paired. A blinded multi-reader multi-case study was performed with a group of 14 radiologists for the selected 320 exams. Each radiologist reads each case without and then with aid of Lunit INSIGHT for Mammography (Lunit Inc., South Korea), a deep learning-based software which shows per-breast malignancy scores as well as region-of-interests (ROIs) for suspicious malignant lesions (Fig.1). The difference of readers' decision without and with AI in terms of likelihood-of-malignancy (LOM; DMIST 7-pt score) and recall-ness (recall or not) was analyzed.

RESULTS

Significant improvement of diagnostic performance was shown for all 14 radiologists; average LOM-based ROC AUC was 0.810 and 0.881 without and with AI, respectively (p-value=0.0000047, C.I.=95%). Based on readers' binary decision whether each exam should be recalled or not, average cancer detection rate was increased from 75.3% to 84.8% while false-positive recalls (i.e. non-cancer recalls) were decreased from 28.0% to 25.4% where 20% of non-cancer exams were recalled benign cases.

CONCLUSION

This reader study showed a statistically significant improvement of diagnostic performance (0.071 increase in ROC AUC). Cancer detection rate was increased by 12.6% and false-positive recall rate was decreased by 9.6% with assistance of AI-based diagnostic-support software.

CLINICAL RELEVANCE/APPLICATION

With increase of cancer detection rate and decrease of false-positive recall rate, AI-based diagnostic-support software can be practically used in routine breast cancer screening.

SSA01-04 Can Artificial Intelligence Be Used as a Standalone Technique for Very Low Probability for Malignancy Mammograms?

Sunday, Dec. 1 11:15AM - 11:25AM Room: S406A

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PURPOSE

The purpose of this study was to determine if an Artificial Intelligence (AI) trained algorithm can be potentially used for standalone interpretation of very low probability for malignancy mammograms. It has been shown that the accuracy of AI based algorithms for 2D mammography can match or exceed the accuracy of the average radiologist. This study was performed to evaluate the accuracy of an AI based software (cmTriage, CureMetrix, Inc.) on a large data set of screening mammograms when set to a 99% sensitivity threshold (95% CI = [0.98, 1.0].

METHOD AND MATERIALS

A case based AI base algorithm was used to analyze 1255 screening mammograms obtained from 3 different imaging facilities. The exams were comprised of a blend of cases that had biopsy-confirmed malignant lesions as well as at least two year followup on the non-biopsied cases as validation of benignity. The thresshold of the software was set to 99% sensitivity. The number of cases that were assigned to very low probability of malignancy was calculated and then compared to the final classification of those cases

RESULTS

Out of the pool of screening cases, 40% of the cases were categorized as not suspicious by the algorithm. Comparison with the biopsy and/or long term followup showed that there were no cancers detected in the cases that were categorized as not suspicious by the triage software. In addition, 99% of the biopsy proven cancers were sorted into the suspicious category by the algorithm.

CONCLUSION

The AI based triage software was shown to be accurate in pre-analyzing mammograms and correctly sorted 99% of the malignant cases into the suspicious category and 40% of the non-malignant cases into the non-suspicious category. This suggests that the high sensitivity threshold setting of the AI-based algorithm could potentially be used to eliminate some very low probability of malignancy mammograms from the radiologist worklist

CLINICAL RELEVANCE/APPLICATION

Pre-analysis of mammograms using AI based triage software can potentially enhance radiologist workflow, productivity, and accuracy. Using high sensitivity thresshold, it is possible that AI based software could potentially be used as a standalone to eliminate very low probability for malignancy cases from the radiologist worklist.

SSA01-05 Data-Driven Imaging Biomarker for Breast Cancer Screening in Digital Breast Tomosynthesis: Multi-Domain Learning with Mammography

Sunday, Dec. 1 11:25AM - 11:35AM Room: S406A

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PURPOSE

To assess feasibility whether mammography data is helpful for developing data-driven imaging biomarker in digital breast tomosynthesis (DIB-DBT; an imaging biomarker for detection of breast cancer, which is derived from DBT data based on deep learning technology).

METHOD AND MATERIALS

A total of 1,517 exams of 4-view digital breast tomosynthesis (DBT) and 49,577 exams of 4-view digital mammograms (MMG) were retrospectively collected from an institution. We divided 1,517 exams of DBT into 1,187 (970 cancer, 52 benign, 165 normal) and 330 (244 cancer, 34 benign, 52 normal) exams for training and validation, and 49,577 exams of MMG into 47,719 (5,599 cancer, 17,971 benign, 24,149 normal) and 1,858 (619 cancer, 620 benign, 619 normal) exams for training and validation, respectively. For external validation, we also collected 448 exams (148 cancer, 150 benign, and 150 normal) of 4-view DBT from another institution. Previously, we demonstrated that using DBT and MMG concurrently is effective for developing DIB-DBT, where it was first trained with (large-scale) MMG then fine-tuned with (small-scale) DBT. We further aimed to enhance the utilization of MMG by multi-domain learning to boost the performance of DIB-DBT. Two-stage training was adopted - 1) pre-training with MMG, followed by 2) multi-domain fine-tuning with both of DBT and MMG. A total of four different approaches was compared in order to find the best way to exploit MMG for developing DIB-DBT - (a) training only with DBT, (b-d) training with MMG and then fine-tuning with (b) DBT (previous work), (c) DBT and MMG, (d) DBT and MMG by multi-domain learning.

RESULTS

Per-exam AUC of DIB-DBT on the internal validation dataset was 0.890, 0.899, 0.901, 0.910 for each method of (a-d) respectively, while per-exam AUC on the external validation dataset was 0.871, 0.880, 0.899, 0.901 for (a-d) respectively. Fig. 1 shows an

example of DIB-DBT (i.e. (d)).

CONCLUSION

This study demonstrated that multi-domain learning with large-scale MMG is an effective way for developing DIB-DBT especially with small-scale DBT. Further clinical validation is needed to utilize DIB-DBT as a reliable diagnostic-support tool for breast cancer detection.

CLINICAL RELEVANCE/APPLICATION

With further clinical validation, DIB-DBT could be practically used as an effective diagnostic-support tool for breast cancer screening in digital breast tomosynthesis

SSA01-06 Data-Driven Imaging Biomarker for Breast Cancer Screening in Mammography: Early Detection of Breast Cancer

Sunday, Dec. 1 11:35AM - 11:45AM Room: S406A

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PURPOSE

To assess feasibility of data-driven imaging biomarker in mammography (DIB-MMG; an imaging biomarker derived from large-scale mammography data based on deep learning technology) whether it can be used for early detection of breast cancer.

METHOD AND MATERIALS

A total of 105,592 exams of 4-view digital mammograms were retrospectively collected from multiple institutions for developing DIB-MMG, where 22,456 were cancer (confirmed by biopsy), 36,821 were benign (confirmed by biopsy or at least 1 year of follow-up imaging), and 46,315 were normal exams. Based on external validation in a separate institution with 3,696 exams of mammograms (1,073 were cancer; one for each patient), DIB-MMG showed 0.963, 94.1%, 80.2% of AUC, sensitivity, specificity, respectively. Among the 1,073 cancer patients, 85 patients had 116 exams of prior mammograms which were diagnosed as non-cancer at that time. A breast radiologist retrospectively reviewed the 116 exams and re-classified into three categories - 1) Missed (46 exams; 47 cancer / 45 non-cancer breasts): retrospectively seen in previous mammogram (mmg-p) and also seen in mammogram at diagnosis (mmg-d), 2) Interval (55; 61/49): retrospectively not seen in mmg-p but seen in mmg-d, and 3) Occult (15; 17/13): not seen both in mmg-p and mmg-d. DIB-MMG was analyzed for the Missed, Interval, and Occult cancers, respectively.

RESULTS

Per-breast AUC, sensitivity, specificity were used since all the data is positive in exam-level. Per-breast AUC was 0.841, 0.676, 0.620 for the Missed, Interval, Occult, respectively. Sensitivity (w/ specificity) at different operating points 0.05, 0.10 were 68.1% (88.9%), 55.3% (91.1%) for Missed, 49.2% (83.7%), 37.7% (91.8%) for Interval, and 41.2% (69.2%), 17.7% (84.6%) for Occult, respectively. Original operating point of DIB-MMG for routine screening was 0.10. Fig.1 shows examples of the Missed and Interval cancers.

CONCLUSION

This retrospective study showed feasibility of DIB-MMG for early detection of breast cancer on mammography, where 32 out of 47 missed cancers, 30 out of 61 interval cancers, 7 out of 17 occult cancers were detected by DIB-MMG. Overall AUC was 0.738. Further clinical validation with observer performance study is needed.

CLINICAL RELEVANCE/APPLICATION

With further clinical validation, DIB-MMG can be used as an effective diagnostic-support tool for early detection of breast cancer in screening mammography.

SSA01-07 Improved Breast Cancer Detection and Reading Time with Concurrent Use of Deep Learning-Based Artificial Intelligence for Digital Breast Tomosynthesis When Interpreted with Digital Mammography versus Synthetic Mammography

Sunday, Dec. 1 11:45AM - 11:55AM Room: S406A

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PURPOSE

To evaluate improvements in accuracy and reading time associated with concurrent use of Artificial Intelligence (AI) with Digital Breast Tomosynthesis (DBT) based on 2D image type combined with DBT.

METHOD AND MATERIALS

Twenty-four (24) radiologists participated in a retrospective reader study with 260 DBT exams, interpreting with Digital Mammography (DM/DBT) in 195 cases, including 43 cancer and 152 non-cancer cases and with Synthetic Mammography (SM/DBT) in 65 cases, including 22 cancer and 43 non-cancer cases. A crossover design was used to read all exams with and without AI with a 4-week washout period. Suspicious soft tissue and calcific lesions were detected in DBT slices by an AI system based on deep convolutional neural networks. Readers were provided detection outlines and 0-100% AI certainty of finding scores. Endpoints included Area Under the ROC Curve (AUC) requiring localization of malignant lesions, sensitivity, specificity and reading time, and were evaluated with AI versus without AI separately for DM/DBT and SM/DBT.

RESULTS

AUC improved for both 2D formats with AI versus without AI: 0.067 increase for DM/DBT (95% CI: 0.026, 0.108) from 0.781 without AI to 0.848 with AI; 0.034 increase for SM/DBT (95% CI: -0.001, 0.070) from 0.812 without AI to 0.846 with AI.Case-level sensitivity improved for both 2D formats with AI versus without AI: 0.092 increase for DM/DBT (95% CI: 0.017, 0.166) from 0.735 without AI to 0.827 with AI; 0.057 increase for SM/DBT (95% CI: 0.011, 0.103) from 0.839 without AI to 0.896 with AI.Specificity improved for both 2D formats with AI versus without AI: 0.080 increase for DM/DBT (95% CI: 0.039, 0.120) from 0.657 without AI to 0.737 with AI; 0.031 increase for SM/DBT (95% CI: -0.028, 0.090) from 0.522 without AI to 0.553 with AI.Reading time was shorter for both 2D formats with AI versus without AI: 29.2 sec with AI and 65.1 sec without AI for DM/DBT; 34.0 sec with AI and 61.2 sec without AI for SM/DBT. Reading time improved 55.1% with use of AI (95% CI: 44.5%, 63.7%) for DM/DBT and 44.4% (95% CI: 31.7%, 54.7%) for SM/DBT.

CONCLUSION

The use of AI with DBT improved AUC, sensitivity, specificity and reading time when reading DBT with digital or with synthetic 2D.

CLINICAL RELEVANCE/APPLICATION

Radiologist's breast cancer detection performance and efficiency improve with concurrent use of AI for DBT with digital or synthetic 2D.

SSA01-08 Artificial Intelligence Detecting Breast Cancer in a Screening Population: Accuracy, Earlier Detection on Prior Mammograms, and Relation with Cancer Grade

Sunday, Dec. 1 11:55AM - 12:05PM Room: S406A

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PURPOSE

To analyze the breast cancer detection accuracy of a deep learning-based artificial intelligence (AI) system in screening mammograms of screen-detected cancers, in their prior exams, and study possible dependencies with cancer grade.

METHOD AND MATERIALS

A total of 2,683 screening mammograms with biopsy-proven screen-detected cancers from the OPTIMAM database were retrospectively collected (1,212 had a prior mammogram available). OPTIMAM contains screening mammograms performed in the UK, where women are invited triennially, and each mammogram is independently read by two radiologists with an approximate recall rate of 4%. Regarding the available histology of the screen-detected cases, 1969 presented invasive cancers and 670 contained DCIS only; 1001 presented high-grade (G3) cancers, 1186 intermediate-grade (G2) cancers, and 314 low-grade (G1) cancers. Each mammogram was analyzed by an AI system (Transpara™, ScreenPoint Medical). The AI system produced a recall decision at different recall rates: 50%, 10%, 4%. Recall rate calibration was established for a typical screening population with another set of independent data. The mammograms in this study were never used to train, validate or test the AI system before. The distributions of recalled mammograms were statistically compared using Pearson's chi-squared test at 95% significance level.

RESULTS

The AI system had a sensitivity for screen-detected cancers of 99.3%, 87.7% and 76.1% at recall rates of 50%, 10%, and 4% respectively. When analyzing prior screening mammograms of screen-detected cancers, 16.8% would have been recalled by the AI system at a recall rate of 4%. There were significative differences when stratifying by cancer grade: at a recall rate of 4%, a greater proportion of the high-grade than low-grade cancers were recalled by the AI (80.7% G3 versus 68.2% G1, $P<0.001$).

CONCLUSION

The AI system achieves a high sensitivity at a recall rate of 50%, meaning that it could discriminate 50% of the screening population as being almost certainly normal, it has potential to detect cancers earlier, while sensitivity is higher for high-grade cancers than for low-grade.

CLINICAL RELEVANCE/APPLICATION

AI systems have great potential to assist radiologists in breast cancer screening by improving efficiency (reduced workload) and/or performance (earlier detection).

SSA01-09 The Effect of Chemoprevention Agents on Convolutional Neural Network-Based Breast Cancer Risk Model Using a Mammographic Dataset

Sunday, Dec. 1 12:05PM - 12:15PM Room: S406A

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PURPOSE

We have previously developed and published a novel convolutional neural network (CNN) derived pixel-wise breast cancer risk model using a mammographic dataset. Purpose of this study is to evaluate whether this risk model is modifiable with known chemoprevention regimen (tomoxifen and aromatase inhibitor therapy).

METHOD AND MATERIALS

An IRB approved study identified 558 high risk patients defined as history of atypia or DCIS diagnosed on core needle biopsy. Of 558 patients, 194 patients (group 1) underwent breast cancer risk reducing chemoprevention regimen (tamoxifen or aromatase inhibitor therapy) for a median of 3 years (range 1 - 5 years). 354 patients (group 2) did not undergo chemoprevention regimen. For each group mammographic dataset was composed of two time points (baseline and follow-up). Mammographic dataset was used for CNN based breast cancer risk prediction based on our previously published study. 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 limit over-fitting. Statistical analysis was performed comparing group 1's risk reduction following chemoprevention regimen predicted by our CNN risk model compared to group 2 which did not undergo chemoprevention regimen.

RESULTS

Using our CNN based breast cancer risk model, the 194 patients in the treatment group (group 1) showed 20.5% in absolute risk reduction and 32.5% in relative risk reduction. 364 patients in the non-treatment group (group 2) showed 3.5% in absolute risk reduction and 6.5% in relative risk reduction. The absolute risk reduction and relative risk reduction between group 1 and group 2 were statistically significant (p=0.01 and p=0.001).

CONCLUSION

Our CNN based algorithm can predict breast cancer risk, and is modifiable with known chemoprevention regimen.

CLINICAL RELEVANCE/APPLICATION

Potential effectiveness of breast cancer chemoprevention agents may be assessed utilizing our CNN based risk prediction model based on mammographic images.

Printed on: 10/29/20

SSA02

Breast Imaging (MRI Diagnostics)

Sunday, Dec. 1 10:45AM - 12:15PM Room: S402AB

BR MR

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

FDA Discussions may include off-label uses.

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Sub-Events

SSA02-01 High-Risk Lesions Detected by MRI-Guided Core Biopsy: Upgrade Rates at Surgical Excision and Implications for Management

Sunday, Dec. 1 10:45AM - 10:55AM Room: S402AB

Participants
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PURPOSE

To assess clinical and imaging characteristics of high-risk lesions detected by MRI-guided core biopsy and to evaluate upgrade rates to carcinoma at surgical excision

METHOD AND MATERIALS

A retrospective review was performed for all women presenting to an academic breast radiology center for MRI-guided biopsy from January 2015 - November 2018. Histopathological results from each biopsy were extracted, and high-risk lesions [atypical ductal hyperplasia (ADH), lobular carcinoma in situ (LCIS), atypical lobular hyperplasia (ALH), radial scar, papilloma, flat epithelial atypia (FEA), and benign vascular lesion] were included for analysis. Clinical history, imaging characteristics, surgical outcome following excision, and follow-up data were also recorded. If the lesion was excised in a mastectomy specimen or a lumpectomy specimen with a known cancer, then upgrade status was deemed indeterminate and not included in the upgrade rate calculation. Rigorous radiologic pathologic correlation was performed of upgraded lesions to determine whether biopsy results were concordant and the lesion was adequately sampled.

RESULTS

Of 810 MRI-guided biopsies, 189 biopsies (23.3%) met inclusion criteria as high-risk lesions. Excluded were 151 (18.6%) malignant and 470 (58.0%) benign lesions. Mean patient age of the included patients was 58.4 years (range 30-83). Upgrade rate was indeterminate in 41 (21.7%) of high-risk lesions. Surgical upgrade rates were high for ADH 32.4% (12/37) and FEA 100.0% (2/2); moderate for LCIS 7.0% (3/43); and low for ALH 0.0% (0/10), radial scar 0.0% (0/24), papilloma 0.0% (0/29), and benign vascular lesions 0.0% (0/3). Of the upgraded lesions, 82.4% (14/17) had concurrent breast carcinoma (7 contralateral and 7 ipsilateral), and 76.5% (13/17) were upgraded to DCIS or well-differentiated carcinoma. ADH was significantly more likely to be upgraded than non-ADH lesions ($p<0.0001$).

CONCLUSION

ADH obtained on MRI-guided core biopsy warrants surgical excision. Other high-risk lesions, however, may be candidates for imaging follow-up rather than surgical excision, especially in the setting of no concurrent breast carcinoma, and after meticulous radiologic-pathologic correlation.

CLINICAL RELEVANCE/APPLICATION

Identifying subsets of high-risk lesions biopsied under MRI-guidance that are rarely upgraded to carcinoma at surgical excision can safely prevent many women from undergoing surgery.

SSA02-02 Tumor Necrosis at Baseline Dynamic Contrast Enhanced (DCE) MRI for Prediction of Neoadjuvant Chemotherapy Treatment (NACT) Response in Triple Negative Breast Cancer (TNBC) Patients

Sunday, Dec. 1 10:55AM - 11:05AM Room: S402AB

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PURPOSE

To determine the predictive value of tumor necrosis at baseline DCE-MRI on treatment response to NACT in TNBC patients.

METHOD AND MATERIALS

This IRB-approved study includes 85 patients with stage I-III TNBC, who had baseline MRI, underwent NACT followed by definitive surgery. Tumors were segmented on the early phase subtraction of DCE-MRI. Necrosis was identified as non-enhancing intra-tumoral tissue on DCE with high T2 signal and shine through on the Apparent Diffusion Coefficient (ADC). Necrotic tumors were segmented with and without inclusion of necrotic regions. The longest dimension of the tumors, volume and percent of necrosis were calculated from contours. Metrics of necrosis were compared with pathologic complete response (pCR) or non-pCR in tissue evaluated after surgical resection, T stage of the tumor, and regional lymph node (LN) involvement at staging and at surgery (positive vs negative). Receiver operating characteristic (ROC) curves, Wilcoxon rank sum tests, and odds ratios (OR) were used for analysis.

RESULTS

Necrosis was seen in 31 pts (36.5 %), median volume was 4.8 cm3 (range 0.7-945 cm3), median percent was 22.8 % (range 4.6-86 %). pCR occurred in 37 pts (43.5%). There was no significant association between pCR and presence of necrosis (OR = 1.4, 95% CI (0.6, 3.3), P=0.49). The volume and percent of necrosis were not significantly different between pts with pCR and non-pCR [AUROCC = 0.52, 95% CI (0.40, 0.65); p=0.69; AUROCC = 0.54, 95% CI (0.41, 0.66) p = 0.52, respectively]. No significant association between T stage of the TNBC and presence of necrosis [OR = 2.3, 95% CI (0.6, 8.8) p = 0.23] was found. Necrotic lesions were seen in 21% (3/14) T1 lesions, 39% (17/44) T2 and 37% (10/27) T3-T4 lesions. There was no significant association between baseline necrosis and LN involvement at staging or at surgery [OR = 0.9, 95% CI = (0.4, 2.1), p= 0.73; OR = 0.5, 95% CI = (0.1, 1.4), p=0.16 respectively]. Tumor necrosis was seen in 38% (15/39) LN+ and in 35% (16/46) LN- pts at staging; 41% (26/64) LN+ and 24% (5/21) LN- pts at surgery.

CONCLUSION

Tumor necrosis at baseline in TNBC patients was not associated with pCR or nodal involvement and was not a predictor of response to NACT.

CLINICAL RELEVANCE/APPLICATION

Our study found that tumor necrosis at baseline imaging in TNBC patients had no association with their treatment response and therefore should not affect their treatment planning.

SSA02-03 Feasibility of Supine MRI-Navigated Ultrasound in Breast Cancer Patients

Sunday, Dec. 1 11:05AM - 11:15AM Room: S402AB

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PURPOSE

To evaluate the feasibility of image fusion between ultrasound (US) and supine magnetic resonance (MR) in breast cancer patients and to evaluate the differences in tumor location between prone and supine positions.

METHOD AND MATERIALS

This prospective study was approved by our institutional review board, and informed consent was obtained. Between May 2016 and December 2017, 88 patients who were undergoing additional supine MR (MRsup) following routine prone MR (MRpro) for breast cancer were included. Clockwise location of the tumor and discrepancies in the distances from nipple to lesion (NLD), skin to lesion (SLD), and lesion to chest wall (CLD) were evaluated between MRpro and MRsup (MRpro-sup), MRpro and MRsup navigated US (MRpro-USnav) and MRsup and USnav (MRsup-USnav). Associations between breast thickness and measurement discrepancies were analyzed using Pearson's correlation.

RESULTS

Total 91 index lesions were evaluated in 88 patients. The intraclass correlation coefficients (ICCs) for the clockwise location of MRpro and MRsup compared with USnav were 0.994 (range: 0.990-0.996) and 0.998 (range: 0.996-0.998), respectively. The mean MRpro-sup and MRpro-USnav measurement discrepancies were greater than those of MRsup-USnav. NLD showed the smallest mean MRsup-USnav measurement discrepancy. Most outer locations showed greater mean measurement discrepancies than inner locations, and each NLD, SLD, and CLD mean measurement discrepancy showed different tendencies according to location and lesion depth. High breast thickness showed significantly greater mean measurement discrepancies than low breast thickness (cutoff: median thickness of 74 mm). Breast thickness showed moderate and strong correlations with MRpro-sup ($r=0.583$, $p<0.001$) and MRpro-USnav ($r=0.634$, $p<0.001$) CLD discrepancies, and weak correlations with MRpro-sup ($r=0.347$, $p=0.001$) and MRpro-USnav ($r=0.343$, $p=0.001$) NLD discrepancies.

CONCLUSION

Image fusion between US and supine MR is feasible in breast cancer patients, although there is a considerable difference in tumor location measurements between prone and supine positions, especially with thicker breasts.

CLINICAL RELEVANCE/APPLICATION

Supine MRI-navigated US is feasible, and the error range between supine and prone position is predictable and may be helpful for estimating breast cancer location and surgical planning.

SSA02-04 Usefulness of MRI Projection Mapping System for Conserving Surgery of Breast Cancer: Comparison with Conventional Method and Pathohistological Findings

Sunday, Dec. 1 11:15AM - 11:25AM Room: S402AB

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PURPOSE

Conserving surgery of breast cancer is conventionally performed by referring MRI acquired in the prone position owing to its accurate detection of the tumor extent. However, the shapes of breast and cancer during MRI scan differ from those under surgery, because the surgery is performed in the supine position. The aim of this study was to evaluate usefulness of MRI projection mapping system (PMS), which we have developed as a prototype, for determining the tumor extent and surgical line in patients who underwent conserving surgery of breast cancer.

METHOD AND MATERIALS

Eleven patients with invasive breast cancer were enrolled. Contrast-enhanced breast MRI in the prone and supine positions was performed separately using a 1.5 T. Conserving surgery of breast cancer was performed based on the conventional method: its extent was determined by palpation, ultrasonography (US) and prone MRI. Immediately before the surgery, maximum intensity projection (MIP) image generated from supine MRI was projected onto the breast surface using structured light method by the MRI-PMS, which consisted of projector-camera system and personal computer. We compared the tumor location and associated intraductal component between the conventional method, MRI-PMS and pathohistological findings.

RESULTS

MRI projection mapping was successfully completed in 9 of the 11 patients; an operational failure occurred in 2 patients. The discrepancy of tumor location ranged from 3 to 9 mm (mean, 4.5 mm) between the conventional method and MRI-PMS. The 5 patients had intraductal component.. The intraductal component was visualized more clearly and perceived more easily by MRI-PMS than by the conventional method in the 4 of them. The total tumor extent defined by MRI -PMS corresponded to that by pathohistological findings in these patients.

CONCLUSION

MRI-PMS visualizes the breast cancer, especially that with intraductal component. Thus, MRI-PMS can be recommended for

conserving surgery of breast cancer.

CLINICAL RELEVANCE/APPLICATION

MRI projection mapping system is useful for conserving surgery of breast cancer because it visualizes the breast cancer well, especially that with intraductal component.

SSA02-05 Accelerating Acquisition of RESOLVE-DWI with Simultaneous Multi-slice (SMS) Technique in Diagnosing Breast Lesions

Sunday, Dec. 1 11:25AM - 11:35AM Room: S402AB

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PURPOSE

To investigate the feasibility and effectiveness of diffusion weighted imaging (DWI) using Simultaneous Multi-slice readout-segmented echo planar imaging (rs-EPI) to diagnose breast lesions.

METHOD AND MATERIALS

The IRB approved study was performed on a 3T scanner with a dedicated 16-channel phased-array breast coil (MAGNETOM Skyra, Siemens Healthcare, Erlangen, Germany). 46 female patients (average age of 42.3 years; range of 26-57 years) with 48 lesions (41 malignant and 7 benign) were enrolled in this study. Patients underwent bilateral breast MRI using a prototypical SMS rs-EPI sequence and a conventional rs-EPI sequence. T1-weighted MRI, T2-weighted MRI, and dynamic contrast-enhanced (DCE-MRI) were also conducted as references. The details of imaging parameters of both DWI sequences were listed in Figure 1. ADC, MK, MD values were quantitatively calculated for each lesion on both sequences. In addition, all images were qualitatively analyzed by a blinded read using a 5-point scale (1 = poor, 5 = excellent). The difference and correlation of both quantitative and qualitative parameters between conventional rs-EPI and SMS rs-EPI data were statistically analyzed.

RESULTS

Compared to conventional rs-EPI, The acquisition time of SMS rs-EPI was markedly reduced (2:17 vs4:27 minutes). The Pearson's correlation showed a excellent linear relationship for each parameter between SMS rs-EPI and conventional rs-EPI ($r = 0.935$, 0.914 and 0.965 for MK, MD and ADC respectively; $P<0.01$ for all, Fig.2). Furthermore, the ROC analysis demonstrated SMS rs-EPI had better diagnostic performance than conventional rs-EPI, however the values didn't differ significantly (Fig.3). In blinded read, SMS rs-EPI showed comparable imaging quality with conventional rs-EPI (Fig.4&5), with moderate to good inter-rater reliability (ICC = 0.63-0.83).

CONCLUSION

Compared to conventional rs-EPI technique, SMS rs-EPI can markedly reduce the acquisition time and yield similar diagnostic accuracy and comparable image quality, which may be useful to expand the scope of its clinical application in breast imaging, and increase the patient throughout.

CLINICAL RELEVANCE/APPLICATION

SMS RESOLVE allows for rapid realization of breast MR imaging, which may serve as a superior alternative for the diagnosis of breast lesions.

SSA02-06 Quantitative Tumor Volumes by Fast Dynamic Contrast Enhanced (DCE) MRI Predict Pathologic Complete Response (pCR) to Neoadjuvant Chemotherapy (NACT) in Triple Negative Breast Cancer (TNBC)

Sunday, Dec. 1 11:35AM - 11:45AM Room: S402AB

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PURPOSE

In TNBC, non-pCR has high risk of recurrence. We evaluated the dependence of the quantitative tumor volumes for predicting pCR status in TNBC on the temporal resolution of DCE MRI.

METHOD AND MATERIALS

In the ARTEMIS trial (NCT02276443), TNBC pts receive 4 cycles of Adriamycin-based chemo (C4AC) followed by taxane-based NACT. 35 pts underwent fast DCE-MRI with range of temporal resolution 8-49 s at baseline (BL) and after C4AC. A retrospective cohort (RC) of 50 TNBC pts who had NACT and BL standard DCE-MRI (temporal resolution 90-120 s) was compared. For all pts pCR was assessed at surgery. 3-dimensional tumor measurements were obtained and tumor volume was contoured by a breast radiologist on the early subtraction phase. Clinical tumor volume (CTV) was calculated using 3 tumor dimensions. Enhanced tumor volume (ETV) was extracted as volume of the contoured voxels, and functional tumor volume (FTV) was extracted as the subset of ETV with voxels below preset signal enhancement ratio (SER). CTV, ETV, FTV, and their changes between BL and C4AC scans were compared between pCR and non-pCR using Receiver Operator Characteristic (ROC) curve and Wilcoxon rank sum test.

RESULTS

An optimal SER of 0.45 was found to maximize AUC of pCR vs non-pCR in ARTEMIS group. In ARTEMIS pts, CTV, ETV, and FTV at BL were able to discriminate pCR and non-pCR, with the pCR pts having significantly smaller tumor volumes (AUC = 0.75, 0.74, 0.74 and p=0.0096, 0.022, 0.022, respectively). CTV, ETV, and FTV at C4AC were significantly different between pCR and non-pCR (AUC = 0.71, 0.74, 0.75 and p=0.041, 0.017, 0.019, respectively). The changes in CTV, ETV, and FTV from BL to C4 were significantly different between pCR and non-pCR (AUC = 0.70, 0.73, 0.71 and p=0.044, 0.026, 0.038). In contrast, CTV, ETV, and FTV in the RC at BL were not significantly different between pCR and non-pCR pts (AUC=0.62, 0.54, 0.53 and p=0.16, 0.66, 0.74 respectively). Tumor volumes measured in ARTEMIS pts were smaller than in the RC (p=0.061).

CONCLUSION

Quantitative tumor volumes measured by fast DCE may serve as an early predictor of treatment response in TNBC. Standard DCE MRI with lower temporal resolution may overestimate the tumor volumes.

CLINICAL RELEVANCE/APPLICATION

Tumor volumes measured with fast DCE MRI improve prediction of treatment response to NACT in TNBC in comparison with standard DCE MRI and may be useful imaging biomarkers of treatment response.

SSA02-07 Efficacy of 3-D Diffusion Weighted Imaging with Background Suppression (DWIBS) in Detection of Breast Carcinoma Compare to Dynamic Contrast Enhanced MRI

Sunday, Dec. 1 11:45AM - 11:55AM Room: S402AB

Participants
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PURPOSE

Aim is to evaluate the efficacy 3-D Diffusion weighted imaging with background suppression in detection of breast carcinoma. To evaluate efficacy of DWIBS in differentiation of malignant and benign breast lesions and it's comparison with CEMR.To evaluate ADC values of benign and malignant breast lesions.

METHOD AND MATERIALS

Study IRB and IEC approved.Study included 103 breast lesions which were detected on mammography and breast ultrasound. All the cases underwent breast MRI on 1.5 Tesla machine using dedicated breast coil. Multiplaner localizer applied with 3mm slice thickness. T1WI, T2WI and STIR in axial, STIR coronal, & sagittal plane. Axial DWI was done with b value 1500 sec/mm2. Pre contrast fat-suppressed T1W gradient echo images were obtained followed by intravenous contrast injection. Post processing was done by digitally subtracting the pre-contrast.ADC calculations obtained.All the cases were correlated histopathologically.

RESULTS

Study included 103 lesions.Lesions which showed diffusion restriction considered positive whereas lesions did not show restriction were considered as benign lesions. DWI with increase b value demonstrates lesions better with background suppression. Total 52(50.5%) lesions were benign and 51(49.5%) were malignant on Histopathology. Sensitivity of DWI was 90.2% (95% CI= 84.5,95.9), specificity was 94.2% (95% CI =89.7,98.7), PPV 93.9% 95% CI =89.3,98.5) and NPV 90.7% (95% CI =85.1,96.3). Mean ADCs of malignant lesions was 0.933 ± 0.21× 10 3 mm 2/s. and benign lesions was 1.847 ± 0.51 × 10 3 mm2/s. Area under curve was 0.97. with P value <0.001(significant).Cut off ADC value was 1.08 × 10 3 mm2. Sensitivity for the CEMR was 94.3 %(95% CI= 88.7-99.8),specificity 96.9% (95% CI= 92.7-100.0) PPV 97.1 95% CI =93,100) and NPV 93.9 95% CI =82.2,99.6).

CONCLUSION

DWIBS is an excellent non contrast investigation which can detect breast carcinoma and differentiate benign and malignant breast lesions and the result was comparable to CEMR technique.It can diagnose skin changes and nipple areolar changes as well.

CLINICAL RELEVANCE/APPLICATION

DWIBS can be use as non invasive, non radiation, non contrast method for differentiation in benign and malignant pathology and number of biopsy can be reduced in the clear benign pathologies . This method can be use in the screening of the high risk and dense breast parenchyma,younger population.

SSA02-08 Power of Time-dependent Diffusion MRI as a Prognostic Biomarker in the Breast

Sunday, Dec. 1 11:55AM - 12:05PM Room: S402AB

Participants
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PURPOSE

To investigate the utility of ADC values obtained with the different diffusion times (including short diffusion time recently available on clinical scanners) for differentiation of benign and malignant breast tumors as well as their prognostic biomarkers.

METHOD AND MATERIALS

200 cases were prospectively enrolled to this IRB-approved study and 149 breast lesions (86 malignant, 63 benign) were analyzed. DWI scans with prototype sequences using different diffusion times (effective diffusion time Deff = 5.1 ms and 96.6 ms) were performed, with b-values of 0 and 700 s/mm2 and acquisition time of 2.5 min for each on a 3T MRI. ADC change was calculated; (ADCshort - ADClong) / ADCshort x 100 (%), where ADC short and ADC long are ADC values with Deff = 5.1 ms and 96.6 ms. ADC values and ADC changes were compared between malignant and benign breast tumors, as well as between positivity and negativity in expression of their prognostic biomarkers.

RESULTS

Significantly smaller ADCshort and ADClong values were found in malignant compared than benign lesions ($P < 0.0001$ and < 0.0001). ADClong had significantly lower values than ADCshort, both in malignant and benign lesions ($P < 0.0001$ and < 0.0001, respectively). ADC changes were significantly larger in malignant compared with benign lesions ($P < 0.0001$). PgR-positive breast cancers had significantly lower ADCshort and ADClong values than PgR negative ($P < 0.01$ and < 0.05). Both ADCshort and ADClong values were significantly lower in ER-positive than ER-negative breast cancers ($P < 0.05$ and < 0.05). Significantly larger ADC change was observed in Ki-67 positive compared to Ki-67 negative cancers ($P < 0.01$). ADC decrease with diffusion times was remarkable in the peripheral region of typical invasive ductal carcinoma, while center had almost no ADC change, suggesting of central necrosis.

CONCLUSION

ADC values significantly changed depending on tumor types or prognostic factors of breast cancers. Time-dependent diffusion MRI might be a useful prognostic and predictive biomarker, allowing more accurate diagnosis and a safe promising approach to personalized therapy of breast cancer. Our results also underline the importance of checking diffusion times in the interpretation of breast DWI.

CLINICAL RELEVANCE/APPLICATION

The diffusion time dependence of ADC values can be a prognostic marker, potentially allowing to tailor treatment plans of breast cancers without the need of contrast agents

SSA02-09 Feasibility Study of Applying Simultaneous Multi-slice Technique in Diffusion-weighted Imaging of Breast Lesions

Sunday, Dec. 1 12:05PM - 12:15PM Room: S402AB

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PURPOSE

To evaluate the feasibility of applying simultaneous multi-slice (SMS) single-shot echo planar imaging (EPI) to accelerate MR diffusion imaging for breast lesions.

METHOD AND MATERIALS

60 patients (30 breast carcinoma,17 fibroadenoma of breast and 13 normal breast) who underwent breast MRI (3T,MAGNETOM Skyra,Siemens Healthcare) were collected.The following three different diffusion weighted imaging (DWI) scan protocols were applied.The first sequence(A) is the conventional single-shot echo planar DWI (EPI-DWI):TR/TE 5200ms/72ms,FOV 360mm×227.4mm,Slice thickness 5mm,Distance factor 1mm,Slices 30,Bandwidth 1644Hz/pix,Voxel size 0.9×0.9×5mm3,GRAPPA factor 2,b-values(averages) 50s/mm2(2) and 800s/mm2(6) with 3-scan trace mode,Scan time 2:31min.For the second(B) and the third(C) DWI protocols,a SMS factor of two and three were applied, respectively.In order to compare the image quality with those acquired by sequence A,all the sequence parameters were kept the as described above, except for changing the TR of sequence B to 2600ms(scan time 75s) and the TR of sequence C to 1800ms(scan time 55s).For all sequences,image quality is evaluated by two radiologists blinded to the acquisition schemes on a five-point scale.The quantitative analysis for the three sequences included image signal-to-noise ratio (SNR),ADC values of normal breast parenchyma and breast lesions.Paired t-test was used to compare the differences of SNR and ADC values between A and B,A and C.Inter-reader reliability was analyzed by calculating the intra-class correlation coefficient (ICC).

RESULTS

Compared with protocol A, the image quality of protocol C was significant reduced (ICC=0.4), while that of protocol B was stable (ICC= 0.9). The image SNR of A, B and C scan protocols were 21.2±3.0, 19.8±3.3 and 15.3±3.7, respectively. There was no significant difference between protocol B and A (p=0.162) of the image SNR. The SNR of protocol C were significant lower than those of protocol A(p<0.001). The ADC values (×10-3mm2/s) of normal breast parenchyma, breast carcinoma lesions and fibroadenoma of breast were 2.01±0.35, 0.98±0.25, 1.78±0.36, respectively. With SMS factor of 2, the ADC values of those three parts were 1.98±0.39,1.02±0.21,1.82±0.33. The ADC value of 3×SMS were 1.83±0.27,0.87±0.31, 1.87±0.27,respectively.There was no significant difference in ADC values between protocol B and A,C and A in normal breast parenchyma and lesions (all p > 0.05).

CONCLUSION

By applying SMS technique with a factor of 2,the acquisition time of breast DWI can be significantly reduced without sacrificing the image quality.However, if the SMS factor increases to 3,the image SNR decreases which affects clinical diagnosis.

CLINICAL RELEVANCE/APPLICATION

Comparing with conventional EPI-DWI,the SMS markedly Reduces the diffusion scan time and the image SNR still shows a good quality.Thus,SMS technique is recommended for DWI of the MR breast study.

Printed on: 10/29/20

VW79

DBT: Why Another Technology to Detect the Same Disease?: Presented by FUJIFILM Medical Systems U.S.A., Inc.

Sunday, Dec. 1 10:45AM - 11:45AM Room: South Building, Booth 5147

Participants

Shilpa V. Lad, MD, Ottawa, ON (*Presenter*) Faculty, C. R. Bard, Inc; Faculty, FUJIFILM Holdings Corporation

Program Information

Through a hands-on review of 2D as well as 3D Tomosynthesis images in screening and diagnostic cases, this workshop will highlight the signs of benign as well as malignant breast lesions seen on 3D Tomosynthesis where 2D mammograms were equivocal or negative. This workshop will also demonstrate synthetic 2Dimages have the potential to replace 2D mammograms for dose reduction, and introduce cases using Contrast Enhanced Mammography to highlight the importance of cost-effective functional imaging as a problem solving tool.

Printed on: 10/29/20

VW63

Efficacy in Diagnosis with Tomosynthesis in Daily Practice (En Español): Presented by Hologic, Inc.

Sunday, Dec. 1 11:00AM - 11:45AM Room: South Building, Booth 5119

Participants

Beatriz E. Gonzalez, MD, Guadalajara, Mexico (*Presenter*) Nothing to Disclose

Program Information

In this lecture an experienced radiologist provides her clinical perspective on how digital mammography with tomosynthesis has aided the diagnosis of breast lesions, since it was implemented into their practice in 2011. *Adding this session to your agenda does not secure your seat in this session. Secure your seat onsite by visiting Hologic's Workshop Room # 5119 in the South Hall.*

Printed on: 10/29/20

VW35

Personalized and Risk-Stratified Screening Using ABUS Technology: Presented by GE Healthcare

Sunday, Dec. 1 11:30AM - 12:00PM Room: South Building, Booth 5135

Participants

Athina Vourtsis, PhD, Athens, Greece (*Presenter*) Nothing to Disclose

Program Information

Women with dense breasts have a higher risk to develop breast cancer, a higher interval cancer rates leading to a delayed diagnosis. ABUS has shown to improve the detection of invasive cancers while further advances of ABUS 2.0 provide an improvement in the scanning technique, software and interpretability. The objectives of this lecture are to understand the implications of breast density and to learn how to integrate ABUS 2.0 into daily practice. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

VW13

More Confidence in Tomosynthesis Reading with Synthetic 2D Reading Session: Presented by Siemens Healthineers

Sunday, Dec. 1 11:40AM - 12:50PM Room: North Building, Booth 8563

Participants

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

Program Information

During this workshop you will get to experience the value that Synthetic 2D mammography (Insight 2D) can bring to tomosynthesis reading. An expert tutor will lead you through cases that will both fascinate and challenge you! All cases have been acquired with Siemens Healthineers latest 50° Wide-Angle system MAMMOMAT Revelation and are displayed on our *syngo*. Breast Care workstations, so you will become familiar with the value of 50° Wide-Angle Tomosynthesis and ease of use of our systems. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP

https://www.fairorg.de/Siemens-Healthineers/portal/workshop.cfm/rsna19/

Printed on: 10/29/20

VW80

Ongoing Measures against Breast Density Issues on Screening Mammography in Japan: Presented by FUJIFILM Medical Systems U.S.A., Inc.

Sunday, Dec. 1 12:00PM - 1:00PM Room: South Building, Booth 5147

Participants

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

Program Information

Mammography is the only breast cancer screening test that has been proven to reduce the mortality all over the world. However, the sensitivity is inversely proportional to breast density. As FDA proposes adding breast density reporting to MQSA, the Japanese mass media is making breast density issues a hot topic in screening mammography. This session will discuss Japan's breast cancer screening programs and its ongoing measures against breast density.

VW64

Implementing Contrast Enhanced Digital Mammography into your Practice: Presented by Hologic, Inc.

Sunday, Dec. 1 12:15PM - 1:30PM Room: South Building, Booth 5119

Participants

Nila H. Alsheik, MD, Park Ridge, IL (*Presenter*) Nothing to Disclose

Program Information

Listen as an experienced radiologist shares how to implement contrast enhanced digital mammography (CEDM) into your practice, followed by a faculty-guided review of CEDM cases. *Adding this session to your agenda does not secure your seat in this session. Secure your seat onsite by visiting Hologic's Workshop Room # 5119 in the South Hall.*

Printed on: 10/29/20

BRS-SUA

Breast Sunday Poster Discussions

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

BR

AMA PRA Category 1 Credit ™: .50

Participants

Thomas H. Helbich, MD, Vienna, Austria (*Moderator*) Research Grant, Medicor, Inc ; Research Grant, Siemens AG ; Research Grant, C. R. Bard, Inc; Research Grant, Guerbet SA; Research Grant, Novomed GmbH

Sub-Events

BR224-SD-SUA1 MRI Radiomics Signature: Association with Disease-Free Survival in Patients with Triple Negative Breast Cancer

Station #1

Participants

Vivian Y. Park, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Sungwon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Min Jung Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To develop and validate a radiomics signature based on preoperative magnetic resonance imaging (MRI) to estimate disease-free survival (DFS) in patients with triple negative breast cancer.

METHOD AND MATERIALS

We identified 289 consecutive patients with newly diagnosed triple negative breast cancer who had underwent preoperative MRI and surgery between April 2012 and December 2016. Patients were temporally divided into training (n= 169) and validation (n=59) sets. Radiomics features were extracted from T2-weighted and contrast-enhanced T1- weighted MRI. A radiomics signature was generated by using the LASSO method in Cox regression. Univariate and multivariate Cox proportional hazards models were used to determine the association of the radiomic signature and clinicopathologic variables with DFS. A radiomics model combining the radiomics signature and clinicopathologic factors was constructed to validate the radiomics signatures for individualized DFS estimation. The incremental values of the radiomics signature were evaluated by using the integrated area under the receiver operating characteristic curve (iAUC) and bootstrapping (n = 1000).

RESULTS

The radiomics signature, which consisted of 5 selected MRI features, was significantly associated with worse DFS in both the training and validation sets (P = 0.002, P = 0.033, respectively). Among clinicopathologic factors, lymphovascular invasion and pathologic axillary lymph node metastasis (N0 vs. N1, N0 vs. N2/3) were associated with worse DFS (P = 0.0458 , P = 0.0347, P = 0.0013, respectively). A radiomics model which incorporated the radiomics signature and clinicopathologic factors demonstrated better performance than the clinicopathologic model in the training set (iAUC, 0.844, 0.764, respectively, P < 0.001) and the validation set (iAUC, 0.765, 0.691, respectively, P < 0.001)

CONCLUSION

The radiomics signature at preoperative MRI can improve DFS survival prediction when integrated with pathologic features in patients with triple negative breast cancer.

CLINICAL RELEVANCE/APPLICATION

Radiomics features at preoperative MRI may serve as a biomarker for risk stratification for DFS in patients with triple negative breast cancer, and potentially affect patient management strategy.

BR222-SD-SUA2 We Are All SO Dense: The Continuing Challenge of Mammographic Density Assessment

Station #2

Participants

Leah H. Portnow, MD, Brookline, MA (*Presenter*) Nothing to Disclose
Irfanullah Haider, MD, MBA, Salt Lake City, MA (*Abstract Co-Author*) Nothing to Disclose
Mirelys Barrios, MD , Miami, FL (*Abstract Co-Author*) Nothing to Disclose
Dianne Georgian-Smith, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Kerrie P. Nelson, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Sughra Raza, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

1. To determine the effect of BIRADS 5th edition (5th-ed) guidelines on inter-reader agreement regarding visual mammographic density assessment compared to previously used BIRADS 4th edition (4th-ed) criteria. 2. To compare assessed distribution across

density categories using 5th-ed vs. 4th-ed. 3. To compare agreement between visual and quantitative volumetric density assessments in 5th-ed vs. 4th-ed.

METHOD AND MATERIALS

In an IRB-approved retrospective review, 7 breast imaging radiologists reviewed 200 screening full field digital mammograms for visual density assessment using 5th-ed. This assessment was compared to previously published data of the same 7 readers evaluating the same 200 mammograms, previously selected as equal numbers in categories A, B, C, D by consensus of 2 senior imagers, using 4th-ed. Overall inter-reader agreement was compared using Nelson's kappa (κ)-statistics for ordinal data. Quantitative volumetric density using the commercially available tool Volpara was compared with both reader assessments.

RESULTS

Inter-reader agreement using 5th-ed criteria is moderately strong at 0.736 (Nelson's κ, s.e. = 0.013), similar to agreement using 4th-ed criteria at 0.721 (Nelson's κ, s.e. = 0.026). A statistically significant difference in assessed distribution of density categories is seen using 5th-ed vs. 4th-ed ($p < 0.0001$), with overall increase in category B (mean 5th-ed 30.8% vs. mean 4th-ed 25.1%) and C (mean 5th-ed 35.3% vs. mean 4th-ed 26.5%). A statistically significant difference is also seen in distribution of not dense categories A/B combined (5th-ed, 43% vs. 4th-ed 53.3%) vs. dense categories C/D combined (5th-ed, 57% vs. 4th-ed 46.7%; $p < 0.0001$). There is moderate reader vs. Volpara agreement for both the 5th-ed (weighted Cohen's κ range = 0.76-0.85) and 4th-ed (weighted Cohen's κ range = 0.76-0.83, CI 95% 0.63-0.86).

CONCLUSION

Although inter-reader agreement is similar with both BI-RADS guidelines, a significant difference in distribution across density categories is noted, with more mammograms in dense categories C/D using 5th-ed criteria. Agreement between visual and quantitative volumetric density assessment remains similar.

CLINICAL RELEVANCE/APPLICATION

Breast imaging readers in this study placed significantly more mammograms in the dense categories using BI-RADS 5th edition guidelines, which has implications for patients due to density legislation encouraging enhanced surveillance.

BR223-SD-SUA3 Diagnostic Performance of HHUS in Differentiating Benign and Malignant Complex Cystic and Solid Breast Lesions

Station #3

Participants
Huiling Xiang, Guangzhou, China (*Presenter*) Nothing to Disclose
Liu Lixian, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Guo-xue Tang, Guangzhou , China (*Abstract Co-Author*) Nothing to Disclose
Xi Lin, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

This study aimed to explore the value of handheld ultrasound(HHUS) in differential diagnosis of benign and malignant cystic and solid breast lesions.

METHOD AND MATERIALS

From January 1, 2000 to December 31, 2018, 505 pathology proven complex cystic and solid breast lesions in 492 patients were retrospectively analyzed. These lesions were divided into four types according to ultrasonic features: type I, with thick wall and/or septations (>0.5mm); type II, with one or multiple mural or papillary nodules; type III, mixed cystic and solid lesion (the cystic component>50%) or type IV, predominantly solid lesion with cystic spaces (the solid part > 50%). Features of each lesion were recorded based on ACR BI-RADS lexicon. Predictive positive values (PPVs) of all types were identified. The values of AUC, sensitivity, specificity, PPV and NPV of each related malignant factor were calculated.

RESULTS

The mean age of 492 patients included in this study was 45.3(SD 12.6). There were 279(55.2%) benign and 226(44.8%) malignant lesions confirmed by pathology. Based on ultrasonic features, 73 lesions were classified as type I, 55 lesions as type II, 100 and 277 lesions as type III and IV, respectively. The PPVs for malignancy were statistically different between any two groups, except for type III and type IV ($P<0.283$). PPVs of type III(55%) and IV(48.7%) were higher, compared with type I (35.6%)and II(18.2%) ($P<0.001$). Age over 51 years old, diameter larger than 26mm, uncircumscribed margin and the presence of structure distortion, vascularity and abnormal axillary lymph nodes were identified to be independent factors for malignancy. Combining these factors to differentiate benign from malignant group, the value of AUC, sensitivity, specificity, PPV and NPV reached 0.840, 65.5%, 87.8%, 81.3% and 75.9% respectively.

CONCLUSION

Complex cystic and solid breast lesions should be at least categorized to BI-RADS 4B, and type III lesions classified as BI-RADS 4C may also be reasonable. HHUS is useful in distinguishing benign and malignant complex cystic and solid breast lesions.

CLINICAL RELEVANCE/APPLICATION

Complex cystic and solid breast lesions are usually simply classified as category 4 and their subclassifications depend on doctors' experience. Based on a large number of cases, this study suggests more accurate subclassification of cystic and solid lesions could be achieved by HHUS which is useful in clinical practice.

BR257-SD-SUA4 Mammography Performance Benchmarks in a Population-Based Screening Cohort of One Million Digital Examinations

Station #4

Awards

Trainee Research Prize - Resident

Participants
Mattie Salim, MD, Stockholm, Sweden (*Presenter*) Nothing to Disclose
Karin Dembrower, MD, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose
Martin Eklund, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose
Peter Lindholm, MD, PhD, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose
Fredrik Strand, MD,PhD, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Our aim was to establish performance benchmarks for AI tumor detection by examining the performance of breast radiologists and to determine for which tumor types sensitivity differ the most.

METHOD AND MATERIALS

The study population consisted of all examinations for women 40 to 74 years of age in a defined geographical area who underwent screening examinations between 2008 and 2015 using FFDM. There were 110 interpreting radiologists of which 24 were defined as breast radiologists based on exceeding 5,000 annual exams. True positive was defined by obtaining a pathology-confirmed cancer within 12 months. Performance benchmarks included sensitivity and specificity, which were examined per quartile of radiologists' performance and subdivided by tumor characteristics.

RESULTS

After exclusion of 23,033 examinations with unknown radiologist, there were 1,186,045 screening examinations with digital mammograms, of which 972,899 had been assessed by a breast radiologist. For the least sensitive quartile of breast radiologists, sensitivity and specificity was 58% and 98% respectively. For the most sensitive quartile the corresponding numbers were 83% and 95% ($p<=0.001$ for difference between quartiles). The relative sensitivity differences between most and least sensitive quartile was 4.3 ($p<0.001$) for lobular cancers, 1.6 ($p<0.001$) for ductal cancers; 1.9 ($p<0.001$) for luminal A, 3.2 ($p=0.019$) for luminal B, 4.5 ($p=0.020$) for Her2-overexpressing and 3.9 ($p=0.005$) for basal tumors. Relative sensitivity differences related to tumor size and invasiveness were less pronounced.

CONCLUSION

We determined benchmarks showing a wide range of performance differences between breast radiologists. Lobular cancers and Her2-overexpressing cancers were associated with the largest relative sensitivity differences and may require deliberate training to master.

CLINICAL RELEVANCE/APPLICATION

We have established mammographic performance benchmarks, and quantified the sensitivity differences by tumor subtypes, to use as guidance for radiologist training and AI CAD system evaluations.

BR258-SD-SUA5 Association of the Kaiser Score with Invasiveness of Breast Cancer: Could it Provide Actionable Information?

Station #5

Participants
Matthias Dietzel, MBA,MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Rudiger Schulz-Wendtland, MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Stephan Ellmann, MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Evelyn Wenkel, MD, Erlangen, Germany (*Abstract Co-Author*) Speaker, Siemens AG
Paola Clauser, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Michael Uder, MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Pascal A. Baltzer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Matthias S. May, MD, Erlangen, Germany (*Presenter*) Speakers Bureau, Siemens AG

PURPOSE

The Kaiser-Score (KS) is an evidence based decision rule based on MRI BI-RADS descriptors. High diagnostic accuracy in the differential diagnosis of benign vs. malignant lesions and high inter-observer reliability has been demonstrated by numerous investigators at multiple institutions. We investigated whether there is also an association between the KS and invasiveness of breast cancer.

METHOD AND MATERIALS

Consecutive patients scheduled for breast MRI (standardized protocols @ 1.5T: dynamic T1-GRE before/after Gd-DTPA [0.1 mmol/kg body weight]; T2-TSE), with subsequent pathological sampling, were investigated. The KS was assessed by two experienced radiologists in consensus (blinded to pathology). Association of KS with invasiveness (benign vs. ductal carcinoma in situ [DCIS] vs. malignant) was assessed by descriptive statistics, Kruskal-Wallis test, correlation- and ROC-analysis (a=5%).

RESULTS

There were 71 DCIS, 531 invasive cancers and 436 benign lesion in 986 patients (mean age: 55.3y, range: 16-87y). There was a significant correlation of the KS with invasiveness (rho=0.7; $P<0.001$). KS enabled the differentiation of DCIS both from benign lesions (AUCDCIS vs. benign=74%; $P<0.001$) and from invasive cancer (AUCDCIS vs. invasive=77.2%; $P<0.001$). A KS >9 accurately identified invasive cancers (specificity=97.6%, sensitivity=41.5%, positive likelihood ratio/+LR=17.4). A KS <6 accurately identified DCIS (specificity=94.0%, sensitivity=33.8%, +LR=5.6).

CONCLUSION

The KS reflects invasiveness of breast cancer. Using appropriate thresholds, the KS enables almost definite identification of patients with invasive breast cancers.

CLINICAL RELEVANCE/APPLICATION

The KS can differentiate DCIS from invasive cancer. Such actionable information could aid the treatment strategy and impact for example the type or extent of breast surgery and the approach to the axillary staging.

BR189-ED-SUA6 Risk-y Business: ATMs to CHEKs: Understanding Risk of Breast Cancer in Patients with Genetic Mutations

Station #6

Awards
Cum Laude

Participants
Zara Wadood, MD, Providence, RI (*Presenter*) Nothing to Disclose
Lauren Massingham, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Z Liu, MD, Providence , RI (*Abstract Co-Author*) Nothing to Disclose
Bianca M. Carpentier, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Review some of the common genetic terminology as it relates to increased risk of breast cancer. 2. Understand the purpose of multi-gene panel testing and why its use is increasing. 3. Learn about five of the more common genetic mutations besides BRCA which have been linked to an increased risk of breast cancer. 4. Learn how these specific mutations relate to different types of breast cancer. 5. Learn where to access useful updated resources regarding gene mutations and their relationships to risk of breast cancer.

TABLE OF CONTENTS/OUTLINE

1. Genetic terminology (i.e. VUS) 2. Direct to consumer genetic testing (i.e. 23 and me) Uses and limitations 3. Overview of genetic mutations (p53, ATM, CDH1, CHEK2, PALB2) 4. Respective increased risk of breast cancer Specific types, when applicable 5. Sample Cases 6. Future Direction and Summary

BR190-ED-SUA7 The Picture is Clear: Acoustic Parameters in Breast Ultrasound (A Primer for Residents and Fellows)

Station #7

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Matthew Bigelow, MD, Vestal, NY (*Presenter*) Nothing to Disclose
Ekta Gupta, MD, Floral Park, NY (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. The value of breast ultrasound (US) for the detection of breast lesions depends on image quality, which itself is heavily operator dependent. 2. Knowledge of various technical parameters is imperative for image optimization and accurate diagnsois. 3. Breast US should be performed using a high-resolution broadband linear transducer (TD) with a center frequency of at least >12 MHz or greater. 4. In macromastic patients, lower frequency TDs may augment a standard exam. However, radiologists should be aware of the inverse relationship between depth penetration and spatial resolution. 5. When gain is too low, fat lobules darken and a solid mass can mimic a cyst. Conversely if the gain is too high, fat lobules brighten mistaking a cyst for a solid mass. 6. Harmonic imaging reduces artifacts such as reverberation, side-lobe, clutter and speckle, improving contrast resolution.

TABLE OF CONTENTS/OUTLINE

1. Approach for optimizing breast ultrasound images 2. Review of following US parameters along with clinically relevant US physics: a. Transducer frequency b. Depth and Field of View (FOV) c. Focal Zone d. Gain and Dynamic range e. Tissue harmonics f. Spatial compounding g. Doppler imaging 3. Physics related pearls and pitfalls in evaluating lesions

BR191-ED-SUA8 BI-RADS 5 - NOT!

Station #8

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Kimberly A. Dao, MD, Boston, MA (*Presenter*) Nothing to Disclose
Rutuparna Sarangi, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Anna Rives, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael D. Fishman, MD, Boston, MA (*Abstract Co-Author*) Consultant, Zebra Medical Vision Ltd; Scientific Advisory Board, Hologic, Inc
Priscilla J. Slanetz, MD,MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

A BI-RADS category 5 assessment is used when, based on imaging findings, the likelihood of malignancy is felt to be >= 95%. However, not all BI-RADS 5 lesions are malignant. There are a variety of benign entities that may be categorized as BI-RADS 5 and prompt surgical excision or repeat biopsy when encountered on percutaneous core biopsy. Radiologists should be aware of these

BI-RADS 5 mimickers in order to inform optimal patient management.

TABLE OF CONTENTS/OUTLINE

Describe the proper use of the BI-RADS category 5 and its implications for management. Review classic imaging features of breast cancer on multimodality imaging (mammography, ultrasound and magnetic resonance imaging). Discuss imaging findings (mammography, ultrasound and MRI) and management of a variety of benign diseases that may be categorized as BI-RADS 5, including: Chronic mastitis Complex sclerosing lesion/radial scar Diabetic mastopathy Fat necrosis Fibromatosis or desmoid tumor Granular cell tumor Granulomatous mastitis Infection, such as from mycobacterium avium intracellulare (MAI)

BR192-ED-SUA9 Imaging Features and Biopsy Techniques of Internal Mammary Lymph Nodes in Breast Cancer

Station #9

Participants
Lucy Chow, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Craig Wilsen, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Anne C. Hoyt, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Melissa M. Joines, MD, Manhattan Beach, CA (*Abstract Co-Author*) Nothing to Disclose
Robert D. Suh, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Kara-Lee Pool, MD , Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The internal mammary lymph node basin receives lymphatic drainage from all four quadrants of the breast, but mainly from the medial and central breast. Isolated internal mammary nodal metastasis is identified in a small percentage of overall breast cancers; however internal mammary nodal disease has significant prognostic and therapeutic implications. Though more challenging than axillary lymph node biopsy, internal mammary lymph node biopsy safely delivers timely and valuable guidance for management of breast cancer patients. Objectives: 1) Describe the significance of the internal mammary lymph nodes in the setting of breast cancer 2) Appreciate multimodality ultrasound, CT, and MRI image findings for internal mammary lymph nodes 3) Review ultrasound-guided and CT-guided techniques of internal mammary lymph node biopsy 4) Understand the management of breast cancer patient with internal mammary lymphadenopathy

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Anatomy of the internal mammary lymph node chain 3. Review of multi-modality ultrasound, CT, and MRI imaging characteristics of internal mammary lymphadenopathy 4. Differential diagnosis of internal mammary lymphadenopathy 5. Ultrasound-guided and CT-guided biopsy techniques 6. Medical and surgical management of breast cancer patient with internal mammary lymphadenopathy 7. Illustrative cases 8. Summary

VW36

ABUS: Reducing False Positives: Presented by GE Healthcare

Sunday, Dec. 1 12:30PM - 1:00PM Room: South Building, Booth 5135

Participants

Marc F. Inciardi, MD, Westwood, KS (*Presenter*) Faculty, General Electric Company; Consultant, Qview Medical, Inc

Program Information

Learn strategies to reduce call backs with screening automated breast ultrasound. Dr. Marc Inciardi, MD, from the University of Kansas Medical Center, will review the mindset of screening ultrasound and share techniques to increase reading consistency and confidence. Participate in hands-on review of unknown clinical cases to resolve "fake-outs" vs. real pathology. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

BRS-SUB

Breast Sunday Poster Discussions

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

VA IR BR

AMA PRA Category 1 Credit ™: .50

Participants

Thomas H. Helbich, MD, Vienna, Austria (*Moderator*) Research Grant, Medicor, Inc ; Research Grant, Siemens AG ; Research Grant, C. R. Bard, Inc; Research Grant, Guerbet SA; Research Grant, Novomed GmbH

Sub-Events

BR221-SD-SUB1 Combined Use of Automated Volumetric Analysis of Breast Cancer Vascularization, Machine Learning and MRI: A Perfect Trio to Predict Survival Outcome in Breast Cancer Patients?

Station #1

Participants

Matthias Dietzel, MBA,MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Rudiger Schulz-Wendtland, MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Stephan Ellmann, MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Evelyn Wenkel, MD, Erlangen, Germany (*Abstract Co-Author*) Speaker, Siemens AG
Michael Uder, MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Pascal A. Baltzer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Matthias S. May, MD, Erlangen, Germany (*Presenter*) Speakers Bureau, Siemens AG

PURPOSE

To investigate whether combined use of automated volumetric analysis of breast cancer vascularization (VAV), machine learning (ML) and MRI (1) improves survival prediction in breast cancer patients and hereby (2) provides actionable information.

METHOD AND MATERIALS

Within this retrospective, IRB-approved study, 314 consecutive patients with primary invasive breast cancer received standard MRI (14 minutes) before the initiation of treatment. Diagnostic work-up, treatment, and follow-up was done at one tertiary care, academic breast-center (disease specific survival/DSS=279; death from breast cancer=35). The Nottingham Prognostic Index (NPI) was used as the reference method with which to predict survival of breast cancer. Based on the raw MRI enhancement data, automated analysis of VAV was accomplished by commercially available, FDA-cleared software. Based on VAV, ML was used to identify PHENOTYPES that provided a specificity >99% for DSS (classification and regression trees). Results of ML were 10-fold cross-validated. Predictions of survival based on PHENOTYPES NPI PHENOTYPES plus the NPI in combination (NPI+) were investigated (Cox-regression and Kaplan-Meier statistics).

RESULTS

In 42.7% (134/314) of the patients ML identified PHENOTYPES. If a PHENOTYPE was present, occurrence of disease related death could be practically ruled out in this patient. 21.6 % (29/134) of these patients showing a PHENOTYPE, would have been falsely predicted by NPI as at-risk for disease-specific death. Inclusion of PHENOTYPES into the NPI significantly improved the prediction of survival by 31.5% (29/92). This gave a hazard ratio/HR of 8.5 for NPI+ compared to the standard NPI (HRNPI = 5.4; P=0.03). The improvement of prediction of survival by breast MRI was verified for all molecular subtypes.

CONCLUSION

Combined use of automated ML, VAV and MRI improved the survival prediction in breast cancer patients.

CLINICAL RELEVANCE/APPLICATION

The proposed method provides PHENOTYPES suggestive of a favorable outcome: These actionable information could be applied in the management of breast cancer. First of all they can be used as a 'Gatekeeper', in order to decide whether a more aggressive therapy (chemotherapy) is actually warranted. Another application is the combination with further prognostic data (genetic analysis, pathology etc.). This creates synergistic effects and further optimizes outcome prediction.

BR225-SD-SUB2 Mammographic Mean Glandular Dose in the Implant Displaced View: Proceed with Caution

Station #2

Participants

Melissa L. Hill, PHD, Issy Les Moulineaux, France (*Presenter*) Consultant, Volpara Health Technologies Limited
Hannah Gilroy, Wellington, New Zealand (*Abstract Co-Author*) Employee, Volpara Health Technologies Limited
Monica H. Saini, MS, MD, Glendale, AZ (*Abstract Co-Author*) Employee, Volpara Health Technologies Limited
Ralph P. Highnam, PhD, Wellington, New Zealand (*Abstract Co-Author*) CEO, Volpara Health Technologies Limited

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PURPOSE

The potential for relatively high mean glandular dose (MGD) for women with breast implants compared to women without is well

The potential for relatively high mean glandular dose (MGD) for women with breast implants compared to women without is well known in digital mammography (DM). Exams may include up to 8 routine views; 4 implant displaced (ID), and 4 with the implant in full view (IF). Given an increasing fraction of the screening population with breast implants, and a question of whether to apply breast tomosynthesis, conventional mammography, or both for these women, the topic of radiation dose is timely for this sub-population. While other researchers have reported that IF view MGD can be higher than in conventional views (CV), the ID view MGD has received little attention. Here we study ID view MGD in clinical practice.

METHOD AND MATERIALS

In a retrospective survey of 70 North American and Australasian sites, DM exam data from 155,000 women with implants and 310,000 women without were reviewed. Images represent four vendors (Fuji, Siemens, Hologic, and GE) and six machine types. The CV and ID view MGD was calculated using Volpara software, which applies the Dance model with a glandularity factor determined according to patient volumetric breast density. Since compressed breast thickness (CBT) has a large influence on MGD, each ID view was matched to a CV view on CBT to within 1 mm. The CV and ID views were grouped into CBT categories for statistical comparison.

RESULTS

A total of 120,474 CV and ID view pairs were included for analysis. For some vendor systems, ID view MGD was significantly greater than CV MGD, and especially at low CBT. Sampling ID views with high doses revealed two main causes; (1) inappropriate manual technique factor selection, and (2) use of automatic exposure control when the implant was partially in view. As such, local exposure practices and machine-specific exposure control features are believed to influence the relative differences between CV and ID view MGD, and will be the topic of future work.

CONCLUSION

In routine clinical practice the MGD of ID views is often higher than the CV MGD for women without implants. Care should be taken when acquiring ID views as inappropriate technique factor selection and implant/breast positioning can have substantial implications for patient MGD.

CLINICAL RELEVANCE/APPLICATION

We demonstrate that implant displaced view dose is frequently high at low compressed breast thickness. Caution when imaging women with breast implants is recommended to avoid unnecessary exposure.

BR226-SD-SUB3 Assessment of Perfusion Parameters and Enhancing Characteristics of Breast Cancer on Dynamic Contrast Enhanced Magnetic Resonance Imaging (DCE-MRI)

Station #3

Participants
Hyeji Ryu, Iksan, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hye-won Kim, MD,PhD, Iksan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seri Kang, Iksan , Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate the value of dynamic contrast enhanced magnetic resonance imaging (DCE-MRI) parameters as an imaging biomarker for predicting angiogenesis in the breast cancer.

METHOD AND MATERIALS

A total of 102 invasive ductal carcinomas (IDCs) in 102 women who underwent preoperative breast DCE-MRI on a 3T scanner were enrolled in this study. Twenty-fifth, 50th, 75th percentile and coefficient of variation (CV) of each perfusion parameter (Ktrans, Kep, Ve and Vp) were calculated within each tumor. Tumor size, shape, margin, internal enhancement and background parenchymal enhancement (BPE) were assessed based on breast imaging reporting and data system (BI-RADS) 5th edition. We evaluated the kinetic features of the tumors including delayed enhancement and percent of curve peak using computer-aided detection (CAD) system. Presence of adjacent vessel sign and ipsilateral whole breast vascularity were also evaluated. The student's t-test or Mann-Whitney U test were used for comparison of two groups and ANOVA or Kruskal-Wallis test for multiple groups. Pearson or Spearman correlation analysis was performed for numerical variables.

RESULTS

Rim enhancing breast cancers showed lower Vpmedian, Vp75 and VpCV than non-rim enhancing tumors ($p<.05$). Tumors with washout kinetic pattern presented higher Ktrans25, Ktransmean, Ktransmedian, Ktrans75, Kep25, Kepmean, Kepmedian and Kep75 than tumors with persistent and plateau pattern ($p<.01$). The percent of curve peak of tumor showed moderate positive correlation with Ktrans25, Ktransmean, Ktransmedian and Ktrans75 ($r>.600$, $p=.000$). Tumors with positive adjacent vessel sign exhibited higher Kep25, Kepmean, Kepmedian and Kep75 than tumors with negative adjacent vessel sign ($p<.03$). On the other hand, tumor size, shape, margin, BPE and ipsilateral whole breast vascularity showed no significant correlation.

CONCLUSION

We identified enhancing features of breast cancer, regarded to reflect tumor angiogenesis, tend to have a better correlation with perfusion parameters than morphologic features do. Therefore, DCE-MRI perfusion parameters of breast cancer can be useful imaging biomarkers for prediction of tumor angiogenesis.

CLINICAL RELEVANCE/APPLICATION

DCE-MRI may be used to anticipate the treatment response and their prognosis as they reflect the tumor angiogenesis which decides the tumor characteristics.

BR259-SD-SUB4 In the National Mammography Database (NMD), BI-RADS 3 Lesions Are Suspicious in Women with a Personal History of Breast Cancer

Station #4

Participants

Wendie A. Berg, MD, PhD, Gibsonia, PA (*Presenter*) Nothing to Disclose
Jeremy M. Berg, PhD, Gibsonia, PA (*Abstract Co-Author*) Nothing to Disclose
Cindy S. Lee, MD, Garden City, NY (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

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PURPOSE

Specific mammographic findings with <= 2% malignancy rate can be safely followed with imaging surveillance. However, this approach may not apply to women with a personal history of breast cancer (PHBC). This study assesses the cancer yield of BI-RADS 3 (BR3) assessments among women with personal history of breast cancer in the National Mammography Database (NMD).

METHOD AND MATERIALS

This retrospective cohort HIPAA-compliant study included all women recalled from screening mammography followed by BR3 assessment at additional evaluation from 2009 to 2018, from 471 NMD facilities. We included only the first BR3 occurrence, for women who underwent biopsy or >= 2-year imaging follow-up or downgrade to BI-RADS 1 or 2 with >= 1-year follow-up. PHBC was determined by patient-report, facility-provided indication, or history of biopsy proven malignancy in the NMD. PPV3 = number of cancers over biopsies performed. Cancer yield (CY) = number of breast cancers per the number of women.

RESULTS

Among 67,995 women with BR3 findings, 2087 (3.1%) women had PHBC (median age 65 yrs; range 32-90). For women with PHBC, overall biopsy rate of BR3 lesions was 26.1% (545/2087), yielding 339 cancers, PPV3 62.2%, CY 16.2% (339/2087; 95%CI 14.7 to 17.8%). 850 women with PHBC were downgraded to BI-RADS 1 or 2 at follow-up visits, and 38 (4.5%) of those underwent biopsy, yielding 25 (65.8%) cancers, CY 2.9%. In comparison, for 65,908 women without PHBC, overall biopsy rate was 10.06% yielding 885 cancers, PPV3 13.3%, CY 1.34%. 44,358 women without PHBC were downgraded to BI-RADS 1 or 2 at follow-up visits, 111 of which were malignant, CY 0.25% ($p<0.0001$ vs. those without PHBC, both comparisons).

CONCLUSION

In the NMD, overall cancer yield for BI-RADS 3 findings in women with PHBC was 16.2%, far exceeding the acceptable rate of 2% and far exceeding the observed 1.34% rate among women without PHBC ($p<0.0001$). PPV3 in this group was also significantly greater than in women without PHBC, at 62.2% vs. 13.3% ($p<0.0001$), respectively. Even among lesions downgraded to BI-RADS 1 or 2 at follow-up, malignancy rate exceeded 2% among women with PHBC.

CLINICAL RELEVANCE/APPLICATION

Imaging findings that would otherwise be considered BI-RADS 3 in average-risk women should generally prompt biopsy in woman with personal history of breast cancer.

BR260-SD-SUB5 Unenhanced Breast Cancer Screening with Diffusion Weighted MRI: Increased Image Quality and Lesion Visibility Using Synthetic b-Values

Station #5

Participants

Hubert Bickel, MD, Vienna, Austria (*Presenter*) Nothing to Disclose
Stephan H. Polanec, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Georg J. Wengert, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Katja Pinker-Domenig, MD, New York, NY (*Abstract Co-Author*) Speakers Bureau, Siemens AG ; Advisory Board, Merantix Healthcare GmbH
Wolfgang Bogner, MSc, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Thomas H. Helbich, MD, Vienna, Austria (*Abstract Co-Author*) Research Grant, Medicor, Inc ; Research Grant, Siemens AG ; Research Grant, C. R. Bard, Inc; Research Grant, Guerbet SA; Research Grant, Novomed GmbH
Pascal A. Baltzer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

High b-value images from diffusion weighted magnetic resonance imaging (DWI) should enable better unenhanced visibility of malignant breast tumors, but are prone to artifacts and prolonged measurement times. The purpose of this study was to evaluate, whether image quality and visibility of malignant breast lesions on can be increased by using synthetic b-values.

METHOD AND MATERIALS

For this IRB-approved, retrospective study, DWI images obtained at 3T from 52 patients with histopathologically verified malignant breast tumors were evaluated by 4 independent readers. From original acquisitions at b=50 and 850s/mm^2, synthetic images were calculated at b=1000, 1200, 1400, 1600, 1800 and 2000s/mm^2. Image quality and lesion visibility were rated using visual grading characteristics (1-5, 5 as the best score). Scores were compared using Friedman and post-hoc by pair-by-pair Wilcoxon signed rank tests. Reproducibility was evaluated using intra class correlation (ICC).

RESULTS

Synthetic images with b-values of 1400-1800s/mm^2 were given the best ratings for image quality (mean ranks 4.49-4.84), with mostly significant differences to the other b-values (p=<.001 to .069), while lesion visibility was rated best at b-values of 1200-1600s/mm^2 (mean ranks 4.65-5.37) with significant differences to the other b-values (p=<.001 to .049). Interreader agreement was moderate concerning image quality (ICC .50-.67) and high concerning lesion visibility (.70-.93).

CONCLUSION

Synthetically increased b-values provide increased image quality and lesion visibility of malignant breast tumors compared to images obtained at usual b-values, while avoiding the disadvantages of performing DWI at such high b-values.

CLINICAL RELEVANCE/APPLICATION

Synthetic b-valus increase the value of DWI for non-invasive and radiation-free breast evaluation and are one step towards optimizing DWI as a tool for unenhanced breast cancer screening.

BR193-ED-SUB6 Beyond BI RADS: Non-Mass Lesions (NMLs) on Breast Ultrasonography -Concept and Clinical Relevance

Station #6

Awards
Certificate of Merit

Participants
Hellen F. Castro, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Giselle G. Mello, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Tatiana C. Tucunduva, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Vanessa R. Sacramento, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Carlos Shimizu, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Luciano F. Chala, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Vera N. Aguillar, MD, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Thiago Henrique M. Costa, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Gustavo C. Lima, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Antonio Gaziero, 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: To conceptualize NMLs. To recognize and illustrate the main etiological causes of NMLs. To review the features to describe NMLs on breast ultrasound. To understand most important predictors of malignancy. To correlate NMLs with other breast imaging methods (mammography and MRI) To discuss practical clinical management and follow up.

TABLE OF CONTENTS/OUTLINE

ULTRASOUND CRITERIA FOR NMLs. ETIOLOGY OF NMLs: physiological, benign (Fibrocystic change, gynecomastia, adenosis, diabetic mastophaty, PASH, papillomatosis, atypical hyperplasia and post-surgical changes), inflammatory (mastitis) and malignant changes (DCIS, inflammatory carcinoma, pleomorphic lobular carcinoma, lymphoma, leucemia, IDC with extensive DCIS). IMAGING FEATURES AND PREDICTORS OF MALIGNANCY - (MORFOLOGY): hypoechoic area (indistint, mottled and geographic), ductal changes (dilatation, wall thickening, irregularity of the caliber, internal echoes or tiny cysts and ductal stacking), a multiple vesicular pattern (small cysts), focal shadowing. (DISTRIBUTION): focal, linear, segmental or regional. ADDITIONAL FINDINGS AND OTHER METHODS: Mammography (calcifications, asymmetry, architectural) and MRI (mass and non-mass enhancement). CLINICAL CASES WITH PRACTICAL GUIDELINE FOR INTERPRETATION AND FOLLOW UP

BR194-ED-SUB7 Radiological Findings After Breast Lipofilling: What Radiologists Need to Know

Station #7

Awards
Cum Laude

Participants
Karina Pesce, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Maria P. Swiecicki, MD, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose
Maria Jose Chico, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Maria B. Orruma, MD, Hudson, Argentina (*Abstract Co-Author*) Nothing to Disclose
Roxana A. Gerosa, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Horacio Mayer, Capital Federal, Argentina (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

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TEACHING POINTS

To describe the radiological appearance of normal and pathological findings resulting from mammary autologous fat injections. To describe the indications and technique of breast remodeling with autologous fat. To analyze the safety of the use of lipofilling in patients with previous diagnosis of breast cancer.

TABLE OF CONTENTS/OUTLINE

Introduction Background and History Indications and Patient Selection Description of the surgical technique Role of imaging after breast lipomodelling Remodelling of the mammary volume after conservative treatment of breast cancers, clinical and radiological considerations Appearance: mammographic, ultrasonography and magnetic resonance imaging Clinical cases Follow up Conclusion: This technique is best performed with a multidisciplinary team: it is key for the radiologist to be familiar with the technique and to recognise radiological features of the breast after lipofilling.

BR195-ED-SUB8 Missteps in Mammography and Approaches to Avoid Them

Station #8

Participants
Shannon Lanzo, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Junjian Huang, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Dayna Levin, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Hima Prabhakar, MD, Moorestown, NJ (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

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TEACHING POINTS

1. Importance of direct comparison of all prior imaging in determining the significance of a finding (new versus stable) 2. Significance of reviewing breast tissue across all available modalities, including non-breast dedicated studies 3. Correct localization of lesions using triangulation techniques 4. Necessity of complete and accurate documentation to ensure appropriate patient follow-up (biopsy versus watchful waiting) 5. Case-based review of potential missteps including inaccurate localization of lesions, lack of trending findings across prior examinations including non-breast dedicated studies (e.g. PET/CT), and inappropriate follow-up of breast lesions

TABLE OF CONTENTS/OUTLINE

• Breast findings suggestive of malignancy on cross-sectional imaging • Breast lesion localization techniques, including the use of the digital breast tomosynthesis scroll bar • Interpretation strategies including looking for new/growing masses, areas of asymmetry, and subtle architectural distortion • Effective strategies to communicate mammogram results to referring healthcare providers and patients • Case based review of breast findings including findings on non-dedicated breast examinations and changes across sequential mammograms

BR196-ED-SUB9 Everything but BRCA: Imaging Hereditary Breast Cancer Genes

Station #9

Awards

Certificate of Merit

Participants
Charmi Vijapura, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose
Rifat A. Wahab, DO, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Mary C. Mahoney, MD, Cincinnati, OH (*Abstract Co-Author*) Researcher, General Electric Company

For information about this presentation, contact:

charmiv@gmail.com

TEACHING POINTS

Discuss the gene mutations associated with breast cancer outside of BRCA Review the current literature about the genetics and molecular biology that increases the risk of breast cancer in these gene mutations Understand the multimodality imaging approach to evaluation of hereditary breast cancer genetic mutations Explain the lifetime risk and breast imaging screening recommendations Recognize the differences in treatment and management in genetically driven breast cancers

TABLE OF CONTENTS/OUTLINE

Overview of genetics and molecular biology of the common hereditary breast cancer genes Screening recommendations Imaging cases and specific considerations ATM BARD1 BRIP1 CDH1 CHEK2 MLH1/MSH6 NBN NF1 PALB2 PTEN STK11 TP55 Treatment and management considerations

VW81

Diagnosing Millimeter-sized Cancers with ASPIRE Cristalle: Presented by FUJIFILM Medical Systems U.S.A., Inc.

Sunday, Dec. 1 1:15PM - 2:15PM Room: South Building, Booth 5147

Participants

Dean Phillips, Stamford, CT (*Presenter*) Nothing to Disclose

Program Information

Diagnosing small cancers in dense breasts can be difficult. This interactive workshop, using a large number of clinical examples, will introduce attendees to how recent technical advances have the potential to help identify millimeter-sized cancers in dense breasts and bring them to the forefront.

Printed on: 10/29/20

VW37

Automating Breast Ultrasound: A Live Experience: Presented by GE Healthcare

Sunday, Dec. 1 1:30PM - 2:00PM Room: South Building, Booth 5135

Program Information

This 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.
RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

RC115

Advanced MRI Applications

Sunday, Dec. 1 2:00PM - 3:30PM Room: E353C

BR MR

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

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

For information about this presentation, contact:

zuleyml@upmc.edu

Sub-Events

RC115A AB-MRI

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) in screening average risk women with dense breasts. 2) Review the current data on the performance of AB-MR compared to DBT and WBUS. 3) Appropriately characterize lesions found on AB-MR and improve interpretation accuracy.

RC115B Ultrafast MRI

Participants
Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Presenter*) 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

LEARNING OBJECTIVES

1) To design a breast MRI protocol incorporating ultrafast breast MRI. 2) To learn how to interpret ultrafast breast MRI. 3) To understand the clinical value of ultrafast breast MRI in lesion detection and classification.

RC115C DWI and Multiple Parametric Imaging

Participants
Katja Pinker-Domenig, MD, New York, NY (*Presenter*) Speakers Bureau, Siemens AG ; Advisory Board, Merantix Healthcare GmbH

For information about this presentation, contact:

pinkerdk@mskcc.org

LEARNING OBJECTIVES

1) Describe the principle of DWI of the breast. 2) Define the basic requirements for the clinical application of DWI in breast imaging. 3) Understand the role of DWI as an essential part of a multiparametric breast MRI protocol. 4) Use multiparametric breast MRI in clinical practice.

ABSTRACT

Magnetic resonance imaging (MRI) of the breast is undisputedly the most sensitive imaging method to detect cancer, with a higher detection rate than mammography, digital breast tomosynthesis, and ultrasound. To overcome limitations of dynamic contrast-enhanced (DCE) MRI in specificity, additional functional MRI parameters have been explored, with diffusion-weighted imaging (DWI) emerging as the most robust and reliable. In DWI, the random movement of water molecules in body tissue can be visualized and quantified by calculating the apparent diffusion coefficient (ADC). Malignancies typically show restricted water molecule diffusivity with higher signal on DWI images and lower signal on ADC maps due to increased cell density, which leads to compression of extracellular space and microstructural changes. Breast DWI can be easily combined with DCE-MRI in every breast MRI protocol without substantially increasing the total scan time, an approach defined as multiparametric MRI. Several studies have demonstrated that multiparametric MRI of the breast with DCE-MRI and DWI can provide a high sensitivity, specificity, and diagnostic accuracy, obviating unnecessary breast biopsies in benign breast tumors. It is therefore increasingly being implemented in clinical routine for an improved cancer detection, characterization and treatment response assessment. Other functional MRI parameters are currently under investigation for the clinical implementation in a multiparametric MRI concept. This presentation aims to provide a comprehensive overview of the current applications and challenges of multiparametric MRI of the breast in the clinical setting.

RC150

MR Imaging-guided Breast Biopsy (Hands-on)

Sunday, Dec. 1 2:00PM - 3:30PM Room: E260

BR MR

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

Participants
Amy L. Kerger, DO, Plain City, OH (*Presenter*) Nothing to Disclose
Kirti M. Kulkarni, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Wendi A. Owen, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Gary J. Whitman, MD, Houston, TX (*Presenter*) Nothing to Disclose
Mai A. Elezaby, MD, Madison, WI (*Presenter*) Research Grant, Exact Sciences Corporation
Amado B. del Rosario, DO, Mesa , AZ (*Presenter*) Nothing to Disclose
Mitra Noroozian, MD, Ann Arbor, MI (*Presenter*) Institutional Grant, General Electric Company; Investigator, General Electric Company
Anika N. Watson, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Lara D. Richmond, MD, Toronto, ON (*Presenter*) Nothing to Disclose
Nikki S. Ariaratnam, MD, Moorestown, NJ (*Presenter*) Consultant, Cleerly, Inc
Clayton R. Taylor, MD, Upper Arlington, OH (*Presenter*) Nothing to Disclose
Rifat A. Wahab, DO, Cincinnati, OH (*Presenter*) Nothing to Disclose
Laurie R. Margolies, MD, New York, NY (*Presenter*) Research Consultant, FUJIFILM Holdings Corporation; Research Consultant, Imago Corporation
Vandana M. Dialani, MD, Boston, MA (*Presenter*) Nothing to Disclose
Esther N. Udoji, MD, Birmingham, AL (*Presenter*) Nothing to Disclose
Jill J. Schieda, MD, Avon Lake, OH (*Presenter*) Nothing to Disclose
Su-Ju Lee, MD, Cincinnati, OH (*Presenter*) Spouse, Stockholder, General Electric Company; Spouse, Stockholder, Siemens AG
Elsa M. Arribas, MD, Houston, TX (*Presenter*) Scientific Advisory Board, Volumetric Biotechnologies, Inc; Stockholder, Volumetric Biotechnologies, Inc
Karen A. Lee, MD, New York, NY (*Presenter*) Nothing to Disclose
Ami D. Shah, MD, New York, NY (*Presenter*) Nothing to Disclose
Katharine D. Maglione, MD, New York, NY (*Presenter*) Nothing to Disclose
Wade C. Hedegard, MD, Brighton, NY (*Presenter*) Nothing to Disclose
Manisha Bahl, MD,MPH, Boston, MA (*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.

Active Handout:Amy L. Kerger

http://abstract.rsna.org/uploads/2019/6005779/Active RC150.pdf

VW65

Increase Confidence and Improve Workflow Efficiencies with High Resolution Imaging Technology: Presented by Hologic, Inc.

Sunday, Dec. 1 2:00PM - 3:15PM Room: South Building, Booth 5119

Participants

Stacy A. Smith-Foley, MD, Fayetteville, AR (*Presenter*) Speakers Bureau, Myriad Genetics, Inc; Scientific Advisory Board, Hologic, Inc

Program Information

Discover how transitioning to Clarity HD® high-resolution imaging with Intelligent 2D® synthesized 2D images and 3DQuorum® may increase reading confidence, improve workflow efficiency while decreasing patient dose. The session includes high-resolution images with 3DQuorum® for attendees to view during the hands-on case-review. *Adding this session to your agenda does not secure your seat in this session. Secure your seat onsite by visiting Hologic's Workshop Room # 5119 in the South Hall.*

Printed on: 10/29/20

VW38

AI-based Decision Support for Diagnostic Breast Ultrasound: Presented by GE Healthcare

Sunday, Dec. 1 2:30PM - 3:00PM Room: South Building, Booth 5135

Participants

Michael Washburn, MS, Wauwatosa, WI (*Presenter*) Nothing to Disclose

Program Information

Clinicians can interpret up to one in three cases differently. How can they reduce variability in BI-RADS categorization to achieve greater consistency and confidence in the decision-making process? This new proprietary algorithm automatically classifies user-selected region(s) of interest (ROIs) containing a breast lesion into four BI-RADS-aligned categories (Benign, Probably Benign, Suspicious, Probably Malignant), and displays a continuous graphical confidence level indicator of where the lesion falls across all categories. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

VW82

The Role of Dual-angle Tomosynthesis in Assessment and Risk Situations: Presented by FUJIFILM Medical Systems U.S.A., Inc.

Sunday, Dec. 1 2:30PM - 3:30PM Room: South Building, Booth 5147

Participants

Claudia Kurtz, MD, Lucerne, Switzerland (*Presenter*) Nothing to Disclose

Program Information

This session begins by introducing the physical properties of narrow-angle vs. wide-angle DBT and, using a large number of clinical examples, compares their impact on overall imaging performance and lesion visualization. The session then progresses to comparison of DBT reconstruction methods (Filtered Back Projection vs. Iterative) and their effect on slice image quality and the production of synthetic 2D images. The session finishes with discussions on breast density assessment methods and Contrast Enhanced Subtraction Mammography (CESM).

Printed on: 10/29/20

VW39

Automating Breast Ultrasound: A Live Experience: Presented by GE Healthcare

Sunday, Dec. 1 3:30PM - 4:00PM Room: South Building, Booth 5135

Program Information

This 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.
RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

VW66

Clinical Perspective on 3D™ Guided Breast Biopsy and Real-Time Specimen Imaging: Presented by Hologic, Inc.

Sunday, Dec. 1 3:45PM - 5:00PM Room: South Building, Booth 5119

Participants

Harriet B. Borofsky, MD, San Mateo, CA (*Presenter*) Nothing to Disclose

Program Information

Come and learn from this experienced radiologist's presentation and demonstration focusing on 3D™ guided breast biopsy and real-time specimen imaging. Participate in the hands-on experience utilizing the Affirm® Prone Biopsy and Brevera® Systems. Additional attendees may join for the hands-on demos after the 20 minute lecture concludes. *Adding this session to your agenda does not secure your seat in this session. Secure your seat onsite by visiting Hologic's Workshop Room # 5119 in the South Hall.*

Printed on: 10/29/20

VW83

Contrast-enhanced Digital Mammography as an Adjunct to MRI: Presented by FUJIFILM Medical Systems U.S.A., Inc.

Sunday, Dec. 1 3:45PM - 4:45PM Room: South Building, Booth 5147

Participants

Anna Russo, Negrar, Italy (*Presenter*) Nothing to Disclose

Program Information

Though digital mammography (FFDM) has improved contrast resolution and dynamic range, it still appears to exhibit weaker performance in dense breasts. This workshop, based on a recently-completed clinical trial, will discuss how Contrast Enhanced Digital Mammography (CEDM) may represent a further improvement in cancer detection sensitivity; similar to other contrast-enhanced techniques (CT and MRI), overcoming the performance limitations of 2D that are due to overlapping tissue.

Printed on: 10/29/20

VW16

The Benefits of 50° Wide-Angle Tomosynthesis: Presented by Siemens Healthineers

Sunday, Dec. 1 3:50PM - 5:00PM Room: North Building, Booth 8563

BR

Participants

Jennifer W. Doe, MD, Houston, TX (*Presenter*) Nothing to Disclose

Program Information

During this hands-on workshop, you will learn more about evaluating breast tomosynthesis data. A reading expert will guide you through cases that will both fascinate and challenge you! All cases have been acquired with Siemens Healthineers 50° Wide-Angle Tomosynthesis technology and can be read on our advanced visualization software *syngo*.Breast Care. You will become familiar with the value of 50° Wide-Angle Tomosynthesis images and the ease-of-use of our reading solutions. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP

https://www.fairorg.de/Siemens-Healthineers/portal/workshop.cfm/rsna19/

Printed on: 10/29/20

PS12

Sunday Afternoon Plenary Session

Sunday, Dec. 1 4:00PM - 5:45PM Room: Arie Crown Theater

BR CH GI IR MK NR NM PD

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

Participants
Valerie P. Jackson, MD, Tucson, AZ (*Presenter*) Nothing to Disclose

Sub-Events

PS12A Report of the RSNA Research and Education Foundation

Participants
Thomas M. Grist, MD, Madison, WI (*Presenter*) Institutional research support, General Electric Company; Institutional research support, Bracco Group; Institutional research support, Siemens AG; Institutional research support, Hologic, Inc; Institutional research support, McKesson Corporation; Stockholder, Elucent; Stockholder, HistoSonics, Inc;

PS12B Image Interpretation Session

Participants
Neil M. Rofsky, MD, Dallas, TX (*Moderator*) Advisory Board, InSightec Ltd; CME & Education Steering Committee, Medscape, LLC
Laura W. Bancroft, MD, Venice, FL (*Presenter*) Nothing to Disclose
Yoshimi Anzai, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose
Robert D. Boutin, MD, Davis, CA (*Presenter*) Nothing to Disclose
Govind B. Chavhan, MD, Toronto, ON (*Presenter*) Speaker, Bayer AG
Philippe A. Grenier, MD, Saint Cloud, France (*Presenter*) Nothing to Disclose
S. Nahum Goldberg, MD, Efrat, Israel (*Presenter*) Consultant, AngioDynamics, Inc; Consultant, Cosman Medical, Inc; Consultant, XACT Robotics;
Nicole M. Hindman, MD, New York, NY (*Presenter*) Nothing to Disclose
Jessica W. Leung, MD, Houston, TX (*Presenter*) Scientific Advisory Board, Subtle Medical
Don C. Yoo, MD, Lexington, MA (*Presenter*) Consultant, inviCRO, LLC

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LEARNING OBJECTIVES

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

VW40

ABUS: A Personalized Screening Solution for Dense Breasts: Presented by GE Healthcare

Sunday, Dec. 1 4:30PM - 5:00PM Room: South Building, Booth 5135

Participants

Simone Schiaffino, MD, Bogliasco, Italy (*Presenter*) Nothing to Disclose

Program Information

Management of patients with dense breasts is still debated; hand-held ultrasound (HHUS), digital breast tomosynthesis, MRI and ABUS (automated breast ultrasound) have been proposed as adjunct screening tools to mammography. ABUS combines HHUS advantages with a standardized and reproducible acquisition, but its adoption as a screening tool could be limited by long reading times. Dr. Schiaffino will discuss the value of the ABUS coronal view, comparing performance and reading times to the complete multiplanar assessment. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

ED001-MO

Breast Monday Case of the Day

Monday, Dec. 2 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
Jody C. Hayes, MD, Southlake, TX (*Abstract Co-Author*) Nothing to Disclose
Stephen J. Seiler, MD, Dallas, TX (*Abstract Co-Author*) Consultant, Delphinus Medical Technologies, Inc; Consultant, Seno Medical Instruments, Inc
Natalie G. Stratemeier, MD, Oklahoma City, OK (*Abstract Co-Author*) Nothing to Disclose
Meghan Woughter, MD, Temple, TX (*Abstract Co-Author*) Spouse, Vice President, nThrive, Inc
Oyindamola Akinseye, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Susan O. Holley, MD,PhD, Raleigh, NC (*Abstract Co-Author*) Nothing to Disclose
Ronald J. Dolin, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Dayna Levin, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Shannon Lanzo, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Sean A. Maratto, MD, Philadelphia, PA (*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.

Printed on: 10/29/20

CS22

High Resolution Breast Imaging: Implementation and Work-flow Optimization: Presented by World Class CME, educational grant provided by Hologic, Inc.

Monday, Dec. 2 8:30AM - 9:30AM Room: S102AB

Participants

Linda R. Greer, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

PROGRAM INFORMATION

This 1 hour symposium will discuss the differences between standard resolution Tomosynthesis and the newest AI-powered high-resolution imaging. The speaker will share their clinical perspective on how implementing the innovative technology improved their work-flow efficiencies including case reviews.

CME

Certificates will be emailed to the email provided through registration or onsite sign in. If we do not have an email on file, attendees can contact our office at office@worldclasscme.com to request a certificate.

RSVP

https://www.worldclasscme.com/conferences/high-resolution-breast-imaging-implementation-and-workflow-optimization/

Printed on: 10/29/20

CS23

Density "Inform" and Insurance Legislation Update: Presented by Bayer

Monday, Dec. 2 8:30AM - 9:30AM Room: S105D

Participants

JoAnn Pushkin, Deerpark, NY (*Presenter*) Nothing to Disclose

PROGRAM INFORMATION

Existing density "inform" laws vary widely; will the soon-to-be-made public FDA national reporting requirement rectify that? This presentation will provide an update on state inform and insurance laws, explain the federal legislative and regulatory processes for a national standard, and share available patient and provider information on the topic of breast density.

CME

This program does not offer CME credit.

Printed on: 10/29/20

MSRO25

BOOST: Breast-Case-based Multidisciplinary Review (Interactive Session)

Monday, Dec. 2 8:30AM - 10:00AM Room: S103CD

BR OI RO

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

Participants
Jonathan B. Strauss, MD, Chicago, IL (*Presenter*) Reviewer, WellPoint, Inc
Bethany L. Niell, MD,PhD, Tampa, FL (*Presenter*) Nothing to Disclose
Cesar A. Santa-Maria, MD, Baltimore, MD (*Presenter*) Research funded, AstraZeneca PLC; Research funded, Pfizer Inc; Research funded, Tesaro; Advisory Board, Polyphor; Advisory Board, Halozyme Therapeutics, Inc; Advisory Board, Genomic Health, Inc
Brian J. Czerniecki, MD, PhD, Tampa, FL (*Presenter*) Nothing to Disclose

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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.

RC215

Breast Series: MRI

Monday, Dec. 2 8:30AM - 12:00PM Room: Arie Crown Theater

BR MR

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.75

Participants
Wendy B. Demartini, MD, Stanford, CA (*Moderator*) Nothing to Disclose
Thomas H. Helbich, MD, Vienna, Austria (*Moderator*) Research Grant, Medicor, Inc ; Research Grant, Siemens AG ; Research Grant, C. R. Bard, Inc; Research Grant, Guerbet SA; Research Grant, Novomed GmbH
Hiroyuki Abe, MD, Chicago, IL (*Moderator*) Nothing to Disclose
Colleen H. Neal, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

zuleyml@upmc.edu

Sub-Events

RC215-01 **MRI: Part 1**

RC215-02 **How Genetics Will Fit Into Your Practice**

Monday, Dec. 2 8:30AM - 8:55AM Room: Arie Crown Theater

Participants
Elizabeth A. Morris, MD, New York, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) Understand the impact that genetics will have on the future of screening. 2) Understand the different methods of assessing risk for breast cancer. 3) Assess different algorithms for screening beyond mammography.

RC215-03 **MRI in Addition to Mammography Screening in Women with Extremely Dense Breasts: Primary Outcome of the Randomized DENSE Trial**

Monday, Dec. 2 8:55AM - 9:05AM Room: Arie Crown Theater

Participants
Marije F. Bakker, PhD, Utrecht, Netherlands (*Presenter*) Grant, Bayer AG; Software support, Volpara Health Technologies Limited
Stephanie V. de Lange, Utrecht, Netherlands (*Abstract Co-Author*) Research Grant, Bayer AG; Software support, Volpara Health Technologies Limited
Rudolf M. Pijnappel, MD,PhD, Haren, Netherlands (*Abstract Co-Author*) Research Grant, Bayer AG
Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) 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
Claudette E. Loo, MD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Bob Bisschops, Dordrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Marc Lobbes, MD, Maastricht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Mathijn D. De Jong, MD, 's-Hertogenbosch, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Katya M Duvivier, MD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jeroen Veltman, MD, Hengelo, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Wouter B. Veldhuis, MD, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Carla H. van Gils, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Software support, Volpara Health Technologies Limited

PURPOSE

To evaluatue the effect of supplemental MRI for women with extremely dense breasts within a population-based screening program.

METHOD AND MATERIALS

Between 2011-2015, we randomized 40,373 screening participants (aged 50-75) with a negative screening mammography and extremely dense breasts (ACR category 4 by Volpara software) to (an invitation for) supplemental 3.0-T MRI at 8 sites (intervention arm; n=8,061) or mammography screening only (control arm; n=32,312). The difference in interval cancers after the first (prevalent) screening round, during the two-year screening interval, was investigated by intention-to-treat (ITT) analysis, and by complier-average causal effect (CACE) analysis to account for noncompliance. The performance of the incident screening rounds was investigated as well.

RESULTS

In the intervention arm, 4,783 (59%) underwent MRI examination. Cancer detection rate was 16.5/1000 screens [95%CI:13.3-

20.5]. For this, 9.5% of women were recalled (6.3% with biopsy). Positive predictive values are 17.4% [95%CI:14.2%-21.2%] (recall) and 26.3% [95%CI:21.7%-31.6%] (biopsy). In the intervention arm, cancers were more frequently stage 0-I than in the control arm (82.8% vs 41.6%, p<0.001). With ITT analysis, the interval cancer rate was 4.98/1000 women in the control arm and 2.48/1000 women in the intervention arm, leading to a reduction of 2.50/1000 women [95%CI:0.98-3.71]; p<0.001. With CACE analysis, this reduction was 4.22/1000 women [95%CI:2.01-6.43]. Preliminary results of the incident screening rounds showed that 3,548 women had again undergone (at least one) mammographic screening with a negative result. Supplemental cancer detection rate was 5.3/1000 screens [95%CI:3.4-7.7]. For this, 2.8% [95%CI:2.4%-3.4%] of women were recalled for further diagnostic work-up. At the meeting, results on cost-effectiveness will be presented as well.

CONCLUSION

Supplemental MRI screening in women with extremely dense breasts results in statistically significantly fewer interval cancers. In subsequent rounds, both the cancer detection rate and the false-positive rate decrease.

CLINICAL RELEVANCE/APPLICATION

There is a heated debate on the value of supplemental screening in women with dense breasts. The DENSE trial is the first randomized trial on supplemental MRI screening that has been performed in women with dense breasts.

RC215-04 Abbreviated Screening Breast MRI Protocol: Impact on Cancer Detection and Biopsy Rates

Monday, Dec. 2 9:05AM - 9:15AM Room: Arie Crown Theater

Participants
Andrew J. Lukaszewicz, MD, Brampton, ON (*Abstract Co-Author*) Nothing to Disclose
Leslie Lamb, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Paul Healey, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Ellen Alie, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Jean M. Seely, MD, Ottawa, ON (*Presenter*) Nothing to Disclose

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PURPOSE

To assess patient outcomes with the implementation of an abbreviated breast magnetic resonance imaging (MRI) protocol for high-risk breast screening.

METHOD AND MATERIALS

In this IRB-approved study performed at a large academic institution, an abbreviated breast MRI protocol (AP) was implemented for high-risk patients (IBIS lifetime risk >= 25%) in a population-based high-risk screening program (pre and two post-contrast T1 and T2 sequences). The protocol was evaluated prospectively for 10 months. It was compared to a standard protocol (SP) in the same population during the 12 previous months. MRI scanning times, BI-RADS assessment categories, positive predictive values (PPV3) and cancer detection rates (CDR) were evaluated.

RESULTS

A total of 1539 patients during the 22-month study period were included. 658 patients underwent 658 AP screening MRIs. Of those, 135 (20.5%) were baseline exams and 523 (79.5%) were prevalent exams. 881 patients underwent 881 SP screening MRIs during the comparison study period. Of those, 230 (26.1%) were baseline exams and 651 (73.9%) were prevalent exams. The AP scanning time was an average of 16.3 minutes (range 12-25), compared to 27 minutes (range 25-30) in the SP. Abnormal interpretation rate with the AP was 12.5% (82/658) compared to 19.1% (168/881) with the SP (p<0.001). The BI-RADS 3 rate for the AP was 6.9% (45/658) compared to 7.2% (63/881) with the SP (p=0.81). Breast biopsies were performed in fewer patients with the AP [8.4 % (55/658)] than with the SP [13.7% (121/881) (p=0.001). PPV3 for the AP was 20.0% (11/55) compared to 12.4% (15/121) for the SP (p =0.19). The CDR was 16.7/1000 (11/658) with the AP and 17.0/1000 (15/881) with the SP (p=0.96).

CONCLUSION

Using an abbreviated breast screening MRI protocol in high-risk patients led to fewer false positives, and was associated with 5% fewer benign biopsies, while a similar cancer detection rate was maintained.

CLINICAL RELEVANCE/APPLICATION

Abbreviated breast MRI screening protocols may lead to increased tolerability and MRI capacity while optimizing quality indicators. Further study is required to determine long-term outcomes.

RC215-05 Radiomics for Prediction of Breast Cancer Prognosis Using Dynamic Contrast-Enhanced Magnetic Resonance Imaging (DCE-MRI)

Monday, Dec. 2 9:15AM - 9:25AM Room: Arie Crown Theater

Participants
Seri Kang, Iksan , Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hye-won Kim, MD,PhD, Iksan, Korea, Republic Of (*Presenter*) Nothing to Disclose

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PURPOSE

To evaluate the value of dynamic contrast enhanced magnetic resonance imaging (DCE-MRI) parameters as an imaging biomarker for predicting prognosis in the breast cancer, we analyzed the association with the histopathologic factors of the tumor.

METHOD AND MATERIALS

A total of 122 invasive ductal carcinomas (IDCs) in 105 women who underwent preoperative breast DCE-MRI on a 3T scanner between November 2017 and December 2018 were enrolled. Twenty-fifth, 50th, 75th percentile and coefficient of variation (CV) of each perfusion parameter (Ktrans, Kep, Ve and Vp) were calculated within each tumor. Histopathologic factors such as estrogen receptor (ER), progesterone receptor (PR), human epidermal growth factor receptor 2 (HER2), Ki-67, p53, epidermal growth factor receptor (EGFR), CK 5/6, histologic grade and lymphovascular space invasion (LVSI) status were assessed. The student's t-test or Mann-Whitney U test were used for comparison of two groups and ANOVA or Kruskal-Wallis test for multiple groups.

RESULTS

Triple negative breast cancers exhibited higher Ktransmedian, Ktrans75, Kepmedian and Kep75 than luminal cancers (p<.05). ER-negative tumors showed higher Ktransmean, Ktransmedian and Ktrans75 than ER-positive tumors (p<.05). PR-negative tumors presented higher Ve25, Vemean, Vemedian and Ve75 than PR-positive tumors (p<.05). Tumors with higher Ki-67 showed higher Kep25, Kepmean and Kepmedian than tumors with lower Ki-67 (p<.05). P53-positive tumors exhibited higher Ktrans25, Ktransmean, Ktransmedian, Ktrans75, Kepmean, Kepmedian and Kep75 than p53-negative tumors (p<.05). Higher histologic grade tumors (grade II/III) presented higher Ktrans25, Ktransmean, Ktransmedian, Ktrans75, Kep25, Kepmean, Kepmedian, Kep75, Vp25, Vpmean and Vpmedian (p<.04) than grade I tumor. Tumors with LVSI presented higher Ktrans25, Ktransmedian, Ktrans75, Kepmean, Kepmedian and Kep75 than tumors without LVSI (p<.05). On the other hand, EGFR, CK 5/6 showed no significant correlation.

CONCLUSION

We identified breast cancer presenting higher Ktrans and Kep on DCE-MRI was associated with poor prognostic factors. Therefore, DCE-MRI perfusion parameters can be useful imaging biomarkers for prediction of tumor prognosis.

CLINICAL RELEVANCE/APPLICATION

DCE-MRI may be helpful to predict prognosis of breast cancer through analysis of perfusion parameters.

RC215-06 Prognostic Factors Associated with Survival in Breast Cancer Patients: Magnetic Resonance Imaging and Clinico-Pathologic Factors Associated with Disease Recurrence

Monday, Dec. 2 9:25AM - 9:35AM Room: Arie Crown Theater

Participants
Eunjin Lee, Suwon, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jeong Min Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sung-Hun Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Bong Joo Kang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Heerin Lee, Seoul , Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate prognostic factors predicting recurrence of breast cancer, focusing on imaging factors including advanced MR techniques and clinico-pathologic factors.

METHOD AND MATERIALS

This retrospective study was approved by our institutional review board, and the requirement to obtain informed consent was waived. A total of 267 patients with breast cancer who underwent dynamic contrast-enhanced magnetic resonance imaging (MRI) before surgery from February 2014 to June 2016 was included in the study sample. Imaging parameters of MRI, including morphologic information, perfusion parameters, and texture analysis, were retrospectively reviewed by two breast expert radiologists. Patient clinical pathologic information was also reviewed. Univariable and multivariable Cox proportional hazards regression analyses were used to identify factors associated with cancer recurrence. Using Kaplan-Meier survival analysis, disease-free survival was compared between patients who experienced recurrence and those who did not.

RESULTS

At a median follow up of 26 months, 23 patients (8%) showed disease: five cases of ipsilateral breast or axilla recurrence, one case of contralateral breast recurrence, 15 cases of distant metastasis, and one case of both ipsilateral breast recurrence and distant metastasis. Increased ipsilateral vascularity, entropy and kurtosis from texture analysis, and multiple perfusion parameters showed significant association with disease recurrence. The Ve 25th percentile value of perfusion parameters had the highest hazard ratio of 4.37 [95% confidence interval (CI): 1.80-11.18]. Pathologic stage, especially if higher than stage II, also showed significant association with disease recurrence, independent of multiple MRI parameters. In addition, higher entropy, higher Kep 25th percentile, higher Ve 25th percentile value, and increased ipsilateral vascularity were associated with short interval time to disease recurrence by Kaplan-Meier survival analysis.

CONCLUSION

Higher pathologic stage and MRI parameters of texture parameters, perfusion parameters, and increased ipsilateral vascularity are predictors of breast cancer recurrence and may also be predictors of poor survival.

CLINICAL RELEVANCE/APPLICATION

Multiple parameters of breast MRI including perfusion and texture analysis can predict breast cancer recurrence in addition to the clinico-pathologic factors.

RC215-07 Diffusion with Very High b-Value in Breast MRI: End of the Contrast Injection?

Monday, Dec. 2 9:35AM - 9:45AM Room: Arie Crown Theater

Participants
Hajar Hamri, MD, Paris , France (*Presenter*) Nothing to Disclose
Zoe Jolibois, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Elisabeth Weiland, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Cedric M. De Bazelaire, MD, PhD, Paris , France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate diagnostic yield of diffusion weighted imaging (DWI) with very high b-value combined with T2 weighted sequence in breast MRI.

METHOD AND MATERIALS

130 patients were included consecutively in this retrospective study approved by our IRB.All patients underwent breast MRI (MAGNETOM Aera, Siemens 1.5T, 18-channel breast antenna) with a 2D-SS-EPI-SPAIR diffusion sequence (TR / TE: 5200 / 67ms, b 2500s / mm²) in addition to the standard protocol with 2D-T1-FSE, 3D-T2-SPAIR and 3D-T1-VIBE-SPAIR -DCE. 2 independent readings were performed by 2 radiologists in consensus: 1) combined analysis of the DWI and T2W sequences and 2) analysis of the standard protocol according to BIRADS lexicon. All findings with hypersignal DWI and low T2 signal were considered as suspicious. All suspicious lesions were biopsied. BIRADS 1-3 lesions had at least 2years follow-up or histological proof. Diagnostic yields were compared using ROC curves.

RESULTS

A total of 180 lesions were analyzed of wich 27% were malignant. Similar sensitivity but higher specificity were found with the combined analysis of DWI and T2W sequences compared with T1W, T2W and DCE sequences (92%, 92% vs 96%, 82% respectively). However, the comparison of ROC curves showed no significant difference (AUC= 0.92 vs 0.89 respectively, p= 0,364).

CONCLUSION

Combined analysis of DWI with a b-value of 2500s / mm² and T2W sequences could be a reliable alternative to gadolinium injection, particularly for screening in women at high risk of breast cancer.

CLINICAL RELEVANCE/APPLICATION

Diagnosis of breast cancer is possible with combined analysis of DWI with a b-value of 2500s/mm² and T2W sequences, even in non-contrast MR imaging.

RC215-08 Updates on the Use of Breast MRI in Women with Higher than Average Risk

Monday, Dec. 2 9:45AM - 10:10AM Room: Arie Crown Theater

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

LEARNING OBJECTIVES

1) To understand which populations at higher than average risk for breast cancer that may benefit from supplemental screening with MRI. 2) To provide an update of the latest ACR recommendations for the use of breast MRI in women of higher risk. 3) To understand the reasoning and data supporting the newest recommendations for high risk women.

RC215-09 MRI: Part 2

RC215-10 MRI Biomarkers

Monday, Dec. 2 10:30AM - 10:55AM Room: Arie Crown Theater

Participants
Julia Camps Herrero, MD, Alzira, Spain (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) To learn about the pathway of an imaging biomarker in its different stages: proof of concept, proof of mechanism, proof of principle and proof of efficacy and effectiveness. 2) To know the different types of MR-derived imaging biomarkers and their current clinical use. 3) To understand how the quantitative MR-phenotypes can be integrated into clinical practice as well as the challenges we face in this implementation.

ABSTRACT

Breast MRI is the most sensitive modality for high-risk screening and for the diagnosis and characterization of breast lesions. Both qualitative and quantitative imaging biomarkers can be derived from breast MRI that can be associated with a patient's risk to develop a breast cancer, the prognosis of a known breast cancer through data mining of MR-phenotypes or a prediction of response evaluation to neoadjuvant therapies.BM of breast cancer risk that can be analyzed through breast MRI are breast density and background parenchymal enhancementBC is a heterogeneous disease and the different molecular subtypes that have been described in the last decade have had a tremendous impact on the personalized treatment of the disease. These subtypes have been shown to be predictive of disease free survival and overall survival. Computer extraction or analysis of quantitative imaging features also known as radiomics has been applied to MRI data (tumor morphology, texture and enhancement kinetics) in order to build predictive or prognostic models and correlate MR features with BC molecular subtypes. The correlation of imaging phenotypes with genomic information is also known as radiogenomics through which MR features are correlated with clinically available genomic assays. These MR-phenotypes can serve as surrogate markers of tumor behaviour and survival and speed up drug development as well as personalized therapies.The process of imaging biomarker validation is not easy nor simple, standardisation of imaging processing and analysis and measurement of the MR features is still a challenge.

RC215-11 Comparison of Four Radiomics-Based Classification Methods in Diagnosis of Breast Lesions with Multi-b Diffusion-Weighted MR Imaging

Monday, Dec. 2 10:55AM - 11:05AM Room: Arie Crown Theater

Participants
Kun Sun, Shanghai, China (*Presenter*) Nothing to Disclose

Zhicheng Jiao, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Xu Yan, Shanghai, China (*Abstract Co-Author*) Employee, Siemens AG
Han Zhang, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Jie-Zhi Cheng, BEng,PhD, Shanghai, China (*Abstract Co-Author*) Employee, Shanghai United Imaging Healthcare Co, Ltd
Fuhua Yan, MS, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Dinggang Shen, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic performance of four radiomics-based classification methods in differentiation between benign and malignant breast lesions with multi-b diffusion-weighted MR imaging.

METHOD AND MATERIALS

Totally, 542 lesions in 542 patients with multi-b diffusion-weighted-images (b values: 0-2500 s/mm2) were acquired, where 100 radiomic features (by using Pyradiomics toolbox) were computed with multi-b diffusion-weighted-imaging, as well as mono-exponential (ME) with ME-ADC0-1000 and ME-ADCall-b, bi-exponential (BE) with BE-D, BE-D*, and BE-f, stretched-exponential (SE) with SE-DDC and SE-a, and diffusion kurtosis imaging (DKI) with DKI-D and DKI-K. Radiomics-based analysis was performed by using four classification methods, including random forest (RF), principal component analysis (PCA), L1 regularization (L1R), and support vector machine (SVM). The dataset is randomly split into the training and testing sets for 100 times to evaluate the performance of all the classification models. The training and testing sets were randomly split into 50% and 50%. The radiomics-based diagnosis was compared to the pathological results. AUCs were used to compare performances of the four classification models.

RESULTS

The AUCs of RF in the differential diagnosis of breast lesions ranged from 0.80 (BE-D*) to 0.85 (BE-D), whereas the AUCs of PCA ranged from 0.53 (SE-DDC) to 0.79 (b1500). The AUCs of L1R and SVM ranged from 0.53 (SE-DDC) to 0.83 (ME-ADC0-1000) and from 0.51 (SE-DDC) to 0.82 (b2500), respectively. The top 5 sequences with the highest AUCs by the RF are BE-D (0.85), ME-ADCall-b (0.84), DKI-K (0.84), ME-ADC0-1000 (0.83) and b2500 (0.83).The top 5 sequences with the highest mean AUCs are b2500 (0.82), b2000 (0.81), ME-ADC0-1000 (0.81), b1500 (0.81), and BE-D (0.81). RF attained higher AUCs than L1R, PCA and SVM. However, there was no significant difference among these four classification methods in the top 5 sequences with the highest mean AUCs (all $P > 0.002$).

CONCLUSION

Radiomics-based analysis with RF model was recommended for the classification of breast lesions. BE-D with the highest AUC by RF model and b2500 with the highest mean AUC were recommended for the diffusion-related radiomic analysis in breast cancer evaluation.

CLINICAL RELEVANCE/APPLICATION

For radiomic analysis of multi-b diffusion-weighted imaging in the evaluation of breast lesions, RF model is provided to be a reliable classification technique.

RC215-12 Radiomic Features Derived from Contrast-Enhanced Magnetic Resonance and Diffusion Weighted Imaging for the Assessment of Breast Cancer Molecular Subtypes

Monday, Dec. 2 11:05AM - 11:15AM Room: Arie Crown Theater

Participants
Doris Leithner, MD, Frankfurt Am Main, Germany (*Presenter*) Nothing to Disclose
Marius E. Mayerhoefer, MD,PhD, Vienna, Austria (*Abstract Co-Author*) Speaker, Siemens AG; Research support, Siemens AG
Blanca Bernard-Davila, MPH,MS, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Maxine S. Jochelson, MD, New York, NY (*Abstract Co-Author*) Speaker, General Electric Company; Consultant, Bayer AG
Joao V. Horvat, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Maria Adele Marino, MD, Messina, Italy (*Abstract Co-Author*) Nothing to Disclose
Daly B. Avendano, MD, Monterrey, Mexico (*Abstract Co-Author*) Nothing to Disclose
Danny F. Martinez, BSC,MSc, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Sunitha Thakur, PhD, MS, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Christophe Arendt, MD, Frankfurt am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Elizabeth A. Morris, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Katja Pinker-Domenig, MD, New York, NY (*Abstract Co-Author*) Speakers Bureau, Siemens AG ; Advisory Board, Merantix Healthcare GmbH

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PURPOSE

To evaluate the performance of combined radiomic features extracted from contrast-enhanced magnetic resonance imaging (CE-MRI) and diffusion-weighted imaging (DWI) for the assessment of breast cancer receptor status and molecular subtypes.

METHOD AND MATERIALS

Ninety-one patients with biopsy-proven breast cancer (luminal A, n=49; luminal B, n=8; HER2-enriched, n=11; triple negative (TN), n=23) who underwent 3T CE-MRI and DWI were included in this IRB-approved HIPAA-compliant retrospective study. Radiomic features (co-occurrence and run-length matrix, absolute gradient, autoregressive model, Haar wavelet transform and lesion geometry) were extracted from manually defined ROIs (total number of features per lesion, n=704) on early CE-MR images and ADC maps. The five best features for the differentiation of molecular subtypes were selected, separately for each technique (i.e. CE-MRI and ADC) using probability of error and average correlation coefficients. A multi-layer perceptron feed-forward artificial neural network (MLP-ANN) was used for radiomics-based classification, with histopathology serving as reference standard. 70% of the cases were used for training, and 30% for validation. The analysis was performed five times each.

RESULTS

MLP-ANN yielded an overall median area under the receiver operating characteristic curve (AUC) of of 0.86 (0.77-0.92) for

MLP-ANN yielded an overall median area under the receiver-operating-characteristic curve (AUC) of of 0.86 (0.77-0.92) for separation of TN from all other cancers, with median accuracies of 85.9% in the training and 85.2% in the validation datasets. The separation of luminal A and triple negative cancers yielded an overall median AUC of 0.8 (0.75-0.83), with median accuracies of 74% in the training, and 68.2% in the validation dataset. All other AUCs were below 0.8.

CONCLUSION

Combination of radiomic features extracted from CE-MRI and DWI may be useful to differentiate triple negative and luminal A breast cancers from other subtypes.

CLINICAL RELEVANCE/APPLICATION

Combined CE-MRI and DWI radiomic features may potentially provide prognostic indicators derived from the entire tumor, which may be used for tumor monitoring during treatment.

RC215-13 Change in Contralateral Parenchymal Enhancement during Neoadjuvant Endocrine Treatment is Associated with Tumor Response in Unilateral ER+/HER2- Breast Cancer Patients

Monday, Dec. 2 11:15AM - 11:25AM Room: Arie Crown Theater

Participants
Max Ragusi, MD, Utrecht, Netherlands (*Presenter*) Nothing to Disclose
Claudette E. Loo, MD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Bas H. van der Velden, MSc, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jelle Wesseling, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Regina G. Beets-Tan, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Sjoerd G. Elias, MD, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To investigate whether contralateral parenchymal enhancement (CPE), a quantitative measure of parenchymal enhancement, is associated with tumor response during neoadjuvant endocrine treatment (NET) of unilateral ER+/HER2- breast cancer.

METHOD AND MATERIALS

Retrospective single center cohort study of unilateral ER+/HER2- breast cancer patients treated with NET between Jan 2013 and Dec 2017. Pretreatment and response DCE-MRIs (3 and 6 months) were acquired using 1.5T or 3T MRI. The early contrast-enhanced images were acquired after 90s post-contrast injection and the late images after 360-450s. CPE is defined as the mean of the top-10% relative parenchymal enhancement between early and late post-contrast images of the contralateral breast. Tumor response was expressed by the preoperative endocrine prognostic index (PEPI), which identifies three distinct groups based on post-treatment pT, pN, Ki-67 and ER-status. A high PEPI-group is associated with increased risks of relapse and death. We used a linear mixed model to assess log(CPE) during NET in relation to tumor response, using patient-level random intercepts to account for clustered data.

RESULTS

A total of 39 patients with 79 CPE measurements were available (patients with unavailable PEPI-score [n=2] or MRIs with motion artifacts [n=2] were excluded). Mean age was 61 (±11) years. Mean treatment duration was 7.2 (±1.4) months. After NET, 12 patients had PEPI-1 score, 15 PEPI-2, and 12 PEPI-3. Pretreatment CPE did not differ between PEPI-groups: difference of 7.8% in PEPI-1 vs 2 (P=.593), 29.9% in PEPI-1 vs 3 (P=.091), and 20.5% in PEPI-2 vs 3 (P=.209). Change in CPE over time depended on tumor response (Pinteractiontime*PEPI=.005). CPE increased in PEPI-1 by 5.0% (95% CI= 0.8-9.4%, P=.025) per month, and decreased in the less favorable groups by 2.4% (95% CI= -1.4-6.0%, P=.224) for PEPI-2 and 5.8% (95% CI= -0.1-11.3%, P=.058) for PEPI-3 per month. The difference in CPE over time was significant for PEPI-1 vs 2 (P=.014) and PEPI-1 vs 3 (P=.005), but not for PEPI-2 vs 3 (P=.327).

CONCLUSION

Change in CPE during NET is associated with tumor response: an increase in CPE over time was associated with a favorable tumor response.

CLINICAL RELEVANCE/APPLICATION

Contralateral parenchymal enhancement has potential as a prognostic biomarker in breast cancer patients to assess tumor response during neoadjuvant endocrine treatment.

RC215-14 DCE-MRI Biomarkers of Changes in Peri-Tumoral and Intra-Tumoral Heterogeneity for Improving Early Prediction of Survival after Neoadjuvant Chemotherapy for Breast Cancer

Monday, Dec. 2 11:25AM - 11:35AM Room: Arie Crown Theater

Participants
Nariman Jahani, Philadelphia, PA (*Presenter*) Nothing to Disclose
Eric A. Cohen, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Susan Weinstein, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Nola M. Hylton, PhD, San Francisco, CA (*Abstract Co-Author*) Research support, General Electric Company
David Newitt, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Christos Davatzikos, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Despina Kontos, PhD, Philadelphia, PA (*Abstract Co-Author*) Research Grant, Hologic, Inc

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PURPOSE

To evaluate changes in peri- and intra-tumoral DCE-MRI heterogeneity as a biomarker for early prediction of recurrence-free survival (RFS) after neoadjuvant chemotherapy (NAC) for breast cancer.

METHOD AND MATERIALS

We analyzed DCE-MRI scans of 132 women from the I-SPY1 TRIAL acquired before and after the first cycle of NAC. A deformable registration technique was applied to quantify voxel-wise changes during NAC. From that, two groups of feature maps were extracted within peri- and intra-tumoral regions: 1) four features representing deformations in shapes and volumes and 2) four kinetic features indicating changes in enhancement patterns. Also, eight additional features were computed to indicate relative changes between peri- and intra-tumoral heterogeneity. Thus, a total of 24 imaging features were extracted and evaluated in three models: 1) using combinations of peri- and intra-tumor features 2) using only intra-tumoral features 3) using only peri-tumoral features. For a proper comparison, the same number of features (top six RFS-associated features) were selected for each model by Cox regression via five-fold cross-validation. Functional tumor volume (FTV) and established covariates of age, race, and hormone receptor status were considered. The C-statistic was evaluated over the cross-validation loops and the likelihood ratio test was used to compare nested models.

RESULTS

Significant improvement was achieved when using both peri- and intra-tumoral features (c-statistic=0.77, $p<0.05$) compared to models using only peri- or intra-tumoral features (c-statistics =0.70 and 0.73, respectively). For the combined model, all selected features including three of relative changes, two intra-tumoral, and one peri-tumoral features had strong associations with RFS ($p<0.01$). Performance of the combined model was improved further by adding FTV and the established histopathologic and demographic covariates (c-statistic=0.79, pLikelihood-Ratio<0.001).

CONCLUSION

Analysis of changes in peri-tumoral heterogeneity features and their relative changes with respect to intra-tumoral heterogeneity may reveal markers from the surrounding tumor tissues that could improve early assessment of RFS for breast cancer NAC.

CLINICAL RELEVANCE/APPLICATION

Quantification of changes in peri- and intra-tumoral heterogeneity may improve early prediction of patient survival after NAC providing better guidance for personalized cancer treatment.

RC215-15 Background Parenchymal Enhancement

Monday, Dec. 2 11:35AM - 12:00PM Room: Arie Crown Theater

Participants
Christoph I. Lee, MD, Mercer Island, WA (*Presenter*) Royalites, The McGraw-Hill Companies; Royalties, Oxford University Press; Royalties, Wolters Kluwer nv;

LEARNING OBJECTIVES

1) Provide an overview of reporting standards for breast parenchymal enhancement observed on breast MRI. 2) Describe the current evidence regarding breast parenchymal enhancement and associated breast cancer risk. 3) Identify future directions for incorporating breast parenchymal enhancement in cancer risk assessment.

RC252

US-guided Interventional Breast Procedures (Hands-on)

Monday, Dec. 2 8:30AM - 10:00AM 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; ;
Michael N. Linver, MD, Alexandria, VA (*Presenter*) Medical Advisory Board, Three Palm Software; Scientific Advisory Board, Real Imaging Ltd; Scientific Advisory Board, Seno Medical Instruments, Inc
Tilden L. Childs III, MD, Fort Worth, TX (*Presenter*) Nothing to Disclose
Sora C. Yoon, MD, Chapel Hill, NC (*Presenter*) Nothing to Disclose
Mary S. Soo, MD, Durham, NC (*Presenter*) Nothing to Disclose
Margaret M. Szabunio, MD, Nicholasville, KY (*Presenter*) Nothing to Disclose
Jean M. Kunjummen, DO, Atlanta, GA (*Presenter*) Nothing to Disclose
Evguenia J. Karimova, MD, Memphis, TN (*Presenter*) Research Consultant, Intrinsic Imaging LLC
Alison L. Chetlen, DO, Hershey, PA (*Presenter*) Consultant, Becton, Dickinson and Company
Bhavika K. Patel, MD, Phoenix, AZ (*Presenter*) Speaker, Hologic, Inc; Research support, GRAIL, Inc
Connie E. Kim, MD, Durham, NC (*Presenter*) Spouse, Consultant, ClarVista Medical, Inc; Spouse, Royalties, Leica Biosystems Nussloch GmbH; Spouse, Intellectual property, Leica Biosystems Nussloch GmbH
Anita K. Mehta, MD, MSc, Washington DC, DC (*Presenter*) Nothing to Disclose
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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

VW02

AI-based Mammography Reading: Self-guided Reading session: Presented by Siemens Healthineers

Monday, Dec. 2 10:15AM - 5:00PM Room: North Building, Booth 8563

Program Information

You will learn about the benefits of the AI-based Transpara™* decision-support tool from ScreenPoint Medical. It has been integrated with the advanced visualization software syngo. Breast Care* to support 2D and 3D mammography reading. Together, they provide interactive decision support with an overall exam score to help prioritize reading. **syngo*.Breast Care VB40 and Transpara™ for 3D are currently under development; they are not for sale in the U.S. Their future availability cannot be guaranteed. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP

https://www.fairorg.de/Siemens-Healthineers/portal/workshop.cfm/rsna19/

Printed on: 10/29/20

VW06

50° Wide-angle Tomosynthesis and Contrast-enhanced Mammography Self-guided Reading Sessions: Presented by Siemens Healthineers

Monday, Dec. 2 10:15AM - 5:00PM Room: North Building, Booth 8563

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 challenging cases with a solution enables you to develop and test your reading skills. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP

https://www.fairorg.de/Siemens-Healthineers/portal/workshop.cfm/rsna19/

Printed on: 10/29/20

SPAI21

RSNA AI Deep Learning Lab: Beginner Class: Classification Task (Intro)

Monday, Dec. 2 10:30AM - 12:00PM Room: AI Showcase, North Building, Level 2, Booth 10342

AI BR CH CT GI HN IN MR NR

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

Participants

Bradley J. Erickson, MD, PhD, Rochester, MN (*Presenter*) Board of Directors, VoiceIt Technologies, LLC; Stockholder, VoiceIt Technologies, LLC; Board of Directors, FlowSigma, LLC; Officer, FlowSigma, LLC ; Stockholder, FlowSigma, LLC

Special Information

In order to get the best experience for this session, it is highly recommended that attendees bring a laptop with a keyboard and decent-sized screen. Having a Gmail account will be helpful. Here are instructions for creating and deleting a Gmail account. Here are instructions for creating and deleting a Gmail account.

ABSTRACT

This class will focus on basic concepts of convolutional neural networks (CNNs) and walk the attendee through a working example. A popular training example is the MNIST data set which consists of hand-written digits. This course will use a data set we created, that we call 'MedNIST', and consists of images of 6 different classes: Chest X-ray, Chest CT, Abdomen CT, Head CT, Head MR and Breast MRI. The task is to identify the image class. This will be used to train attendees on the basic principles and some pitfalls in training a CNN. • Intro to CNNs • Data preparation: DICOM to jpeg, intensity normalization, train vs test • How do we choose the labels? Inconsistencies... Use Fast.AI routines to classify; Validation of results: Are the performance metrics reliable? 'Extra Credit': if there is time, explore data augmentation options, effect of batch size, training set size.

Printed on: 10/29/20

SSC13

Physics (Breast X-Ray Imaging)

Monday, Dec. 2 10:30AM - 12:00PM Room: S503AB

BR PH

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

FDA Discussions may include off-label uses.

Participants
Hilde Bosmans, PhD, Leuven, Belgium (*Moderator*) Stockholder, Qaelum NV Research Grant, Siemens AG Research Grant, General Electric Company Research Grant, Agfa-Gevaert Group
Joseph Lo, PhD, Durham, NC (*Moderator*) License agreement, Gammex, Inc

Sub-Events

SSC13-01 Sensitivity of the New ACR QC Phantom for Detecting Degradations in DBT Systems

Monday, Dec. 2 10:30AM - 10:40AM Room: S503AB

Participants
Lynda C. Ikejimba, PhD, Silver Spring, MD (*Presenter*) Nothing to Disclose
Andrei Makeev, PhD, Silver Spring, MD (*Abstract Co-Author*) Nothing to Disclose
Stephen J. Glick, PhD, Silver Spring, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Recently the FDA approved the use of the new ACR phantom for QC and to accredit DBT systems. Being new, the extent to which it can capture deficiencies in a 3D system is not well known. In this work we investigate how sensitive the new ACR phantom is to various DBT system degradations.

METHOD AND MATERIALS

Degradations were added to assess the impact on image quality: 1. Focal spot (FS) positioning error, and 2. Dose levels corresponding to 100%, 50%, and 25% of the AEC dose. For error in the FS positions, prior to reconstruction the x-ray angular position for each projection was perturbed by a Gaussian random value. Four levels of error were modeled: σ = 0.1°, 0.3°, 0.5°, and 1.0°. For each σ, five trials with different sets of projection data were created and reconstructed. Acquisitions were taken with both narrow- and wide-angle DBT geometries. The narrow-angle acquisition used 15 projections, a 15° span, and 700 mm SID. The wide-angle used 25 projections, a 46° span, and 655 mm SID. The system used a W/Rh tube at 29 kVp and an Anrad direct conversion detector with 85 µm pixel pitch. To determine the effects, images were evaluated by reader scoring and FWHM of z-axis resolution, according the new ACR QC Manual. Each fiber received 1 point each if the length was >= 8 mm and ½ point if 5-8 mm. Speck clusters each get 1 point if 4-6 specks were seen and ½ point for 2-3 specks. Masses received 1 point each if ¾ of the border was visible and ½ point if ½ - ¾ was visible. Passing required at least 2 points for fibers, 3 for speck groups, and 2 for masses. Z-resolution failed if the FWHM was greater than 30% of baseline (σ = 0°).

RESULTS

For both geometries, reader-averaged results show fiber scores passed until an angular error of σ = 1.0°, speck scores passed until an angular error of σ = 0.5°, and mass scores passed at all error levels. Scores failed at 50% AEC for the 15° geometry, but only show failure at 25% AEC for the 46° geometry. The z-resolution test was more sensitive and failed after σ = 0.1°, for both geometries.

CONCLUSION

In general the ACR phantom was only mildly sensitive to factors that might degrade clinical performance. In the future, we will investigate the impact of these failures on detectability of signals in an anthropomorphic breast phantom.

CLINICAL RELEVANCE/APPLICATION

To our knowledge, no work has been done to assess the utility of the ACR phantom in evaluating DBT systems.

SSC13-02 Comparison of Digital Mammograms, Breast Tomosynthesis and Synthetic Mammograms for Small Detail Detection: Phantom-Based Observer Performance Studies

Monday, Dec. 2 10:40AM - 10:50AM Room: S503AB

Participants
Liesbeth Vancoillie, Leuven, Belgium (*Presenter*) Nothing to Disclose
Lesley Cockmartin, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose
Nicholas Marshall, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose
Hilde Bosmans, PhD, Leuven, Belgium (*Abstract Co-Author*) Stockholder, Qaelum NV Research Grant, Siemens AG Research Grant, General Electric Company Research Grant, Agfa-Gevaert Group

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PURPOSE

Compare small detail detectability in digital mammography (DM), digital breast tomosynthesis (DBT) and synthetic mammograms (SM) of 5 vendors using 2 phantoms: CDMAM (homogeneous background with gold discs) and L1 (structured background with calcification inserts).

METHOD AND MATERIALS

Phantom images were acquired for DM/DBT on Fujifilm Amulet Innovality ST, GE HC Senographe Pristina, Hologic Selenia Dimensions, IMS Giotto Class and Siemens Mammomat Revelation, with SM calculated from DBT. Automatic exposure control (AEC) dose levels for DM/DBT modes were respectively: 1.37mGy/1.93mGy; 1.33mGy/1.33mGy; 1.55mGy/2.02mGy; 1.20mGy/1.48mGy; 1.08mGy/2.09mGy. Twelve acquisitions were made at AEC/2, AEC and 2xAEC levels. Both phantoms were read manually, with CDMAM also read using CDCOM software, both using a 4-alternative forced choice method. Threshold gold thickness (Ttr) at 0.13 mm diameter for CDMAM and threshold calcification diameter (dtr) for L1 were defined from the 62.5% correct score. One-way analysis of variance was performed to test significant differences among dose levels/modalities.

RESULTS

For human reading of CDMAM at AEC dose, SM was inferior to DM/DBT. Ttr results for DM/DBT/SM were for Fuji: 0.59µm/0.70µm/1.02µm, GE: 0.61µm/1.10µm/1.27µm, Hologic; 0.71µm/1.09µm/1.19µm, Giotto: 1.17µm/1.30µm/1.65µm, and Siemens: 0.86µm/1.01µm/1.34µm. CDCOM results were within error bars of human results, however CDCOM failed for SM. For L1, dtr results for DM/DBT/SM at AEC dose were for Fuji: 0.118mm/0.117mm/0.118mm, GE: 0.108mm/0.114mm/0.136mm, Hologic: 0.109mm/0.112mm/0.129mm, Giotto: 0.131mm/0.121mm/0.141mm and Siemens: 0.114mm/0.122mm/0.149mm. SM was significantly poorer than DM/DBT for all vendors, all modalities, all doses, except for Fuji, where dtr was not significantly different at AEC dose. For Giotto, differences were only significant between SM and DBT/DM at high dose. dtr of DM and DBT was never significantly different. Dose had a significant impact on object detectability for both phantoms.

CONCLUSION

For all 5 vendors, better small detail scores were obtained for DM and DBT than for SM. Detectability improved as dose increased.

CLINICAL RELEVANCE/APPLICATION

SM, in its current stage of development for all 5 vendors, cannot be recommended as a stand-alone modality if the small detail detectability levels achieved in DM or DBT is required.

SSC13-03 Comparison of Digital Mammograms, Breast Tomosynthesis, and Synthetic Mammograms for Detection of Masses: An Observer Performance Study

Monday, Dec. 2 10:50AM - 11:00AM Room: S503AB

Participants
Liesbeth Vancoillie, Leuven, Belgium (*Presenter*) Nothing to Disclose
Lesley Cockmartin, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose
Nicholas Marshall, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose
Hilde Bosmans, PhD, Leuven, Belgium (*Abstract Co-Author*) Stockholder, Qaelum NV Research Grant, Siemens AG Research Grant, General Electric Company Research Grant, Agfa-Gevaert Group

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PURPOSE

Compare detectability of masses in digital mammography (DM), digital breast tomosynthesis (DBT) and synthetic mammograms (SM) of 5 vendors with a 3D structured (L1) phantom with embedded mass-like lesions.

METHOD AND MATERIALS

L1 is a hemispherical shaped phantom filled with PMMA spheres and water plus nine 3D-printed lesions: 5 non spiculated (diameter 1.6mm to 6.2mm) and 4 spiculated masses (diameter 3.8mm to 9.7mm). DM, DBT and SM images were acquired on these systems: Fujifilm Amulet Innovality ST, GE HC Senographe Pristina, Hologic Selenia Dimensions, IMS Giotto Class and Siemens Mammomat Revelation. Three dose levels were studied (12 acquisitions at each level): automatic exposure control (AEC) level and manually set at AEC/2 and 2xAEC. A 4-alternative forced choice reading paradigm was used. Threshold diameter to reach a 62.5% correct score was evaluated (dtr). One-way analysis of variance was performed to test for significant differences among dose levels/modalities.

RESULTS

For GE, Giotto and Siemens, DBT performed significantly better than SM, while SM showed no difference with DM. For Fuji and Hologic, there was no significant difference between DBT and SM, while DM was inferior to DBT and SM. The dtr values for non-spiculated masses for DM/DBT/SM at AEC dose, were respectively: Fuji: 4.21mm/2.12mm/2.89mm; GE: 4.87mm/2.15mm/4.21mm; Hologic: 7.21mm/1.87mm/3.28mm; Giotto: 4.96mm/2.37mm/4.30mm; Siemens: 4.44mm/2.22mm/4.64mm and for spiculated masses: Fuji: 6.65mm/2.58mm/3.66mm; GE: 4.27mm/2.04mm/3.55mm; Hologic: 5.04mm/2.54mm/3.68mm; Giotto: 4.97mm/2.37mm/4.30mm; Siemens: 5.6mm/2.99mm/4.67mm. Dose did not impact detection of both mass types for GE and Hologic. For Fuji, Giotto and Siemens DBT, decreasing the dose lead to a significantly inferior dtr for spiculated masses and in the case of Fuji and Siemens also for non-spiculated masses.

CONCLUSION

Detectability of mass-like lesions was higher in DBT compared to DM and SM, except for Fuji and Hologic, where SM was not different from DBT. Increasing dose only influenced mass detection in DBT. The L1 phantom demonstrated the superiority of DBT compared to DM for mass detection, for all 5 systems.

CLINICAL RELEVANCE/APPLICATION

For most vendors, SM, in its current stage of development, cannot be recommended as a stand-alone modality if equal mass

detectability as in DBT is required.

SSC13-04 Accurate Local Estimation of Compressed Breast Thickness in Digital Breast Tomosynthesis Using an Iterative Reconstruction Approach

Monday, Dec. 2 11:00AM - 11:10AM Room: S503AB

Participants
Lambert Leong, MS, Honolulu, HI (*Presenter*) Nothing to Disclose
Thomas K. Wolfgruber, PhD, 96813, HI (*Abstract Co-Author*) Nothing to Disclose
Shane Spencer, Honolulu, HI (*Abstract Co-Author*) Nothing to Disclose
Elizabeth K. Zachariah, MD, Pearl Harbor, HI (*Abstract Co-Author*) Nothing to Disclose
Serge L. Muller, PhD, Buc, France (*Abstract Co-Author*) Employee, General Electric Company
John A. Shepherd, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Our purpose is to describe invasive breast cancer in terms of lipid, water, and protein content using dual-energy tomosynthesis. Previous work for full-field digital mammography required an in-image calibration phantom adhered to the compression paddle to describe thickness, tilt, and warp. We show these parameters can be estimated by using an iterative reconstruction approach on the sinograms resulting in a model of the breast characteristics including local breast thickness, compression paddle tilt, and warp.

METHOD AND MATERIALS

Virtual breast objects (VBO) of known geometries, defined using only five unique parameters (thickness, width, density, warp, and tilt), were constructed in simulation with MATLAB and their corresponding sinograms generated. Breast thicknesses from 1 to 80 mm and chest wall to nipple distances from 1 to 200 mm were generated to sample the space. Single coronal sinograms for training and validation sets of 9600 and 1920 VBO's, respectively, were constructed. Principal component analysis (PCA) was used to generate a model which explains the relationship between the five parameters and the sinograms. Clinical DICOM header thicknesses in 24 tomosynthesis exams were also compared to the local model estimates.

RESULTS

We found that 25 PCA components explained greater than 99% of model variance. A comparison between iterative reconstructed models and phantom measures is ongoing. A mean thickness difference (DICOM - model) of 24 breasts was found to be 2.80 mm (SD = 2.95 mm, Min/Max=-12/11 mm). The PCA model captured the local thickness decline from the chest wall to the nipple.

CONCLUSION

We demonstrate a method to capture local breast thickness using an iterative reconstruction method in the sinogram space. The model was able to describe paddle warp and tilt. Phantom calibration of the model is ongoing and accurate local breast thicknesses were seen when compared to DICOM values in clinical images. This method can be implemented on commercial tomosynthesis systems without modification. Future studies will utilize these thickness measures with dual-energy tomosynthesis to create voxels lipid, water, and protein contents instead of greyscale values alone.

CLINICAL RELEVANCE/APPLICATION

Accurate and local breast thickness measures enable lesions to be characterized by their lipid, water, and protein content through a dual-energy 3-compartment model while still in situ to better assess malignancy status.

SSC13-05 Deep Learning-Driven Sparse-View Reconstruction for Radiation Dose Reduction in Dedicated Breast CT: Quantitative Evaluation

Monday, Dec. 2 11:10AM - 11:20AM Room: S503AB

Participants
Zhiyang Fu, MENG, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Hsin Wu Tseng, PHD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Srinivasan Vedantham, PhD, Tucson, AZ (*Presenter*) Research collaboration, Koning Corporation; Research collaboration, General Electric Company
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Ali Bilgin, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To objectively quantify and demonstrate the feasibility of deep learning-driven reconstruction for sparse-view dedicated breast CT (BCT) to reduce radiation dose and to identify the best method for reader study.

METHOD AND MATERIALS

Projection datasets (300 views, full-scan; 12.6 mGy MGD) from 137 BIRADS 4/5 women who underwent BCT prior to biopsy were reconstructed using FDK algorithm (0.273 mm isotropic voxels) and served as reference. Sparse-view (100 views, full-scan; 4.2 mGy median MGD) projection data were reconstructed using FDK algorithm (0.273 mm isotropic voxels) and three variants of multiscale CNN (ResNet) architecture (individual 2D slices, "ResNet2D"; 5 contiguous 2D slices, "ResNet2.5D"; and, residual dense network with 5 contiguous 2D slices, "ResDenseNet2.5D") were used to train the network with sparse-view and reference FDK reconstructions as input and label, respectively. Each network used 2000/900/900 slices from 20/5/5 breasts for training/validation/testing. Once trained, 42868 slices from the remaining 107 breasts were used to quantify normalized mean-squared error (NMSE), bias and absolute bias, all with respect to the reference, and the standard deviation for all reconstructions.

RESULTS

All 3 deep learning methods suppressed streak artifacts and showed significantly reduced NMSE, bias and absolute bias compared to FDK reconstruction (p<0.001). The NMSE (mean+/-SD, log scale) was significantly lower for ResDenseNet2.5D (-2.59+/-0.27; p<0.001). The bias was lowest for ResNet2.5D (-3.05E-5+/-3.05E-4; p<0.001). The absolute bias was lowest for ResDenseNet2.5D (9.05E-4+/-3.51E-4; p<0.001). The standard deviation for each deep learning sparse-view reconstruction was lower than the reference 300-view FDK reconstruction as the CNN learns from the ensemble of breasts. The standard deviation in ResNet2.5D was lowest (3.67E-3+/-1.38E-3; p<0.001).

CONCLUSION

Quantitatively, ResNet architectures using multiple contiguous slices performed better than that using individual slices. Deep learning-driven sparse-view reconstruction for radiation dose reduction is feasible and needs to be investigated.

CLINICAL RELEVANCE/APPLICATION

Deep learning-driven sparse-view reconstruction can potentially enable radiation dose reduction in breast CT to a level that may be suitable for breast cancer screening.

SSC13-06 Measurements of Resolution in Digital Breast Tomography (DBT) Using a Tomosynthesis Phantom, Special Emphasis on Detecting Calcified Specks

Monday, Dec. 2 11:20AM - 11:30AM Room: S503AB

Participants
David J. Goodenough, PhD, Washington, DC (*Abstract Co-Author*) Consultant, The Phantom Laboratory
Joshua Levy, Salem, NY (*Presenter*) Stockholder, The Phantom Laboratory President, The Phantom Laboratory Stockholder, Image Owl, Inc

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PURPOSE

Investigate measurements of resolution in DBT using a Tomosynthesis Phantom with emphasis on meaning and interpretation of "MTF". The limitations of calcified speck detection in DBT depending on where the speck might occur.

METHOD AND MATERIALS

Tomosynthesis Phantom is used for testing DBT. Small beads (0.09mm radius) are used as both "point sources" and elements along slice width ramps for slice geometry and scan slice incrementation (z). This study examines the use of this PSF when located at intra and inter slice positions. PSF bead, and the scan slice geometry bead ramps isolate where any given bead is located (intra and inter) within the phantom and the slice. Spatial distribution of the (bead) PSF can be examined at a given position. A summation of data from neighboring beads shows study change in PSF increases the z axis slice width. FWHM of the PSF, and Fourier Transform (FT) of the PSF yielding an "MTF" type function, and corresponding Modulation levels. Nine identical DBT images taken on a DBT Tomosynthesis system and the data analyzed from both individual beads as well as combined beads examining highest resolution and average resolution within the slice. A theoretical model of PSF shows PSF tends to move from a typical function at the isocenter of the slice, annular shapes as one moves off center. Annular shapes simulated by combination of Bessel functions.

RESULTS

PSF and "MTF" results show changes in positioning of the bead (calcified speck). Results may have important implications to understanding resolution limitations to finding small calcified specks depending on where in the slice the spec occurs. Result within the slice is different than the best-case result within the slice. High contrast object extends along the z axis, then the average result will better reflect spatial resolution.

CONCLUSION

It is possible to examine the changes in Point Spread Function and "MTF" by using small bead, point sources. It is shown that understanding the resolution differences of location of such specks will depend on inter and intra slice locations. The "MTF" can be used to study this effect.

CLINICAL RELEVANCE/APPLICATION

DBT phantom using small beads to study resolution in DBT systems results help the clinician understand the process of limited angle tomography degrades the highest resolution of a calcified speck location to the more average resolution a bead/speck at some random position in the slice.

SSC13-07 Contrast-Enhanced Spectral Mammography with a Compact Synchrotron X-Ray Source

Monday, Dec. 2 11:30AM - 11:40AM Room: S503AB

Participants
Lisa Heck, Garching, Germany (*Presenter*) Nothing to Disclose
Martin Dierolf, Garching, Germany (*Abstract Co-Author*) Nothing to Disclose
Christoph Jud, Garching, Germany (*Abstract Co-Author*) Nothing to Disclose
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Kevin Kroninger, Dortmund, Germany (*Abstract Co-Author*) Nothing to Disclose

Julia Herzen, Garching, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Contrast-enhanced spectral mammography (CESM) based on K-edge subtraction (KES) helps to identify uncertain findings in standard mammography. As CESM requires two acquisitions, dose reduction is a crucial issue. Here, two dual-energy dose-compatible CESM approaches are evaluated with a compact synchrotron X-ray source.

METHOD AND MATERIALS

In this study, the commonly used dual-energy KES imaging technique and a two-material decomposition method were used to implement CESM at a quasi-monochromatic compact synchrotron X-ray source. For a better evaluation of the laboratory results, clinical CESM images were also performed. Low-energy attenuation-based images as well as images only showing the contrast agent iodine were acquired with a mammographic accreditation phantom for both the clinical and the laboratory measurements. The phantom has been modified with a tube filled with iodine in a concentration of 6 mg/ml to mimic the contrast agent.

RESULTS

Confirmed by a higher contrast-to-noise ratio (CNR) and spatial resolution, improved image quality has been accomplished with both aforementioned methods carried out in the laboratory for the iodine images while the spectral approach achieved even better results than the KES imaging technique. Exemplarily, we demonstrate the reduction of the applied dose by up to 66% compared to the clinically applied dose. Additionally, the image quality of the laboratory results of the low-energy images - which are comparable to conventional mammography images - also increases compared to the clinical examinations.

CONCLUSION

Our findings regarding the CNR and the spatial resolution suggest the great potential of novel quasi-monochromatic X-ray sources in combination with a two-material decomposition method as a means to improve the diagnostic quality and to reduce the applied dose in clinical examinations. Our results show a significant increase in image quality at the same radiation dose or a significantly reduced dose level required to obtain the same image quality as in the clinical system.

CLINICAL RELEVANCE/APPLICATION

The reduction of radiation dose in mammography, especially for second-level examinations, is a crucial citeria for the improvement of its clinical diagnostic quality.

SSC13-08 Comparison Between Vendor Reported and Physicist Calculated Doses Within a Quality Control Program for a Tomosynthesis Mammography Screening Trial: Interim Results

Monday, Dec. 2 11:40AM - 11:50AM Room: S503AB

Participants
Aili K. Maki, BEng, Toronto, ON (*Presenter*) Research collaboration, General Electric Company; Contractor, Mammographic Physics, Inc
James G. Mainprize, PhD, Toronto, ON (*Abstract Co-Author*) Institutional research agreement, General Electric Company
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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

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PURPOSE

We are overseeing the quality control (QC) for a screening trial comparing tomosynthesis (DBT) and 2D mammography. The QC involves weekly, monthly and annual tests. We also collect doses and technique factors used for patient imaging. To understand the reliability of the doses recorded in the DICOM image headers, we are comparing mean glandular dose (MGD_calc) calculated using physicists' measurements of half value layer (HVL) and tube output with those reported in the headers for scans of phantoms (MGD_hdr).

METHOD AND MATERIALS

A set of phantoms is circulated annually among the participating sites and imaged with the DBT mode used for patients. Slabs of PMMA 2, 4, 6 and 8 cm thick, with 0, 0.5, 1.5 and 2.3 cm spacers are used. mR/mAs and HVL values are obtained from the physicist's surveys and used with the imaging technique factors to estimate the MGD_calc using the Dance et al method. Corrections are made for spectrum, fraction of glandular tissue and DBT geometry, as parameterized by Li et al. The dose percent difference (DPD) is calculated as 100x(MGD_hdr-MGD_calc)/MGD_calc . Comparisons of DPDs were made between DBT systems, dosimeter manufacturers and phantom thicknesses.

RESULTS

To date 45 surveys on 4 models from 2 vendors have been conducted. Dosimeters from 4 different manufacturers were used. The doses match best for the 4.5 cm thickness with a DPD of 2.1% (95% CI -1% to +5%). The mismatch is greatest at 22% for 2 cm (95% CI 12% to 25%). The average DPD is larger for one of the dosimeter manufacturers, suggesting a bias with that technology. Differing trends were noted in the size of the DPD vs phantom thickness when separating out by DBT model. QC testing is ongoing and updated data will be available at RSNA.

CONCLUSION

Systematic discrepancies between displayed and calculated doses at different thickness suggest that different dose calculation models and assumptions may be used by the various DBT systems. Care must be taken in drawing conclusions about dose estimates to a population when relying on the figures reported in the DICOM headers. In addition, different biases may be present in the different meters used to measure entrance exposure and HVL, further confounding the assssment of dose.

CLINICAL RELEVANCE/APPLICATION

Differences in assumptions used to calculate dose existing between tomosynthesis mammography systems and in beam quality values mean care must be taken when comparing reported and calculated doses.

SSC13-09 Automatic Exposure Control Intelligence in Digital Mammography for a Diagnostic and Post-Therapy Patient Population

Monday, Dec. 2 11:50AM - 12:00PM Room: S503AB

Participants
Lesley Cockmartin, Leuven, Belgium (*Presenter*) Nothing to Disclose
Stoyko Marinov, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose
Joke Binst, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose
Nicholas Marshall, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose
Chantal van Ongeval, MD, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose
Hilde Bosmans, PhD, Leuven, Belgium (*Abstract Co-Author*) Stockholder, Qaelum NV Research Grant, Siemens AG Research Grant, General Electric Company Research Grant, Agfa-Gevaert Group

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PURPOSE

Automatic exposure control (AEC) systems are designed to find the most attenuating region and adjust the exposure parameters so this region is imaged at some predefined dose/quality level. This study quantifies the success rate of the AEC in selecting the densest breast tissue in diagnostic and post-therapy patient populations.

METHOD AND MATERIALS

A total of 615 successive mammograms were collected from a GEHC PristinaTM system. The AEC-selected region was placed in one of three categories a) AEC region within the densest breast tissue (considered "optimal") b) region located in pectoral muscle and c) clips present inside the region. Second, the images were divided into 1x1 mm^2 areas and mean volumetric breast density (VBD) estimated for each area using VolparaTM. Third, images where the difference between maximum VBD within the AEC region and other parts of the breast was >15% were retrieved and visually scored for the presence of disturbing noise.

RESULTS

In 84% of all mammograms the AEC selected the optimal region. In 5% of all mammograms the AEC selection missed the densest breast part, but only 3.7% resulted in differences in VBD >15%. Visual inspection of these images did not show excessive noise. In 6% of all mammograms, the AEC region was positioned in the pectoral muscle, where the correct selection should have been in the breast tissue. The mean, minimum and maximum difference in pixel values between the pectoral muscle and the densest breast tissue was 5%, -15% and 29%. In 32% of these cases a larger than targeted dose compared to breast tissue selection was given, being on average 6%. Finally, 179 mammograms (29%) contained clips. In 32 images (5% of all mammograms), the AEC selected a region that included the clips, but in 28 of these images the signal due to the clip was excluded when determining the exposure settings.

CONCLUSION

Automatic exposure control selection within mammograms of breasts with lesions, clips etc. is a challenging task. Region selection by the GEHC PristinaTM AEC is intelligent and overcomes the current challenges via segmentation techniques and local density calculations.

CLINICAL RELEVANCE/APPLICATION

The selection of the automatic exposure control region and subsequent dose level adjustment is a key parameter in the radiation dose/quality balance and should be optimized for all breast types.

VW41

Breaking Down Barriers in AI Development for Lesion Identification in Breast Care using Ultrasound: Presented by GE Healthcare

Monday, Dec. 2 10:30AM - 11:00AM Room: South Building, Booth 5135

Participants

Sonia Gupta, MD, Boston, MA (*Presenter*) Medical Director, Qure.ai North America; Consultant, IBM Corporation; Consultant, Sauzio; Consultant, General Electric Company; Consultant, Koios; Consultant, Alphabet Inc; Speakers Bureau, Ambra Health ; Speaker, AIMED; Advisory Board, Guerbet SA; Editorial Advisory Board, Anderson Publishing, Ltd;

Program Information

Learn about the current status of artificial intelligence (AI) utilization in diagnostic imaging specific to breast radiology in the USA, as we explore stakeholders, theories of development and hype vs. reality. Specific challenges in development and deployment of AI into a diagnostic breast ultrasound practice will be presented. An overview of GE's partnership with Koios will be shared and highlights of how to break down internal and external barriers will be shown. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

VW67

Transformative Breast US Technology: Clinical Benefits of Specialized Breast Ultrasound Systems: Presented by Hologic, Inc.

Monday, Dec. 2 10:30AM - 11:15AM Room: South Building, Booth 5119

Participants

Stacy A. Smith-Foley, MD, Fayetteville, AR (*Presenter*) Speakers Bureau, Myriad Genetics, Inc; Scientific Advisory Board, Hologic, Inc

Program Information

Listen as an experienced radiologist presents on the clinical benefits and data associated with advanced SuperSonic breast technologies (SWE™, TriVu, Needle PLUS) used across the patient pathway -- Cancer risk assessment, lesion characterization, ultrasound screening, treatment planning and monitoring, and biopsy guidance). The session includes case reviews and hands-on demonstrations. *Adding this session to your agenda does not secure your seat in this session. Secure your seat onsite by visiting Hologic's Workshop Room # 5119 in the South Hall.*

Printed on: 10/29/20

VW84

Differentiating DBT Implementation in Assessment Mammography: Presented by FUJIFILM Medical Systems U.S.A., Inc.

Monday, Dec. 2 10:30AM - 11:30AM Room: South Building, Booth 5147

Participants

Anna Russo, Negrar, Italy (*Presenter*) Nothing to Disclose

Program Information

This interactive session begins by covering various clinical scenarios where the selection of different DBT sweep angles and views would be the most appropriate based on patient history and symptoms. The second part of this workshop will focus on Tomo-guided biopsies with consideration to sweep angles and needle approaches.

Printed on: 10/29/20

VW42

Risk-based Breast Cancer Screening and Breast Density Assessment: Presented by GE Healthcare

Monday, Dec. 2 11:30AM - 12:00PM Room: South Building, Booth 5135

Participants

Eric J. Kraemer, MD, Reno, NV (*Presenter*) Nothing to Disclose

Program Information

The future of breast health looks at personalizing screening protocols tailored to each woman's individual risk of developing breast cancer. Hear how Dr. Kraemer has implemented a personalized breast screening program at Reno Diagnostic Center based on breast cancer risk and breast density. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

VW18

The Benefits of 50° Wide-angle Tomosynthesis: Presented by Siemens Healthineers

Monday, Dec. 2 11:40AM - 12:50PM Room: North Building, Booth 8563

Participants

Paula M. Grabler, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Program Information

During this hands-on workshop, you will learn more about evaluating breast tomosynthesis data. A reading expert will guide you through cases that will both fascinate and challenge you! All cases have been acquired with Siemens Healthineers 50° Wide-Angle Tomosynthesis technology and can be read on our advanced visualization software *syngo*. Breast Care. You will become familiar with the value of Wide-Angle Tomosynthesis images and the ease-of-use of our reading solutions. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP

https://www.fairorg.de/Siemens-Healthineers/portal/workshop.cfm/rsna19/

Printed on: 10/29/20

VW85

Integrating Tomosynthesis into your Breast Imaging Practice: Presented by FUJIFILM Medical Systems U.S.A., Inc.

Monday, Dec. 2 11:40AM - 12:40PM Room: South Building, Booth 5147

Participants

Laurie L. Fajardo, MD,MBA, Park City, UT (*Presenter*) Consultant, Hologic, Inc; Consultant, FUJIFILM Holdings Corporation;

Program Information

This educational program provides an opportunity to learn about the benefits of Digital Breast Tomosynthesis (DBT) for detecting / diagnosing breast cancer, and the interpretation and workflow considerations for implementing DBT into a breast imaging practice. During this session, there will be a review of various DBT system designs, recent technology improvements, future developments, evidence of DBT clinical performance improvements / metrics, and a presentation on challenging lesions and pathologies.

Printed on: 10/29/20

VW68

Personalizing Mammography: Managing the High-risk Patient to the Dense Breast Patient: Presented by Hologic, Inc.

Monday, Dec. 2 11:45AM - 12:30PM Room: South Building, Booth 5119

Participants

Stacy A. Smith-Foley, MD, Fayetteville, AR (*Presenter*) Speakers Bureau, Myriad Genetics, Inc; Scientific Advisory Board, Hologic, Inc

Program Information

Listen to an experienced radiologist's clinical perspective on the importance of assessing patients' risk of breast cancer to manage their individual care. Includes a discussion of the most current recommendations for screening for dense breast patients, along with patient pathways for high risk women. *Adding this session to your agenda does not secure your seat in this session. Secure your seat onsite by visiting Hologic's Workshop Room # 5119 in the South Hall.*

Printed on: 10/29/20

BRS-MOA

Breast Monday Poster Discussions

Monday, Dec. 2 12:15PM - 12:45PM Room: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

Participants

Matthias Dietzel, MBA,MD, Erlangen, Germany (*Moderator*) Nothing to Disclose

Sub-Events

BR227-SD-MOA1 Measurement Error Due to Terminal Digit Preference in Breast Cancer Tumor Diameter Reporting: A Population-Based Study

Station #1

Participants
Kaitlyn Tsuruda, MSc, Oslo, Norway (*Presenter*) Nothing to Disclose
Solveig S. Hofvind, Oslo, Norway (*Abstract Co-Author*) Nothing to Disclose
Lars A. Akslen II, MD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Solveig R. Hoff, MD, Aalesund, Norway (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Breast cancer treatment and therapy is based on tumour characteristics, such as tumour diameter. Error in tumour diameter measurement can lead to biased tumour size staging and hinder the effectiveness of personalized medicine. A subconscious "terminal digit preference" preference for tumour diameters that end with the digits zero or five has been observed in the measurement of colorectal and lung tumours, but has not been well described in breast imaging. The purpose of this study was to assess the extent of terminal digit preference among breast radiologists and pathologists.

METHOD AND MATERIALS

This national study included mammographic and histopathologic tumour diameter information for all T1-T3 invasive breast cancers <100 mm, diagnosed during 2012-2016 (n = 14,468). The presence of terminal digit preference was assessed graphically using histograms. Scatterplots and Bland-Altman plots were used to assess the agreement between mammographic and histopathologic measurements and identify visual signs of terminal digit preference.

RESULTS

Mammographic and histopathologic tumour measurements were available for 6865 cases. An additional 927 and 6676 cases had only mammographic or only histopathologic measurements, respectively. 38.7% of mammographic measurements and 34.8% of histopathologic measurements had terminal digits ending in zero or five. When comparing the agreement between mammographic and histopathologic measurements with a terminal digit of zero or five, the scatterplot demonstrated a checkerboard pattern, while the Bland-Altman plot showed a lattice pattern.

CONCLUSION

The measurement of breast cancer tumour diameters is affected by terminal digit preference. The visual signs identified in this study can be used to point to the presence of this type of measurement error.

CLINICAL RELEVANCE/APPLICATION

Underestimation of tumour diameter due to terminal digit preference can result in under-staging clinical or pathological tumour size classifications.

BR228-SD-MOA2 The Study of Image Quality and Radiation Dosage with Patient-Assisted Compression in Mammography

Station #2

Participants
Feifei Wang, Liaoning , China (*Presenter*) Nothing to Disclose
Tongtong Liu, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
Yahong Luo, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
Huizhi Cao, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Amiee Chen, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the image quality, radiation dose and patient experience of patient-assisted compression (PAC)with those of technologist compression(TC) in mammography.

METHOD AND MATERIALS

This study was approved by institutional review boards, and written informed consent was obtained. 261 participants aged 45-75 years coming for bilateral mammography were enrolled in the diagnostic study. After positioning each breast, the technologist performed the compression and exposure of the first breast, initiated the compression of the other until 4 daN and then let the patient complete the compression using a remote control device. Subjective image quality was rated using 4-point scale(4, excellent;1 bad) by a panel of physicians, and compression force, breast thickness, average glandular dose and pain value for each breast were assessed for PAC and TC. And the patients feeling during the examination was recorded.

RESULTS

The image quality of PAC and TC was 3.8+/-0.4 Vs. 3.7+/-0.5 for craniocaudal (CC) and 3.9+/-0.3 Vs. 3.8+/-0.4 for mediolateral oblique (MLO) views, respectively. The compression level in PAC was 8.85+/-2.31daN(CC) and 10.67+/-2.82daN(MLO) and in TC was 7.70+/-1.39daN(CC) and 9.36+/-2.38daN(MLO), and there was no significant different(P=0.76). Breast thickness was reduced with PAC (CC, 43.81cm Vs.44.97 cm; MLO, 44.37cm Vs. 45.38 cm), as well as glandular dose (CC, 1.17mGy Vs.1.19mGy; MLO, 118mGy Vs. 1.21mGy). When compared discomfort or pain felt in PAC with that in TC, the patients' feeling with better, equal and worse was 45%(118/261) , 40%(104/261) and 15%(39/261), respectively.

CONCLUSION

Patient-assisted compression may be a preferred technique for mammography examinations, providing an equivalent image quality to technologist compression with breast thickness and glandular dose.

CLINICAL RELEVANCE/APPLICATION

Patient-assisted compression can improve the patients experience in mammography examination without sacrificing image quality, which maybe useful in breast imaging.

BR251-SD-MOA4 Tissue Sound Speed is More Strongly Associated with Breast Cancer Risk than Mammographic Percent Density: A Comparative Case-Control Study

Station #4

Participants
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Ruth Pfieffer, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Mark Sherman, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Peter J. Littrup, MD, Rochester Hills, MI (*Abstract Co-Author*) Founder, CryoMedix, LLC Research Grant, Galil Medical Ltd Research Grant, Endo International plc Consultant, Delphinus Medical Technologies, Inc
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Sharon Fan, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Increased mammographic percent density (MPD) is a strong independent risk factor for developing breast cancer. Previous studies have shown that tissue sound speed, derived from ultrasound tomography, is a surrogate biomarker of MPD. We examined associations of sound speed and MPD with breast cancer risk in a case-control study.

METHOD AND MATERIALS

We evaluated breast cancer risk associated with sound speed and MPD in a case-control study involving 59 participants with recent breast cancer diagnoses (cases, aged 30-70 years) and 150 participants with no history of breast cancer (controls), who were matched to cases on age, race, and menopausal status. The cases and controls were imaged with both ultrasound tomography (UST) and mammography. In cases, breast density was measured pre-treatment in the contralateral breast to avoid potential influences of tumor-related changes on MPD or sound speed. In controls, a randomly selected breast was imaged. The ultrasound tomography images were used to estimate the volume averaged sound speed of the breast, and the Cumulus software package was applied to mammograms to determine MPD. Odds Ratios (ORs) adjusted for matching factors and 95% Confidence Intervals (CIs) were calculated for the relation of quartiles of MPD and sound speed with breast cancer risk. OR differences were tested using a bootstrap approach.

RESULTS

MPD was associated with elevated breast cancer risk compared to controls, consistent with previous studies, although the trend did not reach statistical significance (OR per quartile=1.28, 95%CI: 0.95, 1.73; ptrend=0.10). In contrast, elevated sound speed was significantly associated with increased breast cancer risk in a dose-response fashion (OR per quartile=1.79, 95%CI: 1.30, 2.48; ptrend=0.0004) (Figure 1). The OR-trend for sound speed was statistically significantly different from that observed for MPD (p=0.01).

CONCLUSION

Our case-control study showed that increasing quartiles of whole breast sound speed were consistently and more strongly associated with increasing breast cancer risk than quartiles of MPD. These results show promise for UST's role in breast cancer risk stratification.

CLINICAL RELEVANCE/APPLICATION

Elevated breast density strongly increases breast cancer risk. UST has the potential to provide a more accurate, non-ionizing method for assessing breast density and its associated breast cancer risk.

BR252-SD-MOA5 Supplementary Screening Axillary After Breast Cancer Surgery in Clinically and Mammographically Negative Patients

Station #5

Participants
Sung Ui Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung Min Chang, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Ann Yi, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Bo Ra Kwon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Whether postoperative screening breast ultrasound (US) should include axillary scans is controversial. The purpose of this study is to evaluate the necessity of axillary scanning when supplemental screening breast ultrasonography is performed in clinically and mammographically negative postoperative women.

METHOD AND MATERIALS

Between January and March 2017, supplemental postoperative screening US were performed in 4052 consecutive patients. Among those patients, 3287 supplemental screening breast US examinations in asymptomatic women with negative or benign results at mammography were included for this review. Bilateral whole-breast screening US was performed by one of 10 experienced radiologists. The bilateral axillae were routinely scanned, and representative images were documented in all examinations. The positive screening US examinations were defined as cases with BI-RADS category 3 or more. The recall rate, positive predictive value (PPV3) and cancer detection rate (CDR) of biopsies in breasts and axillae were calculated separately.

RESULTS

Among 3287 screening US, there were 7 in breast, and 4 axillary recurrences. By adding supplemental screening US, 46 patients had positive findings in the breast (14.6 per 1000), and 25 had positive axillary findings (7.6 per 1000). Of them, 32 patients underwent biopsy for breast lesions, 5 patients underwent biopsy for axillary LN. Supplemental screening US detected clinically and mammographically occult 3 breast cancers (0.91 per 1000 screens), and 1 axillary recurrence (0.30 per 1000 screens), The PPV3 for the breast and axilla were 9.4% and 25.0%, respectively. Three axillary recurrences not detected by screening US were detected by chest CT or PET examination.

CONCLUSION

Axillary recurrence was very rare in postoperative patients who showed negative findings on mammography and present no symptom. Routine axillary scanning during postoperative screening breast US had minor effect on additional cancer detection, but rather increased the number of false-positive recalls and biopsies.

CLINICAL RELEVANCE/APPLICATION

Routine axillary scanning during postoperative screening breast US does not provide additional breast cancer detection, but rather increases the number of false-positive results leading to recall examinations and biopsies.

BR253-SD-MOA6 Learning Effective Radiomic Features for Characterization of Breast Lesions with Multi-b Diffusion-Weighted MR Imaging

Station #6

Participants
Kun Sun, Shanghai, China (*Presenter*) Nothing to Disclose
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Jie-Zhi Cheng, BEng,PhD, Shanghai, China (*Abstract Co-Author*) Employee, Shanghai United Imaging Healthcare Co, Ltd
Dinggang Shen, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Fuhua Yan, MS, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic performance of radiomic features computed from multi-b diffusion-weighted MR imaging for breast lesions characterization, and also compare the diagnostic performance between the radiomic features and mean values of diffusion metrics.

METHOD AND MATERIALS

Totally, 542 lesions in 542 patients with multi-b diffusion-weighted-images (b values: 0-2500 s/mm2) were acquired, where 100 radiomic features (by using Pyradiomics toolbox) were computed with multi-b diffusion-weighted-imaging, as well as mono-exponential (ME) with ME-ADC0-1000 and ME-ADCall-b, bi-exponential (BE) with BE-D, BE-D*, and BE-f, stretched-exponential (SE) with SE-DDC and SE-a, and diffusion kurtosis imaging (DKI) with DKI-D and DKI-K. Random forest (RF) model was adopted to achieve differential diagnosis based on the radiomic features and mean diffusion metrics of ME (mADCall-b, mADC0-1000), BE (mD, mD*, mf), SE (mDDC, ma), and DKI (mK, mD). The dataset is randomly split into the training and testing sets for 100 times to evaluate the performance of RF. The training and testing sets were randomly split into 50% and 50%. The performance of using radiomic features and mean diffusion metrics was compared with McNemar test and the receiver operating characteristic (ROC) analysis.

RESULTS

The AUCs of radiomic features for breast lesions diagnosis ranged from 0.80 (BE-D*) to 0.85 (BE-D), with sensitivity from 83% to 88%, and specificity from 74% to 82%, while those of the mean diffusion metrics ranged from 0.54 (BE-mf) to 0.79 (ME-mADC0-1000), with sensitivity from 74% to 88%, and specificity from 41% to 71%. There were significant differences between the mean values of all diffusion metrics and radiomic features of AUCs (all $P < 0.0001$). For radiomics computed from the 23 diffusion-related sequences respectively, the most important sequence and feature are BE-D (AUC: 0.85) and Shape-Sphericity (feature importance,

FI: 0.04). For the radiomics computed from the combination of b2500, ME-ADCall-b, BE-D, SE-DDC, and DKI-K, the most important sequence and feature are DKI-K (FI:0.24) and BE-D-First-Order-Skewness (FI: 0.02), respectively.

CONCLUSION

Diffusion radiomic analysis performed better than the mean diffusion metrics alone, which allowed for reliable differentiation between benign and malignant breast lesions.

CLINICAL RELEVANCE/APPLICATION

Diffusion-related radiomics may improve the diagnosis and management of breast cancer.

BR197-ED-MOA7 Knack for the NAC: A Comprehensive Review of the Nipple-Alveolar Complex (NAC)

Station #7

Participants
Daniel A. Lyons, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose
Rifat A. Wahab, DO, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Charmi Vijapura, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Mary C. Mahoney, MD, Cincinnati, OH (*Abstract Co-Author*) Researcher, General Electric Company

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TEACHING POINTS

Review anatomy and imaging techniques of the nipple-alveolar complex. Recognize benign versus malignant pathology of the nipple-alveolar complex and associated imaging findings.

TABLE OF CONTENTS/OUTLINE

Anatomy of the nipple-alveolar complex Superficial anatomy Ductal anatomy Normal variants Imaging techniques of the nipple-alveolar complex Mammography Ultrasound MRI Galactogram Benign pathology of the nipple-alveolar complex Mammary duct ectasia Nipple calcifications Abscess of Montgomery glands Nipple adenoma Malignant pathology of the nipple-alveolar complex Breast Carcinoma Paget's Disease of the nipple-alveolar complex

BR198-ED-MOA8 False Negatives and Missed Opportunities on Breast MRI: How Can We Do Better?

Station #8

Awards
Identified for RadioGraphics

Participants
Katrina Korhonen, MD , Philadelphia, PA (*Presenter*) Nothing to Disclose
Samantha P. Zuckerman, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Susan Weinstein, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Elizabeth S. McDonald, 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, Advisory Panel, iCAD, Inc; Speaker, iiCME

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TEACHING POINTS

1. MRI has high sensitivity in detecting breast cancer. However, false negatives may occur. Most false negatives can be categorized as either a failure to characterize or a failure to detect an abnormality. 2. Different subtypes of breast cancer may have variable enhancement on MRI; some cancers, such as low-grade DCIS or some invasive lobular carcinomas, may demonstrate only low-level or even no detectable enhancement. 3. Diligent search patterns of non-breast regions, including the major nodal stations as well as the liver, lungs, bones, and mediastinum, are critical to avoid missing extra-mammary metastases.

TABLE OF CONTENTS/OUTLINE

1. Review of the literature reporting on false negative breast MR studies. 2. Pictorial review of false negative breast MRIs as well as cancers seen only in retrospect. 3. Highlight reasons why cancers or other significant findings were not appreciated on MRI and suggest opportunities for improvement a. Failure to detect, including satisfaction of search and poor search patterns b. Failure to characterize, including erroneously attributing abnormalities as stable or as benign c. Cancers detected on other modalities due to low-level or no detectable enhancement on MRI 4. Explore technical reasons, including scan timing and patient positioning, that may hamper cancer detection on MRI

BR199-ED-MOA9 Malignant Papillary Tumors of the Breast: Radiologist's Role for a Complete Diagnostic Assessment

Station #9

Awards
Certificate of Merit

Participants
Denny Lara Nunez, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose
Sara Eugenia Vazquez Manjarrez, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Fernando Candanedo Gonzalez, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Rosaura E. Fuentes Corona, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Mariana Licano, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Nancy Margarita Gutierrez Castaneda, MD, Ciudad de Mexico, Mexico (*Abstract Co-Author*) Nothing to Disclose
Nancy Berenice Guzman Martinez, MD, Mexico City, 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. Discuss key concepts of malignant papillary tumors of the breast 2. Describe different imaging characteristics that may facilitate diagnosis of malignant papillary tumors.3. Review the management of malignant papillary tumors with emphasis of the role of imaging in diagnostic biopsies4. To assess the role of magnetic resonance in papillary carcinoma for detection of multicentric disease.

TABLE OF CONTENTS/OUTLINE

1. Description of each of the following categories in malignant papillary tumors:a. Epidemiologyb. General featuresc. Clinical presentationd. Histopathologic characteristics2. Describe key imaging findings of ultrasound, mammography and MRI of each of the following pathologies:a. Malignant noninvasive: Intraductal papillary carcinoma, intracystic papillary carcinoma, solid papillary carcinoma, micropapillary ductal carcinoma in situb. Malignant invasive: Invasive micropapillary carcinoma, invasive papillary carcinoma3. Discuss management of malignant papillary tumors including the role of imaging in diagnostic biopsies with an assessment of proper technique by ultrasound, mammography and MRI4. Review the role of magnetic resonance in papillary carcinoma for detection of multicentric disease5. Conclusion

Printed on: 10/29/20

VW43

Automating Breast Ultrasound: A Live Experience: Presented by GE Healthcare

Monday, Dec. 2 12:30PM - 1:00PM Room: South Building, Booth 5135

Participants

Kristina L. Jong, MD, Santa Barbara, CA (*Presenter*) Nothing to Disclose

Program Information

This 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. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

BRS-MOB

Breast Monday Poster Discussions

Monday, Dec. 2 12:45PM - 1:15PM Room: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Matthias Dietzel, MBA,MD, Erlangen, Germany (*Moderator*) Nothing to Disclose

Sub-Events

BR230-SD-MOB1 Positive Predictive Value for Malignancy of the Molecular Breast Imaging Lexicon

Station #1

Participants
Katie N. Hunt, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Amy Lynn Conners, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Naziya Samreen, MD, Gainesville, FL (*Abstract Co-Author*) Nothing to Disclose
Deborah J. Rhodes, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Jennifer R. Geske, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Matthew Johnson, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Michael K. O'Connor, PhD, Rochester, MN (*Abstract Co-Author*) Royalties, Gamma Medica, Inc
Carrie B. Hruska, PhD, Rochester, MN (*Abstract Co-Author*) Institutional license agreement, CMR Naviscan Corporation

PURPOSE

Evaluate the positive predictive values (PPVs) for malignancy of a validated molecular breast imaging (MBI) lexicon.

METHOD AND MATERIALS

Patients with a positive (BI-RADS analogous categories 0, 3, 4, 5, or 6 with a finding contralateral to the known malignancy) dual-detector CZT MBI performed from 8/2005-8/2017 were retrospectively reviewed. Lesion type [mass vs. non-mass uptake (NMU)], distribution, intensity, and number of views on which the lesion was seen were recorded based on a published gamma breast imaging lexicon, and correlated with follow-up imaging and/or pathology. The association of each characteristic with malignancy was tested by a mixed effects logistic regression model. Additionally, a multivariable model was constructed with lesion type (mass vs. NMU), number of views the lesion was observed on, and lesion intensity.

RESULTS

in 550 patients with a positive MBI, 634 lesions were detected of which 26% (n=165) were malignant and 74% (n=455) benign. The majority were NMU (549/634, 87%). The PPV for malignancy was significantly associated with assessment category [5% for category 0 (n=80), 2% for category 3 (n=214); 40% for category 4 (n=293), 87% for category 5 (n=46), p<.0001]; lesion type (73% for mass lesions vs. 19% for NMU; p<.0001); lesion distribution [multiple regional 0% (0/4); regional 4% (5/115), 4%; focal 21% (77/373); diffuse 33% (4/12), 33%; segmental 38% (17/45); p<.0001]; and intensity of lesion uptake [15% (45/306) for mild; 22% (49/221) for moderate (OR 0.94, 0.55-1.61); and 66% (71/107) for marked (OR 3.22, 1.62-6.42); p=0.0006]. If a lesion was seen on a single MBI view, 6% were malignant (5/88); 2 views, 16% (33/207); 3 views; 15% (12/82); 4 views, 45% (114/256), p=0.0007.

CONCLUSION

Lesions described as masses, and those with marked intensity radiotracer uptake have the highest predictive value for malignancy on MBI, with segmental uptake demonstrating the highest PPV for NMU. Multiple regional and regional uptake have low PPVs for malignancy, and may be appropriate to place in a category 3 (short-term follow-up) assessment.

CLINICAL RELEVANCE/APPLICATION

Understanding the predictive features of MBI lexicon descriptors will improve radiologist interpretation of MBI exams, and allow appropriate management and follow-up of patients.

BR231-SD-MOB2 Automatic 3D Segmentation of Breast MR T1 Images Using 3D Convolutional Neural Network

Station #2

Participants
Heerin Lee, Seoul , Korea, Republic Of (*Presenter*) Nothing to Disclose
Sung-Hun Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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

PURPOSE

To develop and evaluate a deep learning based algorithm for the breast fibroglandular tissue (FGT) and background parenchymal enhancement (BPE) volume segmentation and classification in breast MR images

METHOD AND MATERIALS

Total 711 women (mean age, 55.2 years; range 26 - 89 years) who were diagnosed with invasive breast cancer and underwent preoperative breast MR, between 2014 and 2017 were enrolled in this study. Manual segmentation was performed for the breast and FGT regions. BPE region was determined by thresholding using the subtraction image and segmented FGT mask. For classification, two radiologists independently assessed the categories of FGT and BPE of contralateral breast by consensus. Deep learning based algorithm was designed to segment and measure the volume of whole breast, FGT, and BPE and classify FGT and BPE grade. 594 patients were used for development (training and validation sets), and 117 patients for evaluation (test set). Dice similarity coefficients (DSC) and Spearman correlation analysis were used to compare the segmental results, and kappa statistics were performed for classification results.

RESULTS

The range of DSC values for breast and FGT were 0.88-0.94 (mean 0.91±0.03), 0.73-0.94 (mean 0.83±0.10), respectively. The correlation coefficient between manual segmentation and deep learning were 0.98 for breast, 0.93 for FGT, and 0.96 for BPE, respectively. Agreement in classification between deep learning based algorithm and radiologists in test set were good for FGT (k = 0.65; 95% confidence interval [CI]: 0.51, 0.78) and moderate for BPE (k = 0.46; 95% confidence interval [CI]: 0.32, 0.59).

CONCLUSION

This deep learning based algorithm can provide reliable segmentation and classification results for FGT and BPE in breast MR images.

CLINICAL RELEVANCE/APPLICATION

FGT and BPE are known as risk factors for breast cancer and are associated with poor prognosis. Deep learning based algorithm can provide quantitative and objective information of FGT and BPE.

BR232-SD-MOB3 Shear Wave Elastography for Early Prediction of Response to Neoadjuvant Chemotherapy in Patients with Invasive Breast Cancer

Station #3

Participants
Jiaxin Huang, BA, Guangzhou, China (*Presenter*) Nothing to Disclose
Xiao-Qing Pei, PhD, MD, Guangzhou , China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

This study was designed to evaluate the performance of shear wave elastography (SWE) parameters in predicting the pathological response to neoadjuvant chemotherapy (NAC) of invasive breast cancer.

METHOD AND MATERIALS

The prospective study recruited 90 eligible patients from Aug 2016 to Dec 2018. SWE was performed before biopsy (time point t0, elasticity E0), after the first and second, fourth cycles of anthracycline-based or anthracycline/taxane-based NAC, and compared to a pre-NAC baseline scan. Tumor stiffness was assessed by quantitative SWE velocity. SWE parameters measured included changes in bidimensional tumor size on SWE time, quantitative SWE velocity, the relative changes in them after the first and second, fourth NAC cycles were considerd as the variables[Δt1, Δt2, Δt4]. The pathological response was classified according to the residual cancer burden (RCB) protocol, RCB-0 (pCR, 0); RCB-I (minimal residual disease, 0-1.36); RCB-II (moderate residual disease, 1.36-3.28); and RCB-III (extensive residual disease,>3.28). The group of major histological response (MHR) include RCB-0 and RCB-I, the group of non-major histological response (NMHR) include RCB-II and RCB-III. Correlations between SWE variables and RCB scores were evaluated. The predictive diagnostic performances of SWE parameters, and the predictive RCB (predRCB) score determined by a linear regression model were compared. Besides, this study compared performance of shear wave elastography parameters and lesion size in the grey-scale ultrasonic image and magnetic resonance image in predicting the pathological reponse to neoadjuvant chemotherapy of invasive breast cancer.

RESULTS

SWE variabls were significantly different among the MHR and the NMHR groups. The SWE variables of Δt2 had significantly better diagnostic performance than other variables regarding predicting the pathological. Tumor size on SWE time had significantly diagnostic performance earlier than conventional ultrasound and MRI.

CONCLUSION

Our resullts suggest that SWE can be potentially used as an early predictor of tumor therapy response during NAC for invasive breast cancer.

CLINICAL RELEVANCE/APPLICATION

(dealing with shear wave elastography)'SWE can predict the pathological response to NAC of invasive breast cancer earlier than morphological change.'

BR254-SD-MOB4 Impact of Native and Artificially Improved AI-Based CADx on Breast US Interpretation

Station #4

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

In an enriched case set, our purpose was to assess the impact of native computer-assisted diagnosis (CADx) as well as the impact of CADx with improved sensitivity or specificity on breast ultrasound (US) interpretive performance.

METHOD AND MATERIALS

Orthogonal paired US images of 319 lesions identified on screening were assembled, including 88 (27.6%) cancers (median size 7 mm, range 1 to 34). Nine MQSA-qualified radiologists with 0.5 to 25 years' experience in breast imaging served as observers. Each radiologist reviewed the images in random order and provided a BI-RADS assessment without then with CADx (Koios Medical, Piscataway, NJ). This was done in three modes: 1) native CADx (with output benign, probably benign, suspicious, or malignant); 2) high sensitivity mode; and 3) high specificity mode. For the latter 2 modes, output/score from CADx was artificially modified while constraining the AUC at approximately 0.9 for the CADx alone, with binary output of benign or malignant. Four radiologists began reading in mode 2 and five in mode 3. AUC by reader by mode was determined.

RESULTS

CADx alone had AUC of 0.82 (95% CI: 0.77-0.89). For mode 1, native CADx, average AUC was 0.82 (range 0.76 to 0.84) without CADx and 0.82 (range 0.77 to 0.85) with CADx cues; five readers had slight increase (one least experienced reader significantly improved) and four slight decrease in AUC (none statisitically significant). For mode 2, high sensitivity, all readers' AUCs increased after the CADx cues: average AUC was 0.83 (range 0.78 to 0.86) before CADx cues and increased significantly to 0.88 (range, 0.84 to 0.90) after CADx, $p = 0.0002$. For mode 3, high specificity, again all readers' AUCs increased after CADx cues: average AUC was 0.82 (range, 0.76 to 0.84) before CADx cues and increased significantly to 0.89 (range, 0.87 to 0.92) after CADx, $p < 0.0001$.

CONCLUSION

CADx alone currently performs at about the same level as an experienced radiologist. Once the performance of CADx was artificially improved, radiologist performance significantly improved in each of high sensitivity and high specificity modes.

CLINICAL RELEVANCE/APPLICATION

Further improvement of AI-based US CADx is needed. Radiologist performance interpreting breast US can be improved by CADx if the CADx performs at an AUC approximately 0.08 higher than the radiologist alone.

BR255-SD-MOB5 Relative Mammographic Density Quantification: Deep Learning and Elo Rating

Station #5

Participants
Myeongchan Kim, MD, Boston, MA (*Presenter*) Nothing to Disclose
Sehyo Yune, MD,MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
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Hyunkwang Lee, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Synho Do, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To build a quantifiable deep learning model, high-quality annotations such as segmentation are generally needed. In this study, we aim to develop a quantitative method to measure breast densities that can be readily understood and adopted by clinicians via two methods not using quantity annotations: 1) a deep-learning regression model that quantifies mammographic density as population percentile, and 2) Elo rating of breast density calculation.

METHOD AND MATERIALS

We collected density classifications described in 131,468 mammograms that were archived from 2006 to 2012 at our hospital for the purpose of calculating a median percentile value of each category. Using the median density percentile value of each density, we built a residual convolutional neural network for regression. To train a regression model, we randomly selected and downloaded 10,000 cases of mammograms (1000, 4000, 4000 and 1000 cases for each category) which have all four views to train a deep learning model. We also selected 200 additional random cases of mammographic exams to test and evaluate deep learning predictions. To evaluate this model, we designed an Elo rating system by comparing two exams' densities (Elo rating used to be used in sports to compare various types of players). Totaling 2000 matches, they were performed by four experts to obtain Elo ratings of 200 test cases. We calculated Spearman's rank coefficient (Spearman's ρ) between the regression results and the Elo ratings to evaluate the model.

RESULTS

The median percentiles of density A, B, C, and D are 3.92, 30.04, 73.21 and 97.10, respectively. Mean Elo ratings of density A, B, C and D were 757±450, 1235±412, 1987±325 and 2352±360, respectively, with the test cases. There was a strong correlation between predictions of the Deep learning model and the Elo ratings (Spearman's $\rho = 0.929$, $p<0.001$).

CONCLUSION

We quantified mammographic density by deep learning regression without quantity annotation.

CLINICAL RELEVANCE/APPLICATION

By providing a quantitative scale of breast density, this model can readily be used by clinicians as a guidance. And Elo ratings are applicable to other medical problems with vague definitions.

BR256-SD-MOB6 Assessment of Residual Breast Cancer After Neoadjuvant Chemotherapy by Using Texture Analysis of Dynamic Contrast-Enhanced MRI

Station #6

Participants
Bo Zhao, Beijing, China (*Presenter*) Nothing to Disclose
Cao Kun, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Hui Liu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Ying-shi Sun, MD,PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the ability of texture analysis(TA) on dynamic contrast enhanced (DCE) MRI in identifying residual cancer of on pre-operative contrast-enhanced MRI in evaluation of residual tumor after neoadjuvant chemotherapy(NAC) for mass-like breast cancer.

METHOD AND MATERIALS

Consecutive breast cancer patients who received NAC before operation were enrolled. Regions of interests covering the entire enhanced areas of tumor site were drawn to extract parameters, including volumes and 17 TA features acquired separately on subtractive images of early and late phases to pre-enhanced phase on MR DCE sequences by using a house made radiomics software developed on 3D slicer platform. Comparison of features were made between pathologic complete response (pCR) and non-pCR groups. Multivariate cox regression and receiver operating characteristic (ROC) curve were used to select useful features and to assess the overall diagnostic abilities and among different molecular subtypes.

RESULTS

Totally 112 patients (42 pCR and 70 non-pCR) with mass-like breast cancer on initial MR were enrolled and grouped as pCR(42 cases) and non-pCR (70 cases). Further analysis divided the cohort by residual tumor volume(V) as V=0, 0=0.5cm3. Multivariate regression analysis on group with 0 **CONCLUSION**

TA is a useful tool to depict tumor heterogeneity in post-treatment mass-like breast cancer patients. By stratification of residual volume and combination of uniformity, maximal and mean of enhancement on DCE late phase, MR ability to identify complete response is significantly improved in sensitivity and overall accuracy.

CLINICAL RELEVANCE/APPLICATION

MR has the potential ability to identify complete response and assese treatment

BR200-ED-MOB7 Unusual Breast Implant-Associated Complications and Pathology Correlation

Station #7

Participants
Nancy Sanchez Rubio, MD, Madrid, Spain (*Presenter*) Nothing to Disclose
Maria Duque Munoz, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Jorge Palomar Ramos, Madrid , Spain (*Abstract Co-Author*) Nothing to Disclose
Myriam F. Montes, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Beatriz Lannegrand Menendez, Madrid , Spain (*Abstract Co-Author*) Nothing to Disclose
Maria Jose Ciudad Fernandez, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

- To review the unusual complications associated with breast implants.- To show the radiological findings at the multimodality imaging typically used to evaluate these complications with a combination of mammography, US, MRI, and PET-CT. - To highlight the importance of correct management of a late periprosthetic seroma to diagnose breast implant-associated anaplastic large cell lymphoma. - To revise the pathological findings of these rare complications.

TABLE OF CONTENTS/OUTLINE

Breast implants frequently are used to reconstruct or augment breast and are associated with common complications that mainly include early peri-implant fluid collection or hematoma, infection, capsular contracture, and rupture. Other adverse effects less common are late seroma and infection, silicone-induced granuloma of breast implant capsule, fibromatosis, and breast implant-associated anaplastic large cell lymphoma(BIA-ALCL). We present cases of all these rare complications diagnosed at our institution showing the main radiological findings and their pathological correlation.One of the most worrisome complications is BIA-ALCL that usually manifests as a late seroma. Because of that, the correct management of late seroma is essential for the early diagnosis of BIA-ALCL. We review the management of late seroma and its differential diagnosis.

BR201-ED-MOB8 A Pictorial Review of Breast Procedures Complications

Station #8

Participants
Thiago H. Costa SR, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Tatiana C. Tucunduva, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Marcela P. Viana, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
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Giselle G. Mello, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Carlos Shimizu, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Luciano F. Chala, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Vera N. Aguillar, MD, PhD, 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

Describe and illustrate some complications of percutaneous breast biopsies; Review the management principles for the main complications (Hemorrhage and hematoma; Infecction; Arteriovenous fistula; Pseudoaneurysms; Infection complications; Milk fistula) of percutaneous breast biopsies.

TABLE OF CONTENTS/OUTLINE

Percutaneous breast biopsy is a simple and minimally invasive procedure that is widely used as a diagnostic tool for pathologic evaluation of suspicious breast lesions. Complications are not common, and the majority of these complications are minor, although some can have clinical consequences. Discuss the epidemiology, work-up and treatment of main complications of percutaneous breast biopsies. Imaging appearance by modality (MRI, ultrasound and mammography) of percutaneous breast biopsies. Describe the management and prognosis of patients who present with this diagnosis. Review our institution's cases of complications after percutaneous breast biopsy. Identify the best ways to prevent this complication.

BR202-ED-MOB9 RECIST Applied to Breast MRI: The Real Life

Station #9

Awards

Certificate of Merit

Participants
Ana C. De Ataide Goes, MD, Sao Paulo , Brazil (*Presenter*) Nothing to Disclose
Paulo C. Figueiredo SR, MD, Sao Paulo , Brazil (*Abstract Co-Author*) Nothing to Disclose
Vivian S. Ogata, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
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Su J. Hsieh, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Heni D. Skaf, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Carlos Shimizu, 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

• To prepare breast radiologists to evaluate neoadjuvant treatment response on breast magnetic resonance imaging (MRI). • To present Response Evaluation Criteria in Solid Tumors (RECIST) version 1.1 used for this assessment. • To ilustrate each RECIST category through clinical cases from our institution. • To present tips to reduce interobserver variability applying literature review.

TABLE OF CONTENTS/OUTLINE

• Brief description of Response Evaluation Criteria in Solid Tumors (RECIST) version 1.1 • Brief introduction of the importance of MRI in assessing neoadjuvant chemotherapy response in breast cancer patients. • Present main neoadjuvant treatments available up to date. • Possible effects on neoadjuvant treatment on breast cancer imaging. • Target selection and presentation of all patterns of neoadjuvant treatment response in breast MRI according to RECIST 1.1 criteria. • Illustrative cases of breast tumor response: o Complete response o Partial response o Stable disease o Progressive disease o Lymph nodes assessment • Tips and tricks • Limitations of RECIST 1.1 criteria for breast cancer

VW86

The Evolution of Digital Breast Tomosynthesis and Synthetic 2D: Presented by FUJIFILM Medical Systems U.S.A., Inc.

Monday, Dec. 2 12:50PM - 1:50PM Room: South Building, Booth 5147

Participants

Claudia Kurtz, MD, Lucerne, Switzerland (*Presenter*) Nothing to Disclose

Program Information

Starting with an overview of the capabilities and limitations of various approaches to Digital Breast Tomosynthesis (DBT) architectures and reconstruction methods, this session highlights recent advances in DBT technology and how these advances are now contributing to the creation of synthetic 2D images that may eliminate the need for 2D FFDM and at the same time, reduce patient dose.

Printed on: 10/29/20

VW69

Open Discussion on the Implementation of Contrast Enhanced Digital Mammography: Presented by Hologic, Inc.

Monday, Dec. 2 1:00PM - 2:00PM Room: South Building, Booth 5119

Participants

Matthew Covington, MD, Salt Lake Cty, UT (*Presenter*) Speaker, Hologic, Inc

Program Information

A question & answer discussion with an experienced, published radiologist. Come join us and have your questions answered concerning Contract Mammography procedures. *Adding this session to your agenda does not secure your seat in this session. Secure your seat onsite by visiting Hologic's Workshop Room # 5119 in the South Hall.*

Printed on: 10/29/20

MSRO27

BOOST: GYN/Breast

Monday, Dec. 2 1:30PM - 2:30PM Room: S103CD

BR GU RO

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 0

Participants
Janice N. Kim, Seattle, WA (*Presenter*) Nothing to Disclose
Janie M. Lee, MD, Bellevue, WA (*Presenter*) Research Grant, General Electric Company;

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Printed on: 10/29/20

VW44

Introduction to 3D ABUS Screening Workshop: Presented by GE Healthcare

Monday, Dec. 2 1:30PM - 2:30PM Room: South Building, Booth 5135

Participants

Kristina L. Jong, MD, Santa Barbara, CA (*Presenter*) Nothing to Disclose

Program Information

Kristina Jong, MD, Global Peer Educator, leads this introductory hands-on, interactive, Invenia 3D ABUS (automated breast ultrasound) Workshop. Attendees will review clinical cases on the Invenia™ Viewer and learn how 3D ABUS screening helps increase cancer detection in women with dense breast tissue. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

VW87

Diagnosing Millimeter-sized Cancers with ASPIRE Cristalle: Presented by FUJIFILM Medical Systems U.S.A., Inc.

Monday, Dec. 2 2:00PM - 3:00PM Room: South Building, Booth 5147

Participants

Dean Phillips, Stamford, CT (*Presenter*) Nothing to Disclose

Program Information

Diagnosing small cancers in dense breasts can be difficult. This interactive workshop, using a large number of clinical examples, will introduce attendees to how recent technical advances have the potential to help identify millimeter-sized cancers in dense breasts and bring them to the forefront.

Printed on: 10/29/20

VW20

The Benefits of 50° Wide-angle Tomosynthesis: Presented by Siemens Healthineers

Monday, Dec. 2 2:30PM - 3:40PM Room: North Building, Booth 8563

Participants

Brandie L. Fagin, MD, Glenview, IL (*Presenter*) Nothing to Disclose

Program Information

During this hands-on workshop, you will learn more about evaluating breast tomosynthesis data. A reading expert will guide you through cases that will both fascinate and challenge you! All cases have been acquired with Siemens Healthineers 50° Wide-Angle Tomosynthesis technology and can be read on our advanced visualization software *syngo*.Breast Care. You will become familiar with the value of 50° Wide-Angle Tomosynthesis images and the ease-of-use of our reading solutions. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP

https://www.fairorg.de/Siemens-Healthineers/portal/workshop.cfm/rsna19/

Printed on: 10/29/20

VW70

Clinical Perspective on 3D™ Guided Breast Biopsy and Real-time Specimen Imaging: Presented by Hologic, Inc.

Monday, Dec. 2 2:30PM - 3:45PM Room: South Building, Booth 5119

Participants

Harriet B. Borofsky, MD, San Mateo, CA (*Presenter*) Nothing to Disclose

Program Information

Come and learn from this experienced radiologist's presentation and demonstration focusing on 3D™ guided breast biopsy and real-time specimen imaging. Participate in the hands-on experience utilizing the Affirm® Prone Biopsy and Brevera® Systems. Additional attendees may join for the hands-on demos after the 20 minute lecture concludes. *Adding this session to your agenda does not secure your seat in this session. Secure your seat onsite by visiting Hologic's Workshop Room # 5119 in the South Hall.*

Printed on: 10/29/20

SSE01

Breast Imaging (Risk and Density)

Monday, Dec. 2 3:00PM - 4:00PM Room: E450A

BR SQ

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

FDA Discussions may include off-label uses.

Participants
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
Despina Kontos, PhD, Philadelphia, PA (*Moderator*) Research Grant, Hologic, Inc

Sub-Events

SSE01-01 Use of Comprehensive Health Records to Improve Breast Cancer Risk Prediction

Monday, Dec. 2 3:00PM - 3:10PM Room: E450A

Participants
Michal Chorev, PhD, Haifa, Israel (*Presenter*) Researcher, IBM Corporation
Adam Spiro, Haifa, Israel (*Abstract Co-Author*) Nothing to Disclose
Michal Guindy, MD, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate the efficacy of a machine learning model to predict 1-year risk of breast cancer on the basis of complete electronic health records (EHR).

METHOD AND MATERIALS

We collected EHR data of 68,342 women who underwent a screening mammogram between April 2013 and February 2017, to predict the risk of cancer developing within 1 year of the screening. We developed a gradient boosting machines model based on 17,651 clinical factors. We compared our model against Gail model. Based on sequential factor selection, we have identified the factors most contributing to the prediction. All models were evaluated using area under the ROC curve (AUC) values and DeLong's 95% confidence interval.

RESULTS

The cohort comprised the clinical records of 68,342 women, of which 1,478 (2%) women were diagnosed with breast cancer within 12 months, 5,495 (8%) women had a negative biopsy within 12 months, 1,260 (2%) women had a BI-RADS 3 exam without a follow-up biopsy, and 60,109 (88%) women had at least two years of normal (BI-RADS 1 or 2) exams. We split the women's records to 51,256 (75%) in the train set and 17,086 (25%) in the test set. The model obtained AUC of 0.74 (95% CI, 0.72-0.77) and 0.73 (95% CI, 0.70-0.76) on the test set, based on the 17,651 factors and the top 40 factors, respectively. Gail model obtained AUC of 0.55 (95% CI, 0.51-0.58) on the test set, while a model based on factors from Gail's and other common risk models obtained an AUC of 0.66 (95% CI, 0.63-0.69). In addition to the traditional factors, the model identified factors concerning thyroid function, the immune system, indications of metabolic syndrome, iron deficiency, as well as others.

CONCLUSION

Based on complete EHR data, our model showed an improved 1-year cancer risk assessment in comparison to Gail model. Limiting the model to only the 40 most contributing factors did not significantly affect its performance. We identified additional factors that improve breast cancer prediction.

CLINICAL RELEVANCE/APPLICATION

A machine learning model based on health records for 1-year breast cancer risk outperformed state-of-the art risk assessment models, and shed light on additional risk factors linked to breast cancer.

SSE01-02 The Correlation between the Breast Density, Body Mass Index, and the Risk of Breast Cancer Development in Relation to the Menopausal Status

Monday, Dec. 2 3:10PM - 3:20PM Room: E450A

Participants
Rasha M. Kamal, MD, Cairo, Egypt (*Presenter*) Nothing to Disclose
Salma Mostafa III, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose
Rasha W. Abdelhamid, MD, PhD, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose
Sherif Mokhtar, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose

Norran H. Said, MD, FRCR, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose
Rihab Elsheikh, MA, Cairo , Egypt (*Abstract Co-Author*) Nothing to Disclose
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Ahmed M. Hatw, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate the correlation between the breast density, body mass index and the risk of breast cancer development in relation to the menopausal status.

METHOD AND MATERIALS

The study included 30,443 screened females who were classified into cancer and non-cancer groups and each group was sub-classified into pre- and post-menopausal groups. All patients performed mammography examination. The breast density was classified according to the 2013 ACR BI-RADS breast density classification The weight and height were measured and the BMI was calculated. Independent t test was carried to compare the means of BMI among cancer and non-cancer groups as well as among pre- and post-menopausal groups. The correlation between breast density and breast cancer in the pre and post-menopausal groups was carried using Chi square test and Pearson's correlation. Measures of association were verified by calculating the Odds Ratio (OR) and the independence of each risk factor was verified by performing logistic regression analysis.

RESULTS

According to the BMI, 93.3% of the studied population were classified as over-weight and obese A statistically significant difference was calculated between the mean BMI in the cancer and non-cancer groups (p: 0.027) as well as between the pre- and post-menopausal groups (p <0.001). A positive statistically insignificant correlation was calculated between the breast density and the risk of breast cancer in the pre-menopausal group (OR: 1.062, p: 0.919) and a negative highly significant correlation was calculated in the post-menopausal group (OR: 0.234, p<0.001). A highly statistical negative correlation was found between breast density and BMI (p <0.001) among both pre- and post-menopausal groups.

CONCLUSION

BMI and breast density are inversely associated with each other. This inverse relationship had an impact on the results of this study as the majority of the studied population were obese and overweight. In spite of this, both risk factors still play an independent significant role in increasing the risk of breast cancer development with variations according to the menopausal status.

CLINICAL RELEVANCE/APPLICATION

Identifying the modifiable breast cancer risk factors is essential in breast cancer preventive measures. In view of the results of the current study, strict weight control strategies should be implemented for post-menopausal women to decrease their risk for breast cancer development.

SSE01-03 Changes in Breast Density Awareness, Knowledge, and Attitudes: A National Survey

Monday, Dec. 2 3:20PM - 3:30PM Room: E450A

Participants
Deborah J. Rhodes, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Sarah Jenkins, Rochester, ME (*Abstract Co-Author*) Nothing to Disclose
Celine M. Vachon, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Carrie B. Hruska, PhD, Rochester, MN (*Abstract Co-Author*) Institutional license agreement, CMR Naviscan Corporation
Carmen Radecki Breitkopf, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Recent federal breast density (BD) notification legislation requires standardization of BD communication to women after a mammogram and will supersede BD legislation now active in 37 U.S. states, but little is known about the impact of state BD legislation on women's understanding of BD. We assessed changes in BD awareness, knowledge, and attitudes over a 5-year interval.

METHOD AND MATERIALS

Using a probability-based web panel representative of the U.S. population, we administered an identical survey in 2012 and 2017 to women aged 40 -74 years.

RESULTS

Survey cooperation rate was 55% (1502/2730). Relative to 2012, more U.S. women in 2017 had heard of BD (65.8% vs 57.5%; P=.0002) and had knowledge of BD's relationship to masking (57.9% vs. 48.6%; P<.0001) and breast cancer risk (58.8% vs. 53.2%; P=.01). Of those aware of BD in 2017, 47.3% had discussed BD with their provider (4.2% increase from 2012; P=.13). After multivariable adjustment, factors significantly (p<.01) associated with BD awareness in 2017 included white non-Hispanic race, income, education, and having >5 mammograms. As compared to women residing in state(s) without at least 1 year of legislation, those with legislation in effect were more likely to know the masking effect of BD in 2012 (89.9% vs 71.2%, p<.001) and to know the associated breast cancer risk in 2017 (68.3% vs 58.3%, p<.001); however, BD awareness was not associated with legislation status in 2012 or 2017. Similar to 2012, 62.5% would want to know their BD even in the absence of supplemental screening consensus. Fewer women reported that knowing their BD would make them feel confused in 2017 as compared to 2012 (35.9% vs 43.0%, p=0.002); however there was no change from 2012 in the proportion that would feel anxious or informed to make breast health decisions (44.8% and 89.7%, respectively). The majority (78.8%) felt that the federally mandated letter sent to women after a mammogram should include BD information.

CONCLUSION

Although BD awareness, knowledge, and discussions with providers have increased since 2012, there are few differences by state legislation status. Fewer than half of women acknowledged that knowing their BD would cause anxiety or confusion, while more than three-quarters want to know their BD, would feel empowered to make decisions, and would support federal BD notification legislation.

CLINICAL RELEVANCE/APPLICATION

BD awareness and knowledge is increasing, although the proportion of women who have discussed their BD with a healthcare provider is not. Important disparities in BD awareness remain by race, income, and education. The federal BD notification legislation presents an opportunity to clarify BD information to improve awareness and knowledge and to encourage BD conversations with providers.

SSE01-04 Background Parenchymal Uptake on MBI and Risk of Future Breast Cancer Diagnosis: A Cohort Analysis

Monday, Dec. 2 3:30PM - 3:40PM Room: E450A

Participants
Carrie B. Hruska, PhD, Rochester, MN (*Presenter*) Institutional license agreement, CMR Naviscan Corporation
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Deborah J. Rhodes, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Michael K. O'Connor, PhD, Rochester, MN (*Abstract Co-Author*) Royalties, Gamma Medica, Inc
Rickey E. Carter, PhD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Background parenchymal uptake (BPU), which describes the intensity of radiotracer uptake in fibroglandular tissue relative to fat on molecular breast imaging (MBI), was associated with breast cancer (BC) in case-control studies. Here, we performed the first cohort analysis to examine association of BPU and risk of future BC.

METHOD AND MATERIALS

Women undergoing MBI with Tc-99m sestamibi and a dedicated gamma camera from 2004-2015 without BC diagnosis before MBI or <180 days after MBI were analyzed. BPU on baseline MBI exam was assessed as photopenic, minimal, mild, moderate, or marked; mammographic density was assessed according to BIRADS 5th edition categories. Follow up was performed via tumor registry linkage, record review, and patient survey. Multivariable proportional hazards models of time from baseline MBI until BC diagnosis or most recent negative breast imaging exam were employed.

RESULTS

Of 2987 women, 122 (4.1%) had future BC (86 invasive, 34 DCIS, 2 unknown). Mean time from baseline MBI to BC diagnosis was 48 months (range 6-115 months); mean follow-up in women without BC was 75 months (range 6-151 months). There were 66 BC cases in 2143 (3.1%) women with photopenic/minimal BPU, 27 cases in 434 (6.2%) with mild BPU, and 29 cases in 410 (7.1%) with moderate/marked BPU. 102 of 122 (84%) cases and 2300 of 2865 (80%) women without BC had dense breasts (BIRADS c or d). Relative to photopenic/minimal BPU, age and BMI-adjusted hazard ratios (HR) with 95%CI were 2.4 (1.5,3.7) for mild and 3.1 (1.9,4.9) for moderate/marked BPU ($p<0.0001$). Additional adjustment for BI-RADS density and hormone use minimally impacted HRs: 2.6 (1.6,4.2) for mild, 3.2 (2.0,5.2) for moderate/marked ($p<0.0001$). In 1827 postmenopausal women with 84 cases, HR was 3.5 (2.1,6.0) for mild and 5.0 (2.6,9.4) for moderate/marked ($p<0.0001$). In 1160 premenopausal women with 38 cases, HR was 1.3 (0.5,3.3) for mild and 2.0 (1.0,4.2) for moderate/marked ($p=0.18$).

CONCLUSION

BPU on MBI is associated with future BC and this risk remains after adjustment for mammographic density. Postmenopausal women with moderate/marked BPU have 5-fold risk of those with photopenic/minimal BPU and similar age, BMI, breast density, and hormone use.

CLINICAL RELEVANCE/APPLICATION

Postmenopausal women with high BPU on MBI should be informed of this risk association. Future studies are needed to examine the role of supplemental screening and prevention strategies in this group.

SSE01-05 Application of Machine Learning in the Calculation of Breast Density Using Transmission Ultrasound: A Comparison with Automated Mammographic Assessment

Monday, Dec. 2 3:40PM - 3:50PM Room: E450A

Participants
Bilal Malik, PhD, Novato, CA (*Presenter*) Employee, QT Ultrasound Labs
Sanghyeb Lee, PhD, Novato, CA (*Abstract Co-Author*) Employee, QT Ultrasound
James Wiskin, PhD, Salt Lake City, UT (*Abstract Co-Author*) Employee, QT Ultrasound Labs
Rajni Natesan, MD, MBA, Houston, TX (*Abstract Co-Author*) Officer, QT Ultrasound Labs

PURPOSE

Increased mammographic density has been found to be an important input into breast cancer risk models. Current breast density assessments rely upon 2D projections or a 3D model consisting of 2D reconstructed images, which may not fully capture the topologically complex nature of the breast. In this study, we (1) describe and compare threshold- and clustering-based algorithms that use transmission ultrasound (TU) for the calculation of breast density, and (2) compare Quantitative Breast Density (QBD) with

automated mammographic density calculations.

METHOD AND MATERIALS

Retrospective data was used from all women screened at a single breast center between April 2017 and November 2018 for a total of 309 breast scans. Within a 3-month interval, each subject received both a digital screening mammogram with tomosynthesis and TU of the breast. Mammographic breast density values were provided by VolparaDensity 3.1 (Volpara Health Technologies). QBD algorithms (1) segment breast tissue from water using attenuation, and (2) segment fibroglandular tissue by both thresholding based on the speed of sound, and clustering into fibroglandular tissue and fat. The ratio of fibroglandular tissue to total breast volume is calculated as QBD. QBD values were correlated with mammographic breast density scores and BI-RADS breast composition categories using Spearman's correlation coefficient (r), where $p<0.05$ was considered significant. We discuss the variability of QBD as affected by iterative image reconstruction schemes.

RESULTS

We found strong correlations between automated breast density values from TU and mammography (Spearman r=0.93, 95% CI:0.91-0.94, $p<0.01$), and between QBD and BI-RADS breast composition categories (Spearman r=0.88, 95% CI: 0.86-0.91, $p<0.01$). The machine learning-based QBD was less sensitive to variability (by 65%) than the threshold-based QBD.

CONCLUSION

We provide evidence that QBD calculations derived from TU are strongly correlated with automated mammographic breast density assessments. Further, machine learning-based QBD calculation is more robust and repeatable than threshold-based methods.

CLINICAL RELEVANCE/APPLICATION

The presence of dense breast tissue is an independent risk factor for breast cancer. An accurate calculation of breast density is critical for risk stratification in screening for breast cancer.

SSE01-06 Breast Cancer Development During Postoperative Surveillance for Women Treated for Atypical Ductal Hyperplasia (ADH): Analysis Evaluating Predictive Factors Including Clinical and Radiologic Features

Monday, Dec. 2 3:50PM - 4:00PM Room: E450A

Participants
Hee Jung Moon, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jung Hyun Yoon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hye Sun Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun-Kyung Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Min Jung Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Vivian Y. Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate cancer development rates and the clinicopathological factors associated to them during surveillance after surgery for atypical ductal hyperplasia (ADH) in the current era.

METHOD AND MATERIALS

From November 2003 to December 2014, 205 women (mean age: 47.1±11.2 years) diagnosed as ADH via excisional biopsy were included. Preoperative breast images of the proven ADH were analyzed and grouped as follows: 1) negative, lesions not detectable on either mammography or ultrasonography (US), 2) lesions with calcifications detected on either mammography and/or US, 3) lesions without suspicious calcifications. Cox regression analysis was performed to evaluate clinical and radiological factors associated to breast cancer development after excision for ADH.

RESULTS

Of the 205 women, 15 (7.3%) had developed either ductal carcinoma in situ (DCIS) or invasive breast cancer during surveillance (mean follow-up interval: 63.9±40.8 months). Symptomatic ADH was significantly associated to breast cancer during postoperative surveillance, 2.091 (95% confidence interval 0.008, 4.289, P=0.039). None of the other clinicopathologic features were associated to breast cancer development after excision for ADH (all $P>0.05$, respectively). Among the imaging features, the presence of calcifications detected on preoperative mammography/US did not show significant association to breast cancer development (P=0.268).

CONCLUSION

Breast cancer development rate during surveillance after excision for ADH was 7.3%. Presence of symptoms may have association to breast cancer development after excision for ADH.

CLINICAL RELEVANCE/APPLICATION

Breast cancer development rate during surveillance after excision for ADH was 7.3%, in which symptomatic patients diagnosed with ADH may have higher association with breast cancer development after excision for ADH.

SSE02

Breast Imaging (Ultrasound Screening)

Monday, Dec. 2 3:00PM - 4:00PM Room: E451B

BR SQ

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

Participants
Jung Min Chang, MD, Seoul, Korea, Republic Of (*Moderator*) Nothing to Disclose
H. Carisa Le-Petross, MD, FRCPC, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events

SSE02-01 Assessing Real-World Contribution of Ultrasound and Clinical Data to Breast Cancer Screening Accuracy

Monday, Dec. 2 3:00PM - 3:10PM Room: E451B

Participants
Michal Chorev, PhD, Haifa, Israel (*Abstract Co-Author*) Researcher, IBM Corporation
Adam Spiro, Haifa, Israel (*Abstract Co-Author*) Nothing to Disclose
Efrat Hexter, Givatim, Israel (*Presenter*) Nothing to Disclose
Michal Guindy, MD, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate the contribution of supplemental breast ultrasound performed regularly in addition to mammography as part of breast screening regime, as well as to assess machine learning model based on clinical information from electronic health records (EHR) in further optimizing personalized screening.

METHOD AND MATERIALS

We extracted data of 32,058 women who underwent ultrasound examination as part of their regular breast cancer screening procedure between April 2013 and February 2017 (median age of 58 years). We utilized 17,651 clinical factors from the women's EHR and developed a gradient boosting machines model to predict breast cancer within one year based on mammogram BI-RADS, ultrasound BI-RADS, and their combination.

RESULTS

The cohort comprised the clinical records of 32,058 women, of which 1,087 (3%) were diagnosed with breast cancer within 12 months, 12,362 (39%) had high breast density and 19,696 (61%) had low breast density. Adding ultrasound to screening increased sensitivity from 77% to 93% while decreasing biopsy positive predictive value (PPV) from 40% to 24%. For women with dense breasts, ultrasound increased sensitivity from 67% to 92% and decreased biopsy PPV from 34% to 16%. In order to examine whether EHR data can further improve our results by lowering the false positive rate, we developed a machine learning model, trained on 75% of the data and tested on 25%. Using an operation point of 87% sensitivity, the model's true negative rate (TNR) increased from 66% when using only mammogram BI-RADS to 82% when using mammogram BI-RADS combined with EHR data. Using an operation point of 95% sensitivity, the TNR increased from 68% when using mammograms and ultrasound BI-RADS to 78% when adding EHR data. This effect was more prominent in the high-density sub-population, where TNR improved from 43% to 70%.

CONCLUSION

Supplementing ultrasound examination increased sensitivity, while increasing false positives by increasing biopsy rates. Use of clinical data improved specificity and therefore may reduce unnecessary biopsies. Further analysis may elucidate when ultrasound would be beneficial.

CLINICAL RELEVANCE/APPLICATION

In a population that undergo ultrasound examination as part of their breast cancer screening regime, ultrasound increased sensitivity but reduced specificity. Using comprehensive EHR data can compensate for this reduction, and reduce unnecessary biopsies.

SSE02-02 Is There Value to Screening Breast Ultrasound as a Supplement to Mammography in Women at Average Risk in Comparison to Those with Known Risk Factors?

Monday, Dec. 2 3:10PM - 3:20PM Room: E451B

Participants
Stamatia V. Destounis, MD, Scottsville, NY (*Presenter*) Advisory Committee, Hologic, Inc; Medical Advisory Board, iCad, Inc
Andrea L. Arieno, BS, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To review the outcomes of screening breast ultrasound performed in women dense breast tissue and no other known risk factors and compare with women with dense breasts and at least one known risk factor.

METHOD AND MATERIALS

Retrospective review of 24778 screening ultrasound (US) exams performed during period of 2013-2017 revealed 8415 (34%) exams in patients with no known risk factors (average risk), and 16364 (66%) with one or more known risk factors. All patients undergoing screening US also had screening mammography either on the same day, or within 1 year of the screening US exam. Cases given a BI-RADS 4 or 5 are the focus of further analysis.

RESULTS

There were 550 findings in patients with known risk factor(s) of which 395 were BIRADS 4 or 5 (2.4%). 103 findings were seen on both mammography and US (with 41 invasive cancers diagnosed), and 27 were on mammography only (3 invasive cancers diagnosed). Lesions were detected on US only in 265 (67%); 56 positive biopsies resulted from US only findings of which 50 were invasive breast carcinoma; 70% grade 1 or 2, 6 lymph node positive, and average size at excision of 1.4cm. There were 243 findings from exams performed in patients with no known risk factors; 168 were BIRADS 4 or 5 (2.0%). 13 were on mammography only (1 invasive cancer diagnosed) and 45 on both mammography and US (with 19 invasive cancers diagnosed). 109 US only findings resulted in diagnosis of 14 malignancies; 12 were invasive breast carcinoma, 100% grade 1 or 2, all node negative, and an average size at excision of 1.2cm. US only cancer detection was 3.2/1000 in those with known risk factors, and 1.4/1000 for those with no known risk factors.

CONCLUSION

Screening breast US in patients at average risk can identify invasive malignancy missed on screening mammography, though at a lower rate compared with those with one or more known risk factors (1.4/1000 v. 3.2/1000, respectively). Similar biopsy rates were observed in those with no risk factors compared with those with risk factors (2.0% v. 2.4%). The cancers visualized on US only in the average risk patients were all lower grade, node negative, and averaged 1.2cm, demonstrating there may be value of US in this population.

CLINICAL RELEVANCE/APPLICATION

Determining the optimal screening regimen for women at average risk is an area of continued investigation. Screening US may provide value when used as a supplemental tool with mammography.

SSE02-03 Update on Population Level Supplemental Whole Breast Screening Ultrasound in Women with Dense Breasts

Monday, Dec. 2 3:20PM - 3:30PM Room: E451B

Participants
Liane E. Philpotts, MD, Madison, CT (*Presenter*) Consultant, Hologic, Inc
Liva Andrejeva-Wright, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Tamara Y. Carroll, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Laura S. Sheiman, MD, Southport, CT (*Abstract Co-Author*) Nothing to Disclose
Jaime L. Geisel, MD, Monroe, CT (*Abstract Co-Author*) Consultant, QView Medical, Inc
Maryam Etesami, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Laura J. Horvath, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Paul H. Levesque, MD, Madison, CT (*Abstract Co-Author*) Nothing to Disclose
Melissa A. Durand, MD, Chester, CT (*Abstract Co-Author*) Nothing to Disclose
Madhavi Raghu, MD, Cheshire, CT (*Abstract Co-Author*) Nothing to Disclose
Reni S. Butler, MD, Madison, CT (*Abstract Co-Author*) Nothing to Disclose
Regina J. Hooley, MD, Weston, CT (*Abstract Co-Author*) Consultant, Hologic, Inc

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PURPOSE

Since 2009, we have offered technologist-performed hand-held whole breast screening (WBUS) as supplemental screening for women with dense breasts. With new federal breast density notification legislation recently passed, more women with dense breasts may seek supplemental screening. Understanding the performance outcomes of this adjuvant screening exam is of importance.

METHOD AND MATERIALS

An IRB-approved retrospective search of the breast imaging electronic database (PenRad, MN) was performed for a one-year period (10/1/17 - 9/30/18) for all supplemental WBUS after a normal tomosynthesis screening mammogram. All cases were performed at 3 out-patient satellite offices of a large academic practice by mammography technologists cross-trained in breast sonography using hand-held ultrasound. The final BI-RADS (BR) assessment of WBUS exams was recorded. The lesion size, type and outcome of BR 3 and 4 cases were recorded. Pathology outcomes of all biopsies were reviewed. For malignant cases, cancer size, type and stage was assessed.

RESULTS

A total of 5742 WBUS exams were performed. Final BR assessment was BR1/2 5585 (97.2%), BR3 136 (2.4%), BR4 21 (0.4%). Of 20 biopsies performed (1 cancelled), 2 cases were initially found malignant, PPV 10%. Two BR3 cases showed change on 6 month follow up and were found to be malignant for a total cancer detection 4 (0.7 per 1000). All cancers were 1cm or less, 2 were moderately and 2 were well-differentiated invasive ductal carcinoma. Three were irregular masses and 1 was a 5mm round mass.

Three had negative axillary lymph nodes, but the 5mm round mass had lymphovascular invasion and 2 positive nodes. Reasons for BR3 included: oval mass (58), clustered or complicated cysts (24), likely fibroadenoma (22), multiple masses (9), prominent axillary nodes (6), round mass (5), lobulated mass (4), dilated ducts (4), other (4). All BR3 and BR4 oval masses were all found to be benign on follow up or biopsy.

CONCLUSION

After normal tomosynthesis mammograms, the majority of WBUS cases were found to be normal, with only a small proportion of cases requiring follow up or biopsy. All BR3 and 4 oval masses were found to be benign, suggesting these may be considered BR2. The supplemental cancer detection rate is found to be low.

CLINICAL RELEVANCE/APPLICATION

With experience, the false positive rate of supplemental screening with WBUS over time is low but the supplemental cancer detection is also low.

SSE02-04 BI-RADS 3 on Dense Breast Screening Ultrasound after Digital Mammography versus Digital Breast Tomosynthesis

Monday, Dec. 2 3:30PM - 3:40PM Room: E451B

Participants
Elizabeth H. Dibble, MD, Barrington, RI (*Presenter*) Nothing to Disclose
Tisha M. Singer, MD, Barrington, RI (*Abstract Co-Author*) Nothing to Disclose
Grayson L. Baird, PhD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Ana P. Lourenco, MD, Foxboro, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Compare BI-RADS 3 rate and follow-up of dense breast ultrasound (US) screening following digital mammography (DM) vs digital breast tomosynthesis (DBT)

METHOD AND MATERIALS

For this IRB-approved, HIPAA compliant study, we retrospectively searched databases at two tertiary breast imaging centers and an office practice staffed by the same fellowship-trained breast radiologists for BI-RADS 3 screening US examinations performed 10/1/14-9/30/16. All patients had at least two years of follow-up. Prior DM versus DBT, number and timing of patients lost to follow-up, downgrade rate and timing, upgrade rate and timing, and any pathology results were recorded. Differences between DM and DBT were compared using Chi Square and Fisher's Exact Tests.

RESULTS

3189 screening US examinations were performed, 1434/3189 (45%) after DM and 1674/3189 (52%) after DBT. 81/3189 (2.5%) had no prior mammogram available. 201/1434 (14%) had BI-RADS 3 results after DM and 179/1674 (11%) after DBT (p=0.006). 95% of US screening exams were initial US screening exams. BIRADS 3 rate was 75/624 (12.0%) (42/317 (13%) for DM and 33/307 (11%) for DBT) during the first year of US screening and 75/624 (12.0%) (159/1117 (14%) for DM and 146/1367 (11%) for DBT) during the second year, a small but significant increase (p= 0.0162). Median follow-up time after DBT was 13 months (IQR 9, 24) versus 12 after DM (IQR 6, 23), p=0.0027 (Figure 1). 73/375 (19.5%) of patients were lost to follow-up (38/198 (19%) after DM (26/38 (68.4%) no follow-up after initial exam) and 35/177 (20%) after DBT (19/35 (54.3%) no follow-up after initial exam) 5/375 (1.3%) elected biopsy (3/198 (1.5%) after DM and 2/177 (1.1%) after DBT). 282/375 (75.2%) patients were downgraded (149/198 (74%) after DM and 133/177 (75%) after DBT). 5/198 (2.5%) were upgraded after DM and 1/177 (0.6%) after DBT, p=.6866 Median time to upgrade was 6 months after both DM and DBT. 1/375 (0.3%) patients with BI-RADS 3 results had cancer on follow-up.

CONCLUSION

The BI-RADS 3 rate of screening US was lower after DBT compared to DM. Many patients were lost to follow-up. Median follow-up time was longer after DBT vs DM. The cancer rate of BI-RADS 3 findings was 0.3%.

CLINICAL RELEVANCE/APPLICATION

Patients with prior DBT have the benefit of a lower risk of encountering probably benign findings on screening US that require follow-up imaging, and probably benign findings on screening US have a very low rate of being cancer.

SSE02-05 Added Value of Supplemental Screening Breast Ultrasound Following Digital Breast Tomosynthesis Screening

Monday, Dec. 2 3:40PM - 3:50PM Room: E451B

Participants
Jung Min Chang, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Ann Yi, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sung Ui Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Bo Ra Kwon, MD, 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

To evaluate the added value of screening breast ultrasound (US) following digital mammography (DM) combined with digital breast tomosynthesis (DBT) (DM/DBT).

METHOD AND MATERIALS

This institutional review board approved retrospective review included 958 asymptomatic women (mean age, 54 years; range, 33-

81 years) who underwent screening DM/DBT and whole-breast screening US simultaneously at our health care center between March 2016 and October 2017. On the basis of the findings from DM and DBT, supplemental screening US was performed by one of 5 experienced radiologists using a handheld device, and they reported the DM/DBT and US findings separately. The cancer detection rate (CDR), sensitivity, specificity, and positive predictive value (PPV) of DM/DBT and DM/DBT combined with US were compared to those from histological examinations and to 12-month follow-up data, as a reference standard.

RESULTS

Among 958 women, the breast density was almost entirely fatty in 6.5%, scattered areas of fibroglandular density in 23.9%, heterogeneously dense in 46.6%, and extremely dense in 23.1%. Seven cancers (6 invasive ductal cancer [IDC] and 1 ductal carcinoma in situ [DCIS]) were diagnosed, and the mean size of the invasive cancer was 1.6 cm (range, 0.3-3.3 cm). Four cases of cancer were detected on both DM/DBT and DM/DBT combined with US (4 IDCs), and the other three cases of cancer (2 IDCs and 1 DCIS) were detected when US was added to DM/DBT. All three US-detected cancers were node-negative, and the T stages of the 2 IDCs were T1 and T2, respectively. The sensitivities were 57.1% (95% confidence interval [CI]: 0.25-0.84) for DM/DBT and 100% (95% CI: 0.60-1.00) for DM/DBT combined with US (p=0.25). Supplemental screening US detected additional 3.1 cancers per 1000 screens (95% CI: 0.6-9.6). Regarding specificity, DM/DBT had a 99.4% (95% CI: 0.99-1.00) specificity, whereas the specificity on addition of US was 96.4% (95% CI: 0.95-0.97) (P<0.0001). The PPV was 40.0% (95% CI: 0.17-0.69) for DM/DBT, and the addition of US decreased the PPV to 17.5% (95% CI: 0.08-0.32).

CONCLUSION

The addition of screening US resulted in minor increased CDR, however, increased the number of false-positive results.

CLINICAL RELEVANCE/APPLICATION

Supplemental screening US can detect cancers that may not have been detected on DM/DBT screening; however, it increases the number of false-positive results, leading to recall examinations and biopsies.

SSE02-06 Second Reading DBT versus Supplemental Screening US in Dense Breasts: Interim Analysis from the DBTUST

Monday, Dec. 2 3:50PM - 4:00PM Room: E451B

Participants
Wendie A. Berg, MD, PhD, Gibsonia, PA (*Presenter*) Nothing to Disclose
Andriy I. Bandos, PhD, 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
Denise M. Chough, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Marcela Bohm-Velez, MD, Pittsburgh, PA (*Abstract Co-Author*) Consultant, Koninklijke Philips NV Research Grant, Delphinus Medical Technologies, Inc
Thomas S. Chang, MD, Pittsburgh, PA (*Abstract Co-Author*) Research Grant, Seno Medical Instruments, Inc Research Grant, Delphinus Medical Technologies, Inc Consultant, iCAD, Inc
Christiane M. Hakim, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Marie A. Ganott, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Danielle Sharek, MD, Murrysville, PA (*Abstract Co-Author*) Research Grant, Delphinus Medical Technologies, Inc
Michelle R. Straka, MD, Sewickley, PA (*Abstract Co-Author*) Nothing to Disclose
Jamie Hartman, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Kimberly S. Harnist, MD, Gibsonia, PA (*Abstract Co-Author*) Nothing to Disclose
Uzma Waheed, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Cathy S. Tyma, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Golbahar Houshmand, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Bronwyn Nair, MD, Sewickley, 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 supplemental cancer detection rate from double reading tomosynthesis (DBT) compared to addition of technologist-performed whole breast handheld screening ultrasound (US).

METHOD AND MATERIALS

In an IRB-approved, HIPAA-compliant protocol, 6258 women age 40-75 with heterogeneously dense or extremely dense breasts consented to annual technologist-performed US after DBT for three years at one of three sites in western Pennsylvania. Each modality was independently interpreted in opposing order by two radiologists who were MQSA qualified and met ACRIN 6666 US experience criteria. An interim analysis was performed of 6258 prevalence and 7616 incidence screens through 12/31/18.

RESULTS

Median patient age was 53 years. Among 13,874 analyzable screens, 91 women were diagnosed with cancer (CDR 6.6 per 1000, median invasive size 1.5 cm): 68 (74.7%) detected by reader 1 on DBT; 9 (9.9%) only by reader 2 on DBT (one of which was also visible on US by the primary radiologist, and one of which was dismissed, detected due to symptoms); 12 (12.2%) only on US; 1 (1.1%) by MRI performed for other reasons, and 1 (1.1%) only because of symptoms (interval cancer). Nineteen cancers were DCIS, 18 seen only on DBT (2 only on double reading); 72 were invasive (median size 13 mm), 7 only on DBT double reading (median size 10 mm, 6/7 node negative) and 12 seen only on US (median size 10 mm, 10/12 node negative). Supplemental cancer detection rate of second reading DBT was 0.65/1000 vs. 0.9/1000 for US (p=0.37). Supplemental recall rates were 36.9/1000 for double reading DBT vs. 50.4/1000 for US (p<0.001); PPV1 5.27% vs. 5.33%; NPV 99.89 vs. 99.92%. Of note, 6 cancers detected by reader 1 on DBT in year 1 had been missed on clinical reading of DBT in a subset of 3876 women prior to study entry: if attributed to double reading DBT, yield would be 15/13,874 or 1.1/1000 for double reading.

CONCLUSION

In women with dense breasts, there is a significant yield from supplemental screening with technologist-performed US even after DBT, albeit with sizable increase in recall rate. Double reading DBT increases recall rate less than US. Additional cancers detected by double reading DBT vs. adding US were mostly nonoverlapping and invasive.

CLINICAL RELEVANCE/APPLICATION

The adequacy of screening DBT for women with dense breasts is uncertain. Noninvasive methods to improve cancer detection, including double reading and screening US, merit consideration.

Printed on: 10/29/20

VW45

Automating Breast Ultrasound: A Live Experience: Presented by GE Healthcare

Monday, Dec. 2 3:00PM - 3:30PM Room: South Building, Booth 5135

Participants

Kristina L. Jong, MD, Santa Barbara, CA (*Presenter*) Nothing to Disclose

Program Information

This 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. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

VW88

Ongoing Measures against Breast Density Issues on Screening Mammography in Japan: Presented by FUJIFILM Medical Systems U.S.A., Inc.

Monday, Dec. 2 3:10PM - 3:40PM Room: South Building, Booth 5147

Participants

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

Program Information

Mammography is the only breast cancer screening test that has been proven to reduce the mortality all over the world. However, the sensitivity is inversely proportional to breast density. As FDA proposes adding breast density reporting to MQSA, the Japanese mass media is making breast density issues a hot topic in screening mammography. This session will discuss Japan's breast cancer screening programs and its ongoing measures against breast density.

VW21

More Confidence in Tomosynthesis Reading with Synthetic 2D Reading Session: Presented by Siemens Healthineers

Monday, Dec. 2 3:50PM - 5:00PM Room: North Building, Booth 8563

Participants

Chantal van Ongeval, MD, Leuven, Belgium (*Presenter*) Nothing to Disclose

Program Information

During this workshop you will get to experience the value that Synthetic 2D mammography (Insight 2D) can bring to tomosynthesis reading. An expert tutor will lead you through cases that will both fascinate and challenge you! All cases have been acquired with Siemens Healthineers latest 50° Wide-Angle system MAMMOMAT Revelation and are displayed on our *syngo*. Breast Care workstations. So you will become familiar with the value of 50° Wide-Angle Tomosynthesis and ease of use of our systems. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP

https://www.fairorg.de/Siemens-Healthineers/portal/workshop.cfm/rsna19/

Printed on: 10/29/20

VW46

Advanced 3D ABUS Reading Workshop: Interesting Cases: Presented by GE Healthcare

Monday, Dec. 2 4:00PM - 5:00PM Room: South Building, Booth 5135

Participants

Lisa R. Stempel, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Program Information

Dr. Lisa Stempel, RUSH University, will share interesting cases with attendees in this advanced hands-on, interactive Invenia ABUS (automated breast ultrasound) Workshop. Learn more about the unexpected benefits - beyond screening, of implementing ABUS into your clinical practice. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

VW89

DBT Based on Clinical Evidence (Session in SPANISH): Presented by FUJIFILM Medical Systems U.S.A., Inc.

Monday, Dec. 2 4:00PM - 5:00PM Room: South Building, Booth 5147

Participants

Javier A. Romero, MD, Bogota, Colombia (*Presenter*) Speakers Bureau, Novartis AG Speakers Bureau, Bristol-Myers Squibb Company

Program Information

Desde su aprobación por FDA en 2011, las publicaciones sobre los beneficios de la tomosíntesis son sustanciales. El incremento en la detección de cáncer invasivo y la disminución en el rellamado han sido suficientemente evaluados, además su aplicación en evaluación de asimetrías, distorsiones de la arquitectura mamaria, evaluación de masas, localización de lesiones, disminución en proyecciones adicionales tienen gran impacto en la práctica diaria. Revisaremos casos de estas aplicaciones y revisión de la literatura.

VW71

Efficacy in Diagnosis with Tomosynthesis in Daily Practice (En Español): Presented by Hologic, Inc.

Monday, Dec. 2 4:15PM - 5:00PM Room: South Building, Booth 5119

Participants

Beatriz E. Gonzalez, MD, Guadalajara, Mexico (*Presenter*) Nothing to Disclose

Program Information

In this lecture an experienced radiologist provides her clinical perspective on how digital mammography with tomosynthesis has aided the diagnosis of breast lesions, since it was implemented into their practice in 2011. *Adding this session to your agenda does not secure your seat in this session. Secure your seat onsite by visiting Hologic's Workshop Room # 5119 in the South Hall.*

Printed on: 10/29/20

SPSI21

Special Interest Session: The Best of Radiology in 2019-The Editors of Radiology Keep You Up to Date

Monday, Dec. 2 4:30PM - 6:00PM Room: N227B

BR GI NR RS

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

FDA Discussions may include off-label uses.

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

For information about this presentation, contact:

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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.

Sub-Events

SPSI21A Review of 2019: New Research that Should Impact your Practice

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

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SPSI21B Innovations in Abdominal Imaging in 2019

Participants
Kathryn J. Fowler, MD, San Diego, CA (*Presenter*) Consultant, 12 Sigma Technologies; Researcher, Nuance Communications, Inc; Contractor, Midamerica Transplant Services; ;

SPSI21C Research and Innovations in Breast Imaging in 2019

Participants
Linda Moy, MD, New York, NY (*Presenter*) Grant, Siemens AG; Support, Lunit Inc ; Support, iCad, Inc; Support, FAIR Facebook; Advisory Board, Lunit Inc; Advisory Board, iCad, Inc

SPSI21D New Developments in Neuroimaging in 2019

Participants
Christopher P. Hess, MD, PhD, San Francisco, CA (*Presenter*) Research, Siemens AG; Consultant, General Electric Company;

ED001-TU

Breast Tuesday Case of the Day

Tuesday, Dec. 3 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
Jody C. Hayes, MD, Southlake, TX (*Abstract Co-Author*) Nothing to Disclose
Stephen J. Seiler, MD, Dallas, TX (*Abstract Co-Author*) Consultant, Delphinus Medical Technologies, Inc; Consultant, Seno Medical Instruments, Inc
Natalie G. Stratemeier, MD, Oklahoma City, OK (*Abstract Co-Author*) Nothing to Disclose
Meghan Woughter, MD, Temple, TX (*Abstract Co-Author*) Spouse, Vice President, nThrive, Inc
Oyindamola Akinseye, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Susan O. Holley, MD,PhD, Raleigh, NC (*Abstract Co-Author*) Nothing to Disclose
Ronald J. Dolin, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Dayna Levin, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Shannon Lanzo, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Sean A. Maratto, MD, Philadelphia, PA (*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.

RC315

Breast Series: Emerging Technologies (The In-Person Presentation is Supported by an Unrestricted Educational Grant from Hologic, Inc)

Tuesday, Dec. 3 8:30AM - 12:00PM Room: Arie Crown Theater

AI BR

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.75

FDA Discussions may include off-label uses.

Participants
Fiona J. Gilbert, MD, Cambridge, United Kingdom (*Moderator*) Research Grant, Hologic, Inc; Research Grant, General Electric Company ; Research Consultant, Alphabet Inc; Research support, Bayer AG; Research collaboration, Volpara Health Technologies Limited
Shandong Wu, PhD, MSc, Philadelphia, PA (*Moderator*) Nothing to Disclose
Despina Kontos, PhD, Philadelphia, PA (*Moderator*) Research Grant, Hologic, Inc
John M. Lewin, MD, Denver, CO (*Moderator*) Nothing to Disclose

Sub-Events

RC315-01 Emerging Technologies: Part 1

Participants
Shandong Wu, PhD, MSc, Philadelphia, PA (*Moderator*) Nothing to Disclose
Fiona J. Gilbert, MD, Cambridge, United Kingdom (*Moderator*) Research Grant, Hologic, Inc; Research Grant, General Electric Company ; Research Consultant, Alphabet Inc; Research support, Bayer AG; Research collaboration, Volpara Health Technologies Limited
Despina Kontos, PhD, Philadelphia, PA (*Moderator*) Research Grant, Hologic, Inc

RC315-02 Lessons Learned from CAD and AI

Tuesday, Dec. 3 8:30AM - 8:55AM Room: Arie Crown Theater

Participants
Linda Moy, MD, New York, NY (*Presenter*) Grant, Siemens AG; Support, Lunit Inc ; Support, iCad, Inc; Support, FAIR Facebook; Advisory Board, Lunit Inc; Advisory Board, iCad, Inc

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LEARNING OBJECTIVES

1) To compare traditional CAD for mammography versus machine learning-based platforms. 2) To discuss the status of AI and screening mammography. 3) To discuss the potential roles for AI and mammography beyond improved diagnosis, assessment of breast density, and potential triaging of normal screening mammograms.

ABSTRACT

Breakthroughs in computer processing, data storage and algorithm design have led to development of AI tools for screening mammography. These new systems may improve clinical care throughout the breast care continuum. However, the promise of these AI tools is tempered by lessons learned with traditional CAD systems. This talk will underscore the limitations of traditional CAD and highlight potential solutions with AI systems.

RC315-03 Comparison of the Diagnostic Performance of Abbreviated MRI and Full Diagnostic MRI with CAD System in Patients with a Personal History of Breast Cancer: The Effect of CAD-Generated Kinetic Features on Reader Performance

Tuesday, Dec. 3 8:55AM - 9:05AM Room: Arie Crown Theater

Participants
Taeyang Ha, MD, Suwon, Korea, Republic Of (*Presenter*) Nothing to Disclose
Taehee Kim, MD, PhD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Doo Kyoung Kang, MD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purposes of our study were to compare the diagnostic performance of abbreviated MRI and full diagnostic MRI with CAD system in patients with a personal history of breast cancer and to evaluate how the kinetic features affect the performance of two radiologists.

METHOD AND MATERIALS

Between 1, 2014 and December 31, 2017, 3834 breast MR examinations in 2310 patients with a personal history of breast cancer

composed our study population. MR images were retrospectively reviewed by two radiologists with 8 and 15 years of experience. First, two radiologists independently reviewed T1-weighted images scanned at 90s after the contrast injection and T2-weighted images. After 6 months, the two readers reviewed contrast enhanced T1-weighted images with 5 consecutive delayed images using CAD. We compared the diagnostic performance of abbreviated- and full-sequence MRI.

RESULTS

Fifty one intramammary recurrences were detected with breast MRI in 47 patients. Of fifty one tumor recurrences, 36 (70.6%) lesions occurred at more than 3 years after initial cancer surgery and 7 (13.7%) lesions at less than 2 years after initial surgery. The sensitivity and specificity were 98% and 97.6%-98.6% on the abbreviated sequence and 94.1%-98% and 97.9%-98.3% on full diagnostic MRI showing no significant differences. Of 51 malignant lesions, 6 showed delayed persistent pattern, of which 3 lesions were non-mass enhancement and 3 lesions were small enhancing masses less than 1cm. There were 6 false negative cases in both MRI. On abbreviated MRI, the reasons of false negative were moderate background parenchymal enhancement causing the masking of non-mass enhancement in one case and small size and margin in the other case. Four cases were missed in the full-diagnostic MIR and the reasons were delayed persistent kinetic curve in all cases.

CONCLUSION

Overall diagnostic performances of abbreviated MRI and full diagnostic MRI were similar in both readers. The semi-quantitative kinetic features from CAD system could affect the reader performance and the sensitivity could be improved or the specificity improved according to the readers.

CLINICAL RELEVANCE/APPLICATION

Postoperative MRI screening is useful especially in patients who have undergone surgery for more than 2 years. Using MR-CAD system could increase the sensitivity or specificity according to the readers.

RC315-04 Are Your AI Diagnosis Models Safe Under Attack of Manipulated Images?

Tuesday, Dec. 3 9:05AM - 9:15AM Room: Arie Crown Theater

Participants
Qianwei Zhou, PhD, Hangzhou, China (*Presenter*) Nothing to Disclose
Guo Yuan, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Lu Yang, Chongqing , China (*Abstract Co-Author*) Nothing to Disclose
Giacomo Nebbia, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Shandong Wu, PhD, MSc, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Promising performance has been shown in deep learning-based artificial intelligence (AI) models for Computer-Aided Diagnosis. In implementing deep learning diagnosis tools in clinical workflow, safety issues of such AI models emerge but little research has been done. We performed a study to investigate the effects of a Full Field Digital Mammography (FFDM)-based deep learning diagnosis model under attack of manipulated images.

METHOD AND MATERIALS

In a breast cancer diagnosis setting, we trained a customized VGG network using 853 positive FFDM images (biopsy-proven malignancy) and 2374 negative images (benign or negative findings) for classification. Then, we trained two generative models by the Generative Adversarial Networks (GANs) using the training set of the full data; one model is to generate a fake positive-looking image from a given real negative image and the other is to generate a fake negative-looking image from a given real positive image. The GAN-generated fake images are input to the classification model to test whether it would be fooled. Furthermore, we tested whether or to what extent the fake images may possibly fool human radiologists. Two certified breast imaging radiologists (12 [Reader 1] and 11 [Reader 2] years of experience) were given a set of 322 mixed real and fake images to assess as "real", "fake", or "unsure". An education process is applied by having them read 100 pairs of real and the corresponding GAN-generated fake images to understand the manipulations made by the GAN models and after that, a different set of 324 mixed real and fake images were given to them for assessment. Both readers assess all images independently without knowledge on the GAN models.

RESULTS

The classification model's AUC is 0.86 on 10% unseen testing data and its AUC is 0.82 when tested on the same amount of GAN-generated fake images. Reader 1 and 2 recognized 39% and 69% fake images initially and then 54% and 75% after the education process, respectively.

CONCLUSION

GAN-generated fake images largely fool a deep learning-trained diagnosis model and to a much less extent the experienced radiologists, who can recognize most fake images, where an education intervention can improve their performance.

CLINICAL RELEVANCE/APPLICATION

Defending considerations against intentionally-generated fake images to attack AI diagnosis models are needed in their clinical deployment, where human-AI model interactions may be a key solution.

RC315-05 Masking Risk Index by Deep Learning for a Stratified Screening Program

Tuesday, Dec. 3 9:15AM - 9:25AM Room: Arie Crown Theater

Participants
Theo S. Cleland, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
James G. Mainprize, PhD, Toronto, ON (*Presenter*) Institutional research agreement, General Electric Company
Olivier Alonzo-Proulx, Toronto, ON (*Abstract Co-Author*) Institutional research agreement, General Electric Company

Jennifer A. Harvey, MD, Charlottesville, VA (*Abstract Co-Author*) Stockholder, Hologic, Inc Research Grant, Volpara Health Technologies Limited Stockholder, Volpara Health Technologies Limited
Martin J. Yaffe, PhD, Toronto, ON (*Abstract Co-Author*) Research collaboration, General Electric Company Shareholder, Volpara Health Technologies Limited Co-founder, Mammographic Physics Inc Research Consultant, BHR Pharma LLC

For information about this presentation, contact:

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PURPOSE

Masking in mammography is the reduction of lesion conspicuity by surrounding and overlying dense tissue. Women at risk of masking will likely benefit from other screening methods (e.g. ultrasound). The FDA is proposing that all mammography facilities in the US report on breast density to allow for women with dense breasts to receive supplemental screening. Since ~50% of screening-age women have dense breasts, the cost of supplemental screening could be substantial. We propose a masking risk index (MI) that uses a convolutional neural network (CNN) that is efficient in stratifying women at risk of masking and can potentially lower the cost of a supplemental screening program (SSP).

METHOD AND MATERIALS

A study population of 224 cancer cases (461 mammograms) was used to train an InceptionV3 model pre-trained on ImageNet in a 7 cross-fold validated approach to distinguish mammograms associated with interval or screen-detected cancers. We simulate an SSP by testing the model's ability to identify high masking risk subjects within a simulated population of 100,000 women with 60 interval cancers. The efficiency of the model is estimated as the number of women needed to undergo supplemental screening to find one additional interval cancer (labelled the screening cost, 'SC'). An MI is more efficient if the SC is lower. We compare MI estimates from the CNN to other candidate MIs such as BI-RADS density and volumetric breast density (VBD) in terms of the concordance statistic (C-stat), SC and the capture fraction of interval cancers.

RESULTS

Stratification by the CNN, VBD and BIRADS density MIs yields C-stats of 0.76 [0.67-0.81], 0.66 [0.57-0.74] and 0.63 [0.56-0.69] respectively (95% CI in brackets). As reference, stratification by BI-RADS density in an SSP for all 'dense breasts' would capture 63% (38/60) of missed cancers at a cost of 42645 extra screens out of 100000 (SC=1117). At the same operating point, an MI by VBD would require 40118 extra screens (SC=1051) and by CNN, would require only 22826 extra screens (SC=598).

CONCLUSION

The CNN model has been shown to outperform the BI-RADS and VBD metrics in identifying high masking risk patients and may be more efficient in guiding an SSP.

CLINICAL RELEVANCE/APPLICATION

Individualized breast cancer screening requires an efficient decision tool to identify women who would benefit the most from supplemental screening while minimizing unnecessary extra exams.

RC315-06 Retrospective Detection of Breast Malignancies with Deep Learning in Clinically Negative, Prior Screening Mammograms

Tuesday, Dec. 3 9:25AM - 9:35AM Room: Arie Crown Theater

Participants
Abdul Rahman Diab, Cambridge, MA (*Presenter*) Employee, DeepHealth, Inc
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William Lotter, PhD, Cambridge, MA (*Abstract Co-Author*) Officer, DeepHealth Inc

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PURPOSE

To evaluate the ability of a deep learning model to detect breast cancer in clinically negative, prior screening mammograms of breast cancer patients.

METHOD AND MATERIALS

Screening FFDM x-ray mammograms from 2011 to 2017 were retrospectively collected under an IRB-approved protocol. Women who had a malignancy on either screening or diagnostic x-ray mammography were identified, and their previous screening mammograms, which were interpreted as normal (BI-RADS 1 or 2) and performed 9 months to 3 years prior to the index cancer diagnosis, were collected. These 'prior' screening mammograms were assigned the label 'malignant'. In addition, a set of screening exams interpreted as BI-RADS 1 or 2, each of which was followed by at least one additional screening exam also interpreted as BI-RADS 1 or 2, was assigned the label 'normal'. The resulting full set consisted of 328 'malignant' cases and 13540 'normal' cases. For evaluation on this dataset, we used a top-scoring deep learning model from the Digital Mammography DREAM Challenge which was not trained on data from this institution. The receiver operating characteristic (ROC) and the corresponding area under the curve (AUC) were quantified.

RESULTS

The model achieved an AUC of 0.70 (+/- 0.03). At an operating point of 88.9% specificity - the mean radiologist level according to the Breast Cancer Surveillance Consortium - the model achieved a sensitivity of 35%. Thus, at a recall rate consistent with clinical practice, the model detected 35% of cancer cases using the prior exams. Using this threshold, the earliest cancer detected was in a screening exam 730 days prior to the index diagnosis.

CONCLUSION

A deep learning model successfully detected malignancies in a significant number of clinically negative prior screening exams of women diagnosed with breast cancer.

CLINICAL RELEVANCE/APPLICATION

AI-assisted screening mammography has the potential to help physicians detect breast malignancies earlier, which could ultimately improve prognosis.

RC315-07 What Is the Future of AI in Breast Imaging?

Tuesday, Dec. 3 9:35AM - 10:00AM Room: Arie Crown Theater

Participants
Geraldine B. McGinty, MD, MBA, New York, NY (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Understand the potential for AI to impact breast imaging. 2) Learn about innovations in breast imaging research and practice related to AI tools. 3) Understand the ethical considerations related to data sharing and patient privacy as well as navigating relationships with industry.

RC315-08 Emerging Technologies: Part 2

Participants
John M. Lewin, MD, Denver, CO (*Moderator*) Nothing to Disclose
Fiona J. Gilbert, MD, Cambridge, United Kingdom (*Moderator*) Research Grant, Hologic, Inc; Research Grant, General Electric Company ; Research Consultant, Alphabet Inc; Research support, Bayer AG; Research collaboration, Volpara Health Technologies Limited

RC315-09 Artificial Intelligence for Digital Breast Tomosynthesis Imaging

Tuesday, Dec. 3 10:20AM - 10:45AM Room: Arie Crown Theater

Participants
Ioannis Sechopoulos, PhD, Atlanta, GA (*Presenter*) Research Grant, Siemens AG; Research Grant, Canon Medical Systems Corporation; Speakers Bureau, Siemens AG; Scientific Advisory Board, Fischer Medical

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LEARNING OBJECTIVES

1) List and explain the features of current artificial intelligence (AI)-based systems for digital mammography and digital breast tomosynthesis (DBT) image interpretation. 2) Describe the current performance capabilities of these AI systems. 3) Describe the current and future potential uses for AI systems in mammography and DBT imaging.

RC315-10 Improved Machine Learning-Based Evaluation of Digital Breast Tomosynthesis Screening Mammography through Customized Synthetic 2D Image Creation

Tuesday, Dec. 3 10:45AM - 10:55AM Room: Arie Crown Theater

Participants
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PURPOSE

Synthetic 2D images constructed from digital breast tomosynthesis (DBT) data are a useful tool for summarizing the information across the DBT planes. However, the default synthetic 2D images included in many systems may not summarize the most important information for cancer detection. We use machine learning (ML) to construct optimized 2D images from DBT slices, and subsequently used these images for additional ML training and testing.

METHOD AND MATERIALS

The data used consisted of three sets: Set A - 12000 2D FFDM cases (4500 proven cancers) from two sites; Set B - 22000 DBT cases (300 proven cancers) with default synthetic 2D from a site in Rhode Island; Set C - 1000 screening DBT cases (100 proven cancers) with default synthetic 2D from a site in Oregon. First, a 2D deep learning model was trained on Set A, then used to create ROI-optimized 2D images using a proprietary method on the DBT cases in Set B. The 2D model was then fine-tuned on these novel synthetic images in Set B, as well as also being separately fine-tuned on the default synthetic 2D images in this set. Finally, we tested the resulting models on Set C, where the ROI-optimized 2D images were created in the same manner as those created in Set B. Importantly, neither the model used to create the optimized images nor the model trained to classify these images were trained on data from Set C. Performance on the task of determining the presence or absence of proven cancer was quantified using the AUROC.

RESULTS

The model trained and tested on the ROI-optimized 2D images obtained a significantly higher AUROC than the model trained and tested on the default synthetic 2D images (0.93 vs. 0.90, $p<0.05$). Combining the predictions of both models resulted in an even greater performance of 0.95 AUROC ($p<0.05$), corresponding to a sensitivity of 91% at 89% specificity.

CONCLUSION

Using deep learning to create a ROI-optimized 2D image from DBT images can lead to a higher performance in AI-based classification than the default synthetic 2D image. The images are complementary: combining predictions on both versions leads to even higher performance.

CLINICAL RELEVANCE/APPLICATION

AI has the potential to improve screening mammography performance, especially for DBT. These results suggest that creating optimized 2D images from DBT using ML can be an effective strategy for ML-based classification. Future work will investigate if these optimized synthetics are useful for human readers.

RC315-11 Machine Learning in Multi-Parametric Magnetic Resonance Imaging of Women with Extremely Dense Breasts to Reduce Referral for Benign BI-RADS 3 and 4 Lesions

Tuesday, Dec. 3 10:55AM - 11:05AM Room: Arie Crown Theater

Participants
Erik Verburg, Utrecht, Netherlands (*Presenter*) Nothing to Disclose
Wouter B. Veldhuis, MD, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Marije F. Bakker, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Grant, Bayer AG; Software support, Volpara Health Technologies Limited
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Carla H. van Gils, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Software support, Volpara Health Technologies Limited
Kenneth G. Gilhuijs, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of this study was to demonstrate feasibility of reducing follow-up on benign BI-RADS-3 and 4 lesions in the DENSE trial, involving MRI screening of asymptomatic women with extremely dense breasts.

METHOD AND MATERIALS

Asymptomatic women with extremely dense breasts participated in a randomized controlled MRI screening trial using multi-parametric MRI, after normal screening mammography. In total, 4783 women (49.5-75.2 years) were screened in 8 hospitals between 22-dec-2011 and 22-jan-2016. In total 526 lesions (445 benign and 81 malignant) in 454 women were given a BI-RADS 3, 4 or 5 score. Five different MRI sequences were used: T1-weighted imaging without fat suppression, diffusion weighted imaging, T1-weighted DCE with high spatial resolution, T1-weighted DCE with high temporal resolution and T2-weighted imaging. A machine learning algorithm was developed to reduce the number of referrals for BI-RADS 3 (155 benign, 6 malignant) and BI-RADS 4 (248 benign, 59 malignant) lesions without reducing sensitivity. The algorithm consists of feature extraction and feature classification. After semi-automated segmentation, 49 features were candidate predictors in a radiomic model, 46 were automatically calculated from the MR images supplemented with 3 clinical features; age, BMI and BI-RADS score. To avoid overfitting, a Ridge regression model was developed using 10-fold cross validation. Model performance was analyzed using decision curve analyses and ROC analysis. To simulate impact of an abbreviated MRI protocol, we repeated classification without using any of the 5 features related to the high-resolution DCE series.

RESULTS

The model correctly classified 51.4%±4.2% (mean±1std) of all BI-RADS 3 lesions and 20.1%±2.7% of all BI-RADS 4 lesions as benign, without missing a malignant lesion. The simulated abbreviated protocol resulted in correct classification of 26.0%±3.7% and 14.8%±2.4% of the lesions as benign, respectively, with a fixed sensitivity of 100%.

CONCLUSION

Dedicated multi-parametric machine learning of breast MRI for BI-RADS-3 and 4 lesions in screening of women with extremely dense breasts has promising potential to reduce referral of benign lesions.

CLINICAL RELEVANCE/APPLICATION

The reduction of false-positive referral could be beneficial for women to reduce psychosocial distress associated with such referrals, and for hospital workflow.

RC315-12 Effect of Harmonization on Machine Learning Classification Performance of DCE-MRI Radiomic Features of 2,235 Breast Lesions from Two Populations

Tuesday, Dec. 3 11:05AM - 11:15AM 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
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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*) Advisor, Qlarity Imaging; 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

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PURPOSE

To assess the impact of harmonization on classification performance of radiomic features extracted from dynamic contrast-enhanced magnetic resonance (DCE-MR) images of breast lesions in two populations.

METHOD AND MATERIALS

DCE-MR images of 2,235 breast lesions were retrospectively collected under IRB/HIPAA compliance from two populations, one in the United States (211 benign, 475 cancers) and one in China (481 benign, 1068 cancers). Lesions were segmented using a fuzzy c-means method and thirty-eight radiomic features were extracted. ComBat harmonization was used to standardize radiomic features with three covariates: benign or cancer, pre- or post-biopsy, and field strength (1.5T or 3.0T). Pre- and post-harmonization, t-distributed stochastic neighbor embedding (t-SNE) methods were used to reduce the feature space. Degree of clustering by lesion type between populations before/after harmonization was measured using the Davies-Bouldin index. Performance in the task of classification of lesions as benign or cancer was determined using the t-SNE outputs in ROC analysis, with linear discriminant analysis and ten-fold cross-validation in three scenarios: (1) lesions imaged in the United States, (2) lesions imaged in China, and (3) all lesions together. The area under the ROC curve (AUC) served as figure of merit. Superiority ($p < 0.05$) and similarity testing (equivalence margin identified retrospectively) were used to compare classification performance pre- and post-harmonization.

RESULTS

For benign lesions and for cancers, the Davies-Bouldin index increased 82% and 97% respectively, indicating that the harmonization process increased the similarity of the lesion types between the two populations. When comparing pre- and post-harmonization, classification performance was either statistically equivalent (US database) or demonstrated statistically significant improvement (China and combined databases).

CONCLUSION

In the mixed population dataset, harmonization of radiomic features of breast lesions in two populations yielded statistically significant improvement in classification performance as compared to pre-harmonization.

CLINICAL RELEVANCE/APPLICATION

Harmonization methods can improve the classification performance of radiomic features extracted from combined populations of breast lesions imaged with dynamic contrast-enhanced magnetic resonance.

RC315-13 Combining Deep Learning and Radiomic Classifiers within the Tumor and Tumor Environment Enables Enhanced Prediction of Neo-Adjuvant Chemotherapy Response from Pre-Treatment Breast DCE-MRI

Tuesday, Dec. 3 11:15AM - 11:25AM Room: Arie Crown Theater

Awards
Trainee Research Prize - Medical Student

Participants
Jeffrey E. Eben, Cleveland, OH (*Presenter*) Nothing to Disclose
Nathaniel Braman, Cleveland, OH (*Abstract Co-Author*) Intern, IBM Corporation
Maryam Etesami, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Jame Abraham, MD, Morgantown, WV (*Abstract Co-Author*) Nothing to Disclose
Donna M. Plecha, MD, Cleveland, OH (*Abstract Co-Author*) Research Grant, Hologic, Inc
Anant Madabhushi, PhD, Cleveland, OH (*Abstract Co-Author*) Stockholder, Elucid Bioimaging Inc; Stockholder, Inspirata Inc; Consultant, Inspirata Inc; Scientific Advisory Board, Inspirata Inc; Scientific Advisory Board, AstraZeneca PLC; Scientific Advisory Board, Merck & Co, Inc; Researcher, Koninklijke Philips NV; Researcher, Inspirata Inc; License agreement, Elucid Bioimaging Inc; License agreement, Inspirata Inc; Grant, PathCore Inc; Grant, Inspirata Inc

PURPOSE

Radiomics, the extraction and analysis of quantitative imaging features, and deep learning (DL), the training of a neural network for feature extraction and prediction, have individually shown promise in predicting response to neoadjuvant chemotherapy (NAC) from pre-treatment breast DCE-MRI. Additionally, previous work has shown that employing these approaches separately within subregions of the tumor habitat can further enhance response prediction. In this work, we present a novel approach for combining radiomic and DL-based response classifiers localized in the tumor and its surrounding environment.

METHOD AND MATERIALS

1.5 or 3T pre-treatment breast DCE-MRI scans of 114 patients receiving NAC, supplemented with HER2-targeted agents for HER2+ patients (n=27), were retrospectively analyzed. Patients were randomly divided into training (N=80) and testing (N=34) sets. The scans were segmented into an intratumoral region (IT) consisting of the tumor itself and a peritumoral region (PT) consisting of the annular band 0-3mm surrounding the tumor. IT and PT were separately analyzed in the training set via 3-fold cross-validation using DL and radiomics, with the DL classifier trained on the segmented volume and the radiomic classifier trained on image texture features extracted within the segmented volume. The 4 individual classifiers were fused using a logistic regression classifier based on their predictions in the training set. Ensemble performance was compared against that of the individual classifiers in the held-out testing set by area under the receiver operating characteristic curve (AUC).

RESULTS

The fusion model predominantly incorporated predictions from the IT DL classifier and the IT and PT radiomics classifiers to identify pCR with AUC=0.793, which outperformed individual radiomic and DL classifiers. Non-pCR was characterized by elevated expression of radiomic features quantifying enhancement heterogeneity, while the neural network emphasized IT regions near the tumor's border in tumors that had pCR.

CONCLUSION

An ensemble of classifiers oriented spatially in the tumor habitat better identified pCR on baseline DCE-MRI than approaches incorporating radiomics or DL alone.

CLINICAL RELEVANCE/APPLICATION

A combination of radiomics and DL based on their relative and regional strengths represents a promising approach to identify NAC responders prior to NAC.

RC315-14 Radiomics in Transmission Ultrasound Improve Differentiation between Benign and Malignant Breast Masses

Tuesday, Dec. 3 11:25AM - 11:35AM Room: Arie Crown Theater

Participants
Rajni Natesan, MD, MBA, Houston, TX (*Presenter*) Officer, QT Ultrasound Labs
Sanghyeb Lee, PhD, Novato, CA (*Abstract Co-Author*) Employee, QT Ultrasound
Diane Navarro, Novato, CA (*Abstract Co-Author*) Employee, QT Ultrasound LLC
Christopher Anaje, Novato, CA (*Abstract Co-Author*) Employee, QT Ultrasound LLC
Bilal Malik, PhD, Novato, CA (*Abstract Co-Author*) Employee, QT Ultrasound Labs

PURPOSE

Over the past decade, radiomic features have proved to be helpful in characterizing tumor biology in vivo by correlating imaging with ground truth pathology. In this study, we identified and utilized such features applied to transmission ultrasound (TU). An abundance of imaging biomarkers are encoded in the TU speed-of-sound maps of breast tissue, which can be used to characterize breast masses. The purpose of this study was to evaluate the efficacy of using these radiomic features to differentiate benign from malignant breast masses.

METHOD AND MATERIALS

We randomly selected 90 pathology-proven cases with space-occupying breast masses (49 benign and 41 malignant) from our imaging database. Masses were included in the study if they were able to be segmented using our segmentation algorithm. Radiomic features, including mass irregularity, circularity, and first-order statistics of the pixel distribution, were calculated. T-tests were used to evaluate each feature in its ability to characterize a mass as benign or malignant ($p<0.05$ considered significant). These features were used in machine learning-based classifiers to differentiate benign from malignant masses.

RESULTS

Both irregularity and circularity proved to be significantly different when comparing benign and malignant masses. Irregularity was measured to be 0.202 ± 0.014 for benign masses and 0.402 ± 0.019 for malignant masses. Similarly, circularity was measured to be 0.788 ± 0.013 and 0.719 ± 0.017, respectively, demonstrating that fundamental morphological features typically used to differentiate benign from malignant masses can also be derived meaningfully from TU imaging. The mode, median and average speed of sound values showed significant differences for benign and malignant mases. Using the two morphological features along with the speed of sound, our algorithm testing found that K-nearest neighbor method with 10-fold cross-validation provided the highest accuracy of 86.7% (ROC-AUC of 0.85).

CONCLUSION

Our study shows that a range of radiomic features derived from TU can differentiate benign from malignant breast masses. These features may serve as important tools when developing artificial-intelligence-based and computer-aided diagnosis tools for TU.

CLINICAL RELEVANCE/APPLICATION

Radiomics in transmission ultrasound may contribute to decision support to increase precision in the diagnosis and treatment of breast cancer.

RC315-15 AI For Breast Ultrasound and MRI

Tuesday, Dec. 3 11:35AM - 12:00PM Room: Arie Crown Theater

Participants
Maryellen L. Giger, PhD, Chicago, IL (*Presenter*) Advisor, Qlarity Imaging; 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

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LEARNING OBJECTIVES

1) Appreciate the motivation and scientific premise of AI for breast ultrasound and MRI for various clinical tasks. 2) Learn about the role of AI in computer-aided diagnosis using computer-extracted hand-engineered radiomic features and methods in deep learning in 2D and 3D. 3) Understand the role of AI beyond breast cancer detection and diagnosis, in which data extracted from breast images could be used to inform multi-omics cancer discovery studies and virtual biopsies.

VW03

AI-based Mammography Reading: Self-guided Reading Session: Presented by Siemens Healthineers

Tuesday, Dec. 3 10:15AM - 5:00PM Room: North Building, Booth 8563

Program Information

You will learn about the benefits of the AI-based Transpara™* decision-support tool from ScreenPoint Medical. It has been integrated with the advanced visualization software syngo. Breast Care* to support 2D and 3D mammography reading. Together, they provide interactive decision support with an overall exam score to help prioritize reading. **syngo*.Breast Care VB40 and Transpara™ for 3D are currently under development; they are not for sale in the U.S. Their future availability cannot be guaranteed. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP

https://www.fairorg.de/Siemens-Healthineers/portal/workshop.cfm/rsna19/

Printed on: 10/29/20

VW07

50° Wide-angle Tomosynthesis and Contrast-enhanced Mammography Self-guided Reading Sessions: Presented by Siemens Healthineers

Tuesday, Dec. 3 10:15AM - 5:00PM Room: North Building, Booth 8563

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 challenging cases with a solution enables you to develop and test your reading skills. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP

https://www.fairorg.de/Siemens-Healthineers/portal/workshop.cfm/rsna19/

Printed on: 10/29/20

VW22

The Benefits of 50° Wide-angle Tomosynthesis: Presented by Siemens Healthineers

Tuesday, Dec. 3 10:15AM - 11:25AM Room: North Building, Booth 8563

Participants

Thomas S. Helling Jr, MD, Lawrence, KS (*Presenter*) Nothing to Disclose

Program Information

During this hands-on workshop, you will learn more about evaluating breast tomosynthesis data. A reading expert will guide you through cases that will both fascinate and challenge you! All cases have been acquired with Siemens Healthineers 50° Wide-Angle Tomosynthesis technology and can be read on our advanced visualization software syngo. Breast Care. You will become familiar with the value of 50° Wide-Angle Tomosynthesis images and the ease-of-use of our reading solutions. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP

https://www.fairorg.de/Siemens-Healthineers/portal/workshop.cfm/rsna19/

Printed on: 10/29/20

AI31

AI Theater: AI-powered Precision Diagnostics - Beyond Expert Level Imaging Biomarkers for Chest and Breast Imaging: Presented by Lunit

Tuesday, Dec. 3 10:30AM - 10:50AM Room: AI Showcase, North Building, Level 2, Booth 10724

Participants

Brandon Suh, MD,MPH, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

Program Information

'Perfecting Intelligence, Transforming Medicine,' Lunit thrives to expand the boundaries of AI-driven capabilities for medical image analytics based on its world-leading deep learning technology, specifically focused on chest and breast imaging. Demos of Lunit INSIGHT CXR and Lunit INSIGHT MMG, Lunit's most mature products tested on +3 million images from more than 80 countries combined, will be presented. Key clinical study results conducted to validate specific clinical utility of Lunit INSIGHT will also be shown. Lunit is a medical AI software company devoted to providing AI-powered total cancer care. Lunit AI solutions help discover cancer and predict cancer treatment response, achieving timely and individually-tailored cancer treatment. With the help of AI, Lunit seeks to reduce medical costs and prolong survival. Founded in 2013, Lunit has been internationally acknowledged for its advanced technology and its application in medical images.

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www.lunit.io www.insight.lunit.io'"

Printed on: 10/29/20

SSG01

Breast Imaging (CESM, DBT)

Tuesday, Dec. 3 10:30AM - 12:00PM Room: S102CD

BR

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

FDA Discussions may include off-label uses.

Participants
Catherine S. Giess, MD, Wellesley, MA (*Moderator*) Nothing to Disclose
Despina Kontos, PhD, Philadelphia, PA (*Moderator*) Research Grant, Hologic, Inc
Thomas H. Helbich, MD, Vienna, Austria (*Moderator*) Research Grant, Medicor, Inc ; Research Grant, Siemens AG ; Research Grant, C. R. Bard, Inc; Research Grant, Guerbet SA; Research Grant, Novomed GmbH

Sub-Events

SSG01-01 Weakly Supervised Deep Learning Modeling on Sub-Volumes for Pre Assessment of Digital Breast Tomosynthesis

Tuesday, Dec. 3 10:30AM - 10:40AM Room: S102CD

Participants
Emine Doganay, PhD, Pittsburgh, PA (*Presenter*) Nothing to Disclose
Puchen Li, Shenyang City, China (*Abstract Co-Author*) Nothing to Disclose
Yahong Luo, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
Wendie A. Berg, MD, PhD, Gibsonia, PA (*Abstract Co-Author*) Nothing to Disclose
Shandong Wu, PhD, MSc, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Digital breast tomosynthesis (DBT) is a quasi-3D imaging modality which can increase cancer detection and reduce false recalls. It, however, entails a much larger volume of imaging data to read, decreasing the time-efficiency of radiologists. In this study, we leverage a weakly supervised approach to build deep learning models to improve radiologists' reading, where the model performs a pre-reading to DBTs to identify potential examinations that are more likely to have malignancy or be breast cancer free.

METHOD AND MATERIALS

This retrospective study includes 546 patients (205 malignant and 341 benign cases, all confirmed by pathology), each having a DBT acquired between 2017-2018 at the same institution. Considering the 3D nature of DBT and the varying length of slice numbers (ranging 31 to 111) per breast across the patients, we proposed a sub-volume (i.e., 11 consecutive slices)-based scheme for 3D-based classification. A total of 1005 and 1753 sub-volumes were generated from the malignant and benign cases, respectively, for multi-sub-volume-based analysis. No lesion segmentation/labeling was performed in any slices; instead, only a weak label of 'malignancy' or 'benign' was given to each sub-volume. We constructed 3D convolutional neural network models using the shallow VGG-19 to perform three binary-classification tasks: (1) malignant vs. all benign, (2) malignant vs. BI-RADS 2&3 benign (109 cases), and (3) malignant vs. BI-RADS 4a&4b&4c benign (168 cases). Patient-wise 10-fold validation was performed, using AUC and sensitivity/specificity to measure model performance.

RESULTS

Average AUC was 0.72 (range 0.70-0.74) when using all benign cases in task 1. For the sub-group analysis, we observe an increased AUC of 0.74 (range 0.72-0.77) in task 2 and a decreased AUC of 0.60 (range 0.50-0.69) in task 3. In particular, a high specificity (0.89) is observed for task 1 and high sensitivity (0.91) is observed for task 2. The ROC curves are given in the attached figure.

CONCLUSION

Without the need of lesion segmentation and labeling, our deep learning method can effectively identify potential concerning DBT scans of reader's interests (more likely to have malignancy or be normal).

CLINICAL RELEVANCE/APPLICATION

Volumetric deep learning models can be a helpful tool to pre-read DBT scans for radiologists, with the promise to optimize reading priority, shorten reading time, and reduce unnecessary biopsy.

SSG01-02 Contrast-Enhanced Spectral Mammography (CESM) for Diagnostic Work-Up of MR-BI-RADS 4 Lesions Detected on Contrast-Enhanced Breast MRI

Tuesday, Dec. 3 10:40AM - 10:50AM Room: S102CD

Participants

Simone Schrading, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Claudia Kurtz, MD, Lucerne, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Timm Dirrichs, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Julia Vinnenberg, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christiane K. Kuhl, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

CESM has been proposed as an alternate to MRI for screening as well as staging of breast cancer. Recent studies suggest that CESM offers a similar sensitivity, yet a significantly higher specificity and PPV compared with MRI. Therefore, we investigated whether one can exploit the superior diagnostic accuracy of CESM for work-up of suspicious findings made on breast MRI.

METHOD AND MATERIALS

This prospective bi-center study included 53 asymptomatic patients with 53 contrast-enhancing lesions detected on breast MRI, and categorized as MR-BIRADS-4. All women underwent standard CESM (Selenia 3D Dimensions). MRI and CESM studies were read independently from each other by four breast radiologists. Thereafter, MR and CESM images were read in consensus side-by-side in order to correlate respective imaging findings. All findings were clarified by MR-guided vacuum biopsy.

RESULTS

Of the 53 findings suspicious on MRI, 25 (47.2%) were finally proven to be malignant (11 DCIS, 14 invasive cancers), and 28 (52.8%) benign. CESM suggested presence of breast cancer in 45/53 patients, and absence in 8/53. Of the 25 patients with final diagnosis of a malignant lesion, CESM was positive in 19, and negative in 6. Of the 28 women with final diagnosis of a benign lesion, CESM was positive in 26, and negative in 2. Accordingly, CESM would have caused a correct down-categorization in 2/28 false-positive (benign) MR-BIRADS-4 lesions (7%), but would have caused an incorrect down-categorization of 6/25 true-positive (malignant) MR-BIRADS-4 lesions (24%). No additional breast cancers were found by CESM, but 5 (9%; 5/53) additional false-positive findings. PPV of CESM was lower than that of MRI (47.2% [25/53] vs. 42.2% [19/45]).

CONCLUSION

CESM is not suitable for the non-invasive work up of MR-BI-RADS-4 lesions, because false-positive findings on MRI do mostly also enhance on CESM, with only a minimal reduction of false-positive diagnoses (-7%). Yet even this (low) rate of down-categorization cannot be exploited in clinical practice because it would be associated with cancers going undiagnosed in one out of four cases (24%).

CLINICAL RELEVANCE/APPLICATION

This study does not confirm the reported high sensitivity and superior specificity of CESM. CESM is not suitable for non-invasive work up of MR-BRADS-4 findings.

SSG01-04 Wide versus Narrow Angle Tomosynthesis: What's the Difference?

Tuesday, Dec. 3 11:00AM - 11:10AM Room: S102CD

Participants
Anastasia Plaunova, MD, Stony Brook, NY (*Presenter*) Nothing to Disclose
Hailiang Huang, MS, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Kim Rinaldi, RT, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
David A. Scaduto, PhD, Pittsfield, ME (*Abstract Co-Author*) Research Grant, Siemens AG
Wei Zhao, PhD, Stony Brook, NY (*Abstract Co-Author*) Research support, Siemens AG
Paul R. Fisher, MD, East Setauket, NY (*Abstract Co-Author*) Research Grant, Siemens AG

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PURPOSE

Today, digital breast tomosynthesis (DBT) is quickly becoming the standard of care for practices across the US and worldwide. While benefits of tomosynthesis are widely known - e.g., increased cancer detection rate and fewer callbacks - performance differences in DBT systems are unclear. Since the inception of DBT, discussion of optimal angular range and reconstruction algorithms has been at the forefront of the evolving 'ideal tomosynthesis' package. To our knowledge, this pilot study is the first to compare two clinical DBT units of differing angular ranges (AR) side by side.

METHOD AND MATERIALS

In this prospective study, patients coming to diagnostic follow-up (BIRADS 0) were recruited and imaged with both narrow-angle (Hologic Selenia Dimensions, AR = 15°) and wide-angle (Siemens MAMMOMAT Inspiration, AR = 50°) DBT. A total of 60 patients were included to yield 39 mass, 23 asymmetry/focal asymmetry, 4 architectural distortion, and 19 calcification comparison pairs for evaluation. Each abnormality was rated on a five-point scale for conspicuity (-2: lesion much better seen on narrow-angle DBT, to +2: lesion much better seen on wide-angle DBT).

RESULTS

Mass conspicuity was superior on wide-angle DBT compared to narrow-angle (mean score 0.97; 95% confidence interval (CI): 0.68, 1.27), as with asymmetry/focal asymmetry (0.96; CI: 0.56, 1.36). Architectural distortion was equivocal (0.50; CI: -0.42, 1.42), while narrow-angle showed calcifications better (-0.79; CI: -1.23, -0.35). Six cases were excluded from comparison because an asymmetry or mass was only seen on narrow-angle DBT, with that area demonstrating overlapping tissue on wide-angle (final work-up confirmatory). In one case, an asymmetry was a single view finding on narrow-angle DBT (CC view), while it was identified on both wide-angle views.

CONCLUSION

Wide-angle DBT makes it easier to identify masses and asymmetries when compared to narrow-angle DBT. The former can be used to reduce callbacks, reduce false positives, and perhaps identify a true finding faster with less imaging. Narrow-angle DBT performs better for calcifications and remains an Achilles heel for wide-angle DBT. Future endeavors include improving visualization of

calcifications through reconstruction techniques.

CLINICAL RELEVANCE/APPLICATION

Wide-Angle DBT can be used to reduce callbacks, reduce false positives, and potentially identify a true finding faster with less imaging.

SSG01-05 Evaluation of Response to Neoadjuvant Chemotherapy by Contrast-Enhanced Mammography in Different Biological Subtypes of Breast Cancer

Tuesday, Dec. 3 11:10AM - 11:20AM Room: S102CD

Participants
Sherihan M. Abdelhameed, Cairo, Egypt (*Presenter*) Nothing to Disclose
Rasha M. Kamal, MD, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose
Mohammed M. Gomaa, MD, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To assess how the molecular biomarker status of breast cancer affects the accuracy of Contrast Enhanced Spectral Mammography (CESM) in the assessment of residual disease extent after Neoadjuvant Chemotherapy (NAC).

METHOD AND MATERIALS

This study was approved by the institutional review board. 81 patients (age range, 27-77 years) receiving NAC were monitored with CESM. All patients had 2 CESM examinations; prior to and post NAC (maximum 10 days prior to surgery). The longest dimension of the residual cancer was measured at the post-NAC CESM and correlated with the post-operative pathologic findings. Patients were further divided into subgroups on the basis of HER2, hormone receptor, and Ki-67 status. The Pearson correlation was used to correlate CESM and pathologic tumor size, and the unpaired t test was used to compare CESM-pathologic size discrepancies.

RESULTS

Of the 81 patients; 41 had Luminal A tumors, 18 had triple-negative tumors, 16 had HER2-enriched tumors and 6 patients had Luminal B tumors. A strong correlation was found between the size of residual lesions on CESM and histopathology specimens in the total 81 patients ($r=0.921$, $P<0.001$). The overall mean size discrepancy was 0.85 cm +/- 1.04 SD. The HER2-enriched tumors showed the highest correlation with the histologic diameter ($r=0.988$, $P<0.001$), followed by the triple negative tumors ($r=0.932$, $P<0.001$) and then the Luminal A tumors ($r=0.834$, $P<0.001$), while the Luminal B tumors had the weakest correlation with histologic size ($r=0.840$, $P=0.036$). The mean CESM-pathologic size discrepancy was the smallest in the triple negative tumors and HER2-enriched tumors; 0.44 cm +/- 0.5 SD and 0.56 cm +/- 0.7 SD respectively, while the greatest mean size discrepancy was seen with the Luminal A and B tumors; 1.13 cm +/- 1.2 SD and 1.17 cm +/- 0.8 SD respectively.

CONCLUSION

CESM showed overall high diagnostic accuracy in the assessment of residual disease extent, achieving better correlation with pathologic size and smaller size discrepancy with the triple-negative and HER2-enriched tumors.

CLINICAL RELEVANCE/APPLICATION

Accurate assessment of residual disease extent after NAC is crucial for optimum surgical planning. Understanding the impact of the biological subtype of breast cancer on the diagnostic accuracy of a certain imaging modality leads to making sound decisions when it comes to surgical planning, eventually leading to better surgical outcome with tumor free margin.

SSG01-06 Use of Contrast-Enhanced Digital Mammography (CEDM) for Monitoring the Effects of Neoadjuvant Chemotherapy: Results from the "NEO-CEDM Trento Trial"

Tuesday, Dec. 3 11:20AM - 11:30AM Room: S102CD

Participants
Daniela Bernardi, MD, Rozzano, Italy (*Presenter*) Nothing to Disclose
Alessandra Acquaviva, MD, Salerno, Italy (*Abstract Co-Author*) Nothing to Disclose
Marvi Valentini, MD, Trento, Italy (*Abstract Co-Author*) Nothing to Disclose
Vincenzo Sabatino, MD, Gragnano, Italy (*Abstract Co-Author*) Nothing to Disclose
Giulia Vatteroni, MD, Rozzano, Italy (*Abstract Co-Author*) Nothing to Disclose
Marco Pellegrini, MD, Trento, Italy (*Abstract Co-Author*) Nothing to Disclose
Carmine Fanto, MD, Trento, Italy (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To report the results of a trial on the comparison between CEDM and Magnetic Resonance (MR) for assessing the size of the residual tumor during and after neoadjuvant chemotherapy (NAC) and estimating the response to therapy

METHOD AND MATERIALS

Between May 2015 and April 2018, 63 women who underwent NAC for breast cancer, were enrolled in this propective study approved by institutional review board. Exclusion criteria were: pregnancy, breastfeeding and contraindications to CEDM and/or MR. Women had contrast examinations before starting (PRE), during (MID) and at the end of NAC (POST). Two experienced radiologists blindly looked at MR, two others looked at CEDM and then reported, for each exam and NAC step, the largest diameter of the target lesion. The response to therapy was finally classified using RECIST criteria comparing first PRE- and MID-NAC, then MID- and POST-

NAC lesion size. Pathological results were collected and used as reference standard for comparison with last CEDM and MR controls. Statystical analysis: Pearson correlation and Bland Altman plot to test, for each NAC step, the agreement between CEDM, MR and pathological measurements; Chi-square test to evaluate the agreement in assessing RECIST criteria

RESULTS

Consistent correlation was found between CEDM and MR measurements both in PRE (0.94, IC 0.90-0.96), MID (0.92, IC 0.86- 0.95) and POST-NAC (0.92, IC 0.86-0.95); when POST-NAC CEDM and MR measurements were individually compared with pathological findings, the correlation found was lower for both methods and with similar results (respectively 0.64, 95% CI 0.44-0.77 and 0.63, IC 95% 0.44-0.77). Classifying the response to therapy according to RECIST criteria, there was significative agreement between CEDM and MR at MID-NAC (88.2%, p <0.0001) and at POST-NAC (84.6%, p <0.0001). Comparing the POST-NAC controls with the pathologist's response, the agreement was higher for MR (84.6%, p <0.0001) compared to CEDM (77%, p <0.0001). MR showed significant higher sensitivity (79% vs 69%) and specificity (100% vs 91%) than CEDM for assessment of complete response (CR) category

CONCLUSION

CEDM seems to be equivalent to MR for assessing tumor size and evaluating the response to NAC although in this study it has shown some limitations compared to MR in estimating the final entity of response

CLINICAL RELEVANCE/APPLICATION

CEDM may represent a reliable alternative in case of contraindications to MR or when MR is not available

SSG01-07 Computerized Scheme for Distinguishing Sentinel Lymph Nodes with and Without Cancer Metastasis Using Computed Tomography Lymphography before Breast Cancer Surgery

Tuesday, Dec. 3 11:30AM - 11:40AM Room: S102CD

Participants
Hiroshi Ashiba I, PhD,RT, Saitama City , Japan (*Presenter*) Nothing to Disclose
Ryohei Nakayama, PhD, Kusatsu, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Sentinel lymph node (SLN) biopsy for evaluating cancer metastasis during breast cancer surgery can cause the consequent increase in operation time or the abrupt changes in the treatment plan during the operation. Although it is desirable to distinguish SLNs with and without metastasis before surgery, there is no established examination for this purpose. The purpose of this study was to develop a computerized scheme for evaluating metastasis in SLNs by analyzing computed tomography lymphography (CTLG) images.

METHOD AND MATERIALS

Our database consisted of CTLG images obtained from 100 patients with breast cancer who underwent surgery. The number of patients with SLN metastasis was 45, whereas that without SLN metastasis was 55. In our computerized scheme, nine objective features were assessed for SLN and lymphoduct. Support vector machine (SVM) was employed to evaluate cancer metastasis in SLNs. The hyper-parameters of the SVM were determined with a Bayesian optimization. The objective features used as inputs for the SVM were selected from the nine features according to a stepwise method based on Wilks's lambda. A leave-one-out testing method was used for the training and testing of the SVM.

RESULTS

The six objective features used for the SVM were selected from the nine features using the stepwise method. These features were as follows: 1) the shape of the lymphoduct, 2) degree of enhancement of the SLN, 3) long axis of the SLN, 4) area of the SLN, 5) standard deviation of CT values of the SLN, and 6) mean CT value of the SLN. With the computerized scheme, the classification accuracy, sensitivity, and specificity were 98.0% (98/100), 97.8% (44/45), and 98.2% (54/55), respectively. The positive and negative predictive values were 97.8% (44/45) and 98.2% (54/55), respectively. In the receiver operating characteristic analysis, the area under the curve was 0.972.

CONCLUSION

The computerized scheme for distinguishing between SLNs with and without metastasis can provide high classification accuracy by analyzing CTLG images before breast surgery.

CLINICAL RELEVANCE/APPLICATION

The computerized scheme for analyzing CTLG images exhibited high classification accuracy and would be useful in planning surgical procedures for determining whether to implement lymph node dissection.

SSG01-08 Prospective Study: Added Value of Contrast-Enhanced Spectral Mammography (CESM) in the Clinical Management of Indeterminate to High-Risk Lesions

Tuesday, Dec. 3 11:40AM - 11:50AM Room: S102CD

Participants
Amanda Ling Fung Liew, Singapore, Singapore (*Presenter*) Nothing to Disclose
Niketa Chotai, MD, FRCR, Singapore, Singapore (*Abstract Co-Author*) Nothing to Disclose
Ern Yu Tan, MBBS,DPhil, Singapore, Singapore (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To assess the added value of CESM in clinical management of BIRADS 4/5 lesions.

METHOD AND MATERIALS

BIRADS 4/5 lesions detected on conventional imaging (mammogram and/or ultrasound) between July 2016 and Sep 2018 were selected for adjunct dual energy CESM. Histopathology correlation was obtained on all lesions. Additional suspicious lesions that were detected by CESM were also included for histopathological correlation. All images were evaluated independently by two breast-trained radiologists using BIRADS classification.

RESULTS

A total of 105 lesions (63 patients) were included- 30 BIRADS 4A, 21 BIRADS 4B, 34 BIRADS 4C and 20 BIRADS 5 lesions- of which 22 did not enhance. These 22 non-enhancing lesions were all BIRADS 4A and were all found to be benign. Out of the remaining 83 enhancing lesions, 54 (65.1%) were malignant and 29 (34.9%) were benign (p value< 0.05). CESM alone detected 6 additional lesions, which were all later identified on second look ultrasound and were included for biopsy. Out of these 6, 4 were proven malignant and resulted in clinical upstaging.

CONCLUSION

There is evidence that absence of enhancement in CESM strongly favours benignity (almost 100% negative predictive value in our study). Along with conventional imaging, it may lend sufficient confidence to the reporting radiologist to downgrade some cases to BIRADS 3. This can reduce unnecessary biopsies and improve the diagnostic yield of future biopsies. CESM also increases the detection rate for potentially malignant lesions, thereby changing treatment strategy.

CLINICAL RELEVANCE/APPLICATION

BIRADS 4 comprises 4A-4C lesions, all of which need biopsy. Adding CESM may help avoid up to 1/2 of benign biopsies, reduce patient's physical and mental stress and allow better resource utilization.

SSG01-09 Prediction of Invasive Component Using Contrast-Enhanced Spectral Mammography in Patients Diagnosed as Ductal Carcinoma in Situ on Preoperative Core Biopsy: Prospective Observational Study

Tuesday, Dec. 3 11:50AM - 12:00PM Room: S102CD

Participants
Eunjin Hwang, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hee Jung Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Grant, General Electric Company
Jin Hee Seo, 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
Eun Young Chae, 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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PURPOSE

To evaluate the role of contrast-enhanced spectral mammography (CESM) for the prediction of invasive component in patients diagnosed as ductal carcinoma in situ (DCIS) on preoperative core biopsy.

METHOD AND MATERIALS

A total of 113 tumors in 108 patients diagnosed as DCIS on preoperative core biopsy were prospectively included in this study. Digital mammography (DM), CESM, and breast MRI were performed. Detection rate, lesion type, size on imaging and pathologic features on core biopsy were recorded. CESM grey value of combined image were also evaluated. Intraclass correlation coefficient (ICC), chi-square test, and student t-test were used for statistical analysis. Multivariate logistic regression analysis was used to find independent factors for the prediction of an invasive component.

RESULTS

On final pathology, 50 (44%) were pure DCIS, and 63 (56%) were microinvasive or invasive carcinomas. Detection rate of pure DCIS was 74% for DM, 90% for CESM, 100% for breast MRI, while that of microinvasive or invasive carcinoma 76% for DM, 98% for CESM, and 98% for breast MRI. ICC of tumor size between imaging and final pathology 0.773 for DM, 0.904 for CESM, and 0.832 for breast MRI. A total of 113 lesions, 25% (28/113) was not detected on DM, 5% (6/113) in CESM, and 1% (1/113) in breast MRI. When lesions were divided into calcified and noncalcified lesions, calcified lesions were 59 (52%) and noncalcified lesions were 54 (48%). Detection rate of calcified DCIS was 100% for DM, 98% for CESM, and 98% for breast MRI, while that of noncalcified DCIS was 48% for DM, 91% for CESM, and 100% for breast MRI. On multivariate analysis, nuclear grade on core biopsy, tumor extent on CESM and breast MRI, maximum CGV and maximum-to-minimum difference on CC view of CESM were independent factors for the prediction of invasive components, and AUC of combined feature was 0.84.

CONCLUSION

This study showed that CESM for the detection of DCIS, especially noncalcified DCIS showed similar performance to breast MRI, and significantly higher than DM. Tumor extent and CGV on CESM were independent factors for the prediction of invasive component on final pathology, and AUC was 0.84 when adding the nuclear grade on core biopsy.

CLINICAL RELEVANCE/APPLICATION

As for the detection of DCIS and prediction of invasive component on final pathology, CESM could show a similar diagnostic performance to breast MRI,

VW47

Screening Breast Ultrasound: Where Are We Today? Presented by GE Healthcare

Tuesday, Dec. 3 10:30AM - 11:00AM Room: South Building, Booth 5135

Participants

Rachel F. Brem, MD, Washington, DC (*Presenter*) 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

Program Information

Dr. Rachel Brem, an international thought leader in ultrasound screening and the PI of the seminal SomoInsight Study , will review current breast ultrasound screening literature and clinical trends. She will share how to improve your cancer detection rate today - using ultrasound as a supplemental screening modality for intermediate risk women with dense breasts. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

VW72

Increase Confidence and Improve Workflow Efficiencies with High-Resolution Imaging Technology: Presented by Hologic, Inc.

Tuesday, Dec. 3 10:30AM - 11:45AM Room: South Building, Booth 5119

Participants

Linda R. Greer, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

Program Information

Discover how transitioning to Clarity HD® high-resolution imaging with Intelligent 2D® synthesized 2D images and 3DQuorum® may increase reading confidence, improve workflow efficiency while decreasing patient dose. The session includes high-resolution images with 3DQuorum® for attendees to view during the hands-on case-review. *Adding this session to your agenda does not secure your seat in this session. Secure your seat onsite by visiting Hologic's Workshop Room # 5119 in the South Hall.*

Printed on: 10/29/20

VW90

Diagnosing Millimeter-sized Cancers with ASPIRE Cristalle: Presented by FUJIFILM Medical Systems U.S.A., Inc.

Tuesday, Dec. 3 10:30AM - 11:30AM Room: South Building, Booth 5147

Participants

Dean Phillips, Stamford, CT (*Presenter*) Nothing to Disclose

Program Information

Diagnosing small cancers in dense breasts can be difficult. This interactive workshop, using a large number of clinical examples, will introduce attendees to how recent technical advances have the potential to help identify millimeter-sized cancers in dense breasts and bring them to the forefront.

Printed on: 10/29/20

VW48

Breaking Down Barriers in AI Development for Lesion Identification in Breast Care using Ultrasound: Presented by GE Healthcare

Tuesday, Dec. 3 11:30AM - 12:00PM Room: South Building, Booth 5135

Participants

Sonia Gupta, MD, Boston, MA (*Presenter*) Medical Director, Qure.ai North America; Consultant, IBM Corporation; Consultant, Sauzio; Consultant, General Electric Company; Consultant, Koios; Consultant, Alphabet Inc; Speakers Bureau, Ambra Health ; Speaker, AIMED; Advisory Board, Guerbet SA; Editorial Advisory Board, Anderson Publishing, Ltd;

Program Information

Learn about the current status of artificial intelligence (AI) utilization in diagnostic imaging specific to breast radiology in the USA, as we explore stakeholders, theories of development and hype vs. reality. Specific challenges in development and deployment of AI into a diagnostic breast ultrasound practice will be presented. An overview of GE's partnership with Koios will be shared and highlights of how to break down internal and external barriers will be shown. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

VW91

The Role of Dual-Angle Tomosynthesis in Assessment and Risk Situations: Presented by FUJIFILM Medical Systems U.S.A., Inc.

Tuesday, Dec. 3 11:40AM - 12:40PM Room: South Building, Booth 5147

Participants

Claudia Kurtz, MD, Lucerne, Switzerland (*Presenter*) Nothing to Disclose

Program Information

This session begins by introducing the physical properties of narrow-angle vs. wide-angle DBT and, using a large number of clinical examples, compares their impact on overall imaging performance and lesion visualization. The session then progresses to comparison of DBT reconstruction methods (Filtered Back Projection vs. Iterative) and their effect on slice image quality and the production of synthetic 2D images. The session finishes with discussions on breast density assessment methods and Contrast Enhanced Subtraction Mammography (CESM).

Printed on: 10/29/20

BRS-TUA

Breast Tuesday Poster Discussions

Tuesday, Dec. 3 12:15PM - 12:45PM Room: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

Participants

Jung Min Chang, MD, Seoul, Korea, Republic Of (*Moderator*) Nothing to Disclose

Sub-Events

BR233-SD-TUA1 Overweighting of Individual Outcomes is the Main Source of Base Rate Neglect in Mammography

Station #1

Participants
Fallon Branch, MS, Augusta, GA (*Presenter*) Nothing to Disclose
Jay Hegde, PhD,MS, Augusta, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To quantitatively characterize the roles of various contributing factors to base rate neglect (or base rate fallacy) in mammography, wherein radiologists fail to adequately take into account the prevalence of a given outcome (e.g., breast cancer) in the relevant patient population.

METHOD AND MATERIALS

Fourteen practicing radiologists volunteered for this study. Subjects were simultaneously given three pieces of information: (1) The base rate of breast cancer in the given cohort of patients, (2) The hit rate and false alarm rate of a machine learning system for breast cancer detection, and (3) The binary decision of the system (+ve or -ve for cancer) for a given mammogram from the present patient cohort. Using only this information, subjects had to estimate, using an on-screen slider, the percent chance that the mammogram in question is actually positive breast cancer. We systematically varied the above three pieces of information and measured its effect on the subjects' reports.

RESULTS

The estimated probability of cancer was significantly anti-correlated with the theoretically expected probabilities (r = -0.39; df = 3148; t = -23.41, $p << 0.05$; see figure), indicating that base rate neglect had a significant biasing effect in this case. A general linear model of the data revealed that item #3 above (i.e., binary decision) made a large, statistically significant contribution to the outcome (t = 20.87; p < 2e-16). The false alarm rate had a modest effect (t = -2.28; p = 0.02). Base rate (item #1 above) did not have a significant effect (t = -0.33; p = 0.74).

CONCLUSION

Information about the cancer status in individual case, 'individuating information', had a disproportionately large effect, and the base rate had a statistically insignificant effect on the subjects' estimates of the probability of cancer. This is consistent with the results of previous studies of the sources of the base rate fallacy in other, non-clinical contexts.

CLINICAL RELEVANCE/APPLICATION

This study suggests, albeit does not prove, that base rate neglect in mammography arises primarily because radiologists attach too much importance to individuating information, i.e., the cancer status of individual mammograms.

BR234-SD-TUA2 The Usefulness of Bayesian Network in Assessment of Triple-Negative Breast Cancer Risk

Station #2

Participants
Chushan Zheng, MD, Guangzhou, China (*Presenter*) Nothing to Disclose
Yun Huang, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Jun Shen, MD, Guagnzhou, China (*Abstract Co-Author*) Nothing to Disclose
Yuantao Hao, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Xiang Zhang, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Zehong Yang, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To determine whether a Bayesian network model learned from epidemiologic, clinical, and pharmacokinetic quantitative dynamic contrast-enhanced (qDCE) MRI parameters can aid in preoperative classification of triple-negative breast cancer (TNBC)

METHOD AND MATERIALS

The institutional review board exempted this retrospective study from requiring informed consent. 197 women (mean age ± standard deviation, 50.43±10.25 years) with breast cancer confirmed by surgical pathology were included from April 2016 to August

2017. All patients underwent DCE MRI within one week before surgery. The pattern of the time of intensity curve and pharmacokinetic parameters were derived from DCE-MRI for each lesion. The epidemiologic and clinical parameters were also collected. By using 5-fold cross validation, a Bayesian network model was trained and tested to estimate TNBC risk based on epidemiologic, clinical, and qDCE MRI pharmacokinetic parameters. Probability estimates were used to build receiver operating characteristics (ROC) curves, and the performance of the Bayesian network was evaluated by using area under the ROC curves (Az), positive predictive value (PPV), and accuracy.

RESULTS

The established Bayesian network consisted of 21 features that were conditionally dependent on each other. Posttest probability table of the deterministic node showed that patients with age 0.186 tend more likely to have TNBC, while patients with age < 35 years and a mass-like lesion, or patients with age between 35 and 50 with non-mass-like lesion are almost impossible to have TNBC. The Bayesian network model showed good performance in terms of Az (0.731, 95% CI: 0.635-0.828), PPV (0.397, 95% CI: 0.257-0.538), and accuracy (0.834, 95% CI: 0.738-0.930) when the threshold level of posttest probability was set as 0.163 (95% CI: 0.114-0.211).

CONCLUSION

Bayesian network model with integration of epidemiologic, clinical, and qDCE MRI pharmacokinetic parameters can be used to predict the risk of TNBC in women with breast cancer.

CLINICAL RELEVANCE/APPLICATION

Bayesian network model can be used to predict the risk of TNBC in women with breast cancer by using epidemiologic, clinical, and qDCE MRI findings..

BR235-SD-TUA3 Independent Validation of Diagnostic Machine Learning Radiomics on a Large Clinical Dataset of Consecutive Breast MRIs

Station #3

Participants
Yu Ji, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Hui Li, PHD, 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
Wenjuan Ma, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Peifang Liu, MD, PhD, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Maryellen L. Giger, PhD, Chicago, IL (*Abstract Co-Author*) Advisor, Qlarity Imaging; 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

PURPOSE

To evaluate radiomic machine learning in the task of distinguishing between malignant and benign breast lesions on a consecutive, independent MRI clinical dataset from China.

METHOD AND MATERIALS

Retrospective analysis was conducted of consecutive breast MRI images from 1,483 breast cancer and 496 benign patients who underwent MRI examinations between February 2015 and October 2017. The age range of the cancer and benign patients were 19 to 77 and 16 to 76 years old with an average of 48.1 and 42.1 years, respectively. Database was divided into a training dataset (years 2015 & 2016; 1444 cases) and an independent testing dataset (year 2017; 535 cases) based on MRI examination date. Once a lesion is localized on the radiomics workstation, the computerautomatically segments and extracts radiomic features, which are merged with an SVM (support-vector machine) yielding a lesion signature malignancy score. On the independent, consecutive clinical dataset, the area under the ROC curve served as the primary figure of merit in the classification task for all lesions as well as only mass lesions and only non-mass lesions.

RESULTS

In the task of distinguishing malignant and benign breast lesions on DCE-MRI, the trained radiomic signature yielded an AUC value of 0.89 (se = 0.02) on the independent test dataset. For mass lesions only and non-mass lesions only, the trained signature yielded AUC values of 0.88 (se = 0.02) and 0.90 (se = 0.03), respectively. Compared with the actual clinical management decisions, the predictive model achieved 99.5% sensitivity with 9.6% fewer recommended biopsies.

CONCLUSION

On an independent, consecutive clinical dataset from China, a trainedMRI radiomics signature yielded high performance in distinguishing between malignant and benign breast lesions.

CLINICAL RELEVANCE/APPLICATION

Our computerized radiomic analysis method has potential to aid clinicians in improving breast cancer diagnosis and patient management.

BR265-SD-TUA4 Diffusion Tensor MRI in the Diagnostic Workup of Pregnancy Associated Breast Cancer (PABC): Clinical and Technical Considerations

Station #4

Participants
Noam Nissan, MD,PhD , Tel Hashomer, Israel (*Presenter*) Nothing to Disclose
Debbie Anaby, Tel Hashomer, 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
Michael Gotlieb, MD, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose

Renata Faermann, MD, Porto Alegre, Brazil (*Abstract Co-Author*) Nothing to Disclose
Eli Konen, MD, Tel Hashomer, Israel (*Abstract Co-Author*) Nothing to Disclose
Miriam Sklair-Levy, MD, Tel -Hashomer, Israel (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To review the preliminary data of breast DTI studies among pregnant and lactating patients, focusing on the opportunities for additive diagnostic value in screening, diagnosis and management of PABC, as well as the current drawbacks and technical challenges

METHOD AND MATERIALS

All patients were prospectively scanned on 1.5T MRI. Pregnant patients (n=40) were scanned in prone position using unenhanced protocol including DTI and T2-weighted sequences, whereas lactating patients (n=43) were scanned by DTI together with conventional protocol, including dynamic contrast enhanced (DCE). Imaging indications included pre-treatment evaluation of newly diagnosed PABC (n=24) as well as screening of high-risk patients and diagnosis of breast symptoms. DTI was acquired applying 32 diffusion gradients in using b-values of 0, 700 s/mm2 during 09:38min. DTI parametric maps were generated and analyzed at pixel resolution and were compared with reference to conventional imaging and pathology.

RESULTS

All scans of pregnant patients were technically completed and reached diagnostic quality, except one with notable motion artifacts due to positional discomfort. Examinations of lactating subjects were characterized with better signal-noise ration and reduced artifacts. The newly diagnosed PABC lesions were visible on the DTI maps of λ1, λ 2, λ 3, mean diffusivity (MD), and λ 1- λ3, with substantial parametric contrast compared with the apparently normal contralateral fibroglandular tissue ($P<0.001$ for all), except for two sub-centimeter lesions that were below the detection resolution. A representative example of DTI results in pregnant patient is given in Fig1. Comparison of the contrast-noise ratio between DTI and DCE among lactating patients, revealed higher CNR for λ1 and MD. Further comparison with tumor measurements between the two MRI methodologies showed high congruency. Negative findings were found in the screening and symptomatic cohorts.

CONCLUSION

DTI is well tolerated and may serve as a standalone technique in evaluation of pregnant patients, and as a valuable adjunct modality during lactations. Yet, further clinical trials are required to demonstrate the additive value of this approach in achieving earlier diagnosis of PABC.

CLINICAL RELEVANCE/APPLICATION

This work may open the door for new screening and diagnosis strategies during the periods of pregnancy and lactation, in which current practice is limited.

BR266-SD-TUA5 Perceived Realism of Generative Adversarial Network-Derived Synthetic Mammograms

Station #5

Participants
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Tobias Rijken, London, United Kingdom (*Presenter*) Stockholder, Kheiron Medical Technologies Ltd

PURPOSE

Quality assessment of generative adversarial network (GAN)-derived images, both during training to detect model collapse and more importantly afterwards for model performance evaluation and comparison purposes, is notoriously difficult to do. Several metrics (inception, Frechet inception and sliced Wassestein's) have been proposed, but none provide an objective assessment of perceived realism. We designed a simple randomised comparison study to determine whether high resolution GAN-derived medical images could be distinguished from real ones as a proxy measure for perceived realism.

METHOD AND MATERIALS

Mammographic MLO-views were selected from a pool of 1000 real and 1000 high resolution GAN-derived images. Randomly assigned GAN-derived/real image pairs were displayed in a custom tablet app, with image pinch and zoom capability, and assigned to the left and right of the screen on a 'coin-toss' upon presentation. Attendees at a large radiology conference were asked to assess 10 randomly-paired cases with no time limit, and select which of the two presented images were real. No two image pairs were ever identical, and once presented an image was removed from the pool for that participant's session.

RESULTS

117 participants took part: 55 were radiologists (82% board certified, 60% specialised in breast radiology). The remaining 62 were non-radiologists. Chi-square goodness-of-fit test with the null hypothesis being that our observations were drawn from a binomial distribution with success probability $n= 0.5$ gave a p-value of 0.999, which indicates failure to reject the null hypothesis at any significance level for all participant groups. Radiologists had a slightly wider distribution spread, but no significant increase in performance compared to non-radiologists.

CONCLUSION

The spectrum of correct identification rate for real images from the GAN-derived/real image pairs approximated to a normal distribution for all sub-groups (all participants, radiologists and non-radiologists) indicating that participants were effectively random in their choice. This suggests that GAN-derived synthetic mammography images are perceived to be as realistic as, and therefore indistinguishable from, real mammography images.

CLINICAL RELEVANCE/APPLICATION

GAN-derived medical images are indistinguishable from real ones. Further research is required to assess whether these can be used to augment training/validation datasets for machine learning tasks.

BR267-SD-TUA6 Weakly-Supervised Deep-Learning Modeling on Sub-Volumes for Pre-Assessment of Digital Breast Tomosynthesis

Station #6

Participants
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Yahong Luo, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
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Shandong Wu, PhD, MSc, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Digital breast tomosynthesis (DBT) is a quasi-3D imaging modality which can increase cancer detection and reduce false recalls. It, however, entails a much larger volume of imaging data to read, decreasing the time-efficiency of radiologists. In this study, we leverage a weakly supervised approach to build deep learning models to improve radiologists' reading, where the model performs a pre-reading to DBTs to identify potential examinations that are more likely to have malignancy or be breast cancer free.

METHOD AND MATERIALS

This retrospective study includes 546 patients (205 malignant and 341 benign cases, all confirmed by pathology), each having a DBT acquired between 2017-2018 at the same institution. Considering the 3D nature of DBT and the varying length of slice numbers (ranging 31 to 111) per breast across the patients, we proposed a sub-volume (i.e., 11 consecutive slices)-based scheme for 3D-based classification. A total of 1005 and 1753 sub-volumes were generated from the malignant and benign cases, respectively, for multi-sub-volume-based analysis. No lesion segmentation/labeling was performed in any slices; instead, only a weak label of 'malignancy' or 'benign' was given to each sub-volume. We constructed 3D convolutional neural network models using the shallow VGG-19 to perform three binary-classification tasks: (1) malignant vs. all benign, (2) malignant vs. BI-RADS 2&3 benign (109 cases), and (3) malignant vs. BI-RADS 4a&4b&4c benign (168 cases). Patient-wise 10-fold validation was performed, using AUC and sensitivity/specificity to measure model performance.

RESULTS

Average AUC was 0.72 (range 0.70-0.74) when using all benign cases in task 1. For the sub-group analysis, we observe an increased AUC of 0.74 (range 0.72-0.77) in task 2 and a decreased AUC of 0.60 (range 0.50-0.69) in task 3. In particular, a high specificity (0.89) is observed for task 1 and high sensitivity (0.91) is observed for task 2. The ROC curves are given in the attached figure.

CONCLUSION

Without the need of lesion segmentation and labeling, our deep learning method can effectively identify potential concerning DBT scans of reader's interests (more likely to have malignancy or be normal).

CLINICAL RELEVANCE/APPLICATION

Volumetric deep learning models can be a helpful tool to pre-read DBT scans for radiologists, with the promise to optimize reading priority, shorten reading time, and reduce unnecessary biopsy.

BR203-ED-TUA8 Breast Radiotherapy: What the Breast Radiologist Should Know

Station #8

Participants
Matthew Parsons, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose
Kristine Kokeny, MD, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose
Nicole S. Winkler, MD, Cottonwood Heights, UT (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is to: 1. Familiarize radiologists with current breast radiotherapy approaches in the setting of breast conserving therapy 2. Explain the rationale behind radiation treatment approaches including data from selected landmark trials 3. Review indications and techniques for post mastectomy radiation and how imaging impacts decision making 4. Review common radiation related side effects and the natural history of the radiated breast both clinically and on imaging 5. Address frequently asked patient questions with regard to breast radiation

TABLE OF CONTENTS/OUTLINE

-Basics of breast radiotherapy -Radiation oncology workflow and general treatment timeline -Radiation in the setting of breast conserving therapy -Whole vs. partial breast irradiation -Nodal management -Omission of radiation in selected patients -Radiation for DCIS -Post mastectomy radiation -Toxicity of breast radiation

BR204-ED-TUA9 How Artificial Intelligence May Help Improve Accuracy and Reading Times in the Interpretation of Digital Breast Tomosynthesis Screening Studies

Station #9

Participants
Emily F. Conant, MD, Philadelphia, PA (*Presenter*) Grant, Hologic, Inc; Consultant, Hologic, Inc; Grant, iCAD, Inc; Consultant, Advisory Panel, iCAD, Inc; Speaker, iiCME
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Justin E. Boatsman, MD, Alamo Heights, TX (*Abstract Co-Author*) Consultant, iCad, Inc
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TEACHING POINTS

Artificial Intelligence (AI) may help radiologists improve the accuracy of digital breast tomosynthesis (DBT) interpretations while also decreasing reading times when AI data is presented concurrently compared to reading DBT without AI. The AI data is presented at the lesion-level as outlines on DBT slices. AI confidence of malignancy scores are also provided at the lesion-level and case-level.Although AI may have high standalone performance, it will miss some cancers, so readers should not overly rely on AI when suspicious lesions are not outlined by AI. Conversely, AI may outline some non-malignant lesions, and readers must balance the lesion score with their characterization of such lesions to determine the appropriate action.

TABLE OF CONTENTS/OUTLINE

This exhibit demonstrates concurrent use of a deep learning-based AI system for DBT that detects soft tissue and calcific lesions in DBT slices and provides lesion outlines and calibrated confidence scores at the lesion-level and case-level.Example cases are from a reader study with 24 radiologists each reading 65 cancer and 195 non-cancer cases both with and without AI showing significant improvements, on average, in AUC, sensitivity, specificity, recall rate and reading time. Cases include examples where AI either increased or decreased sensitivity and/or specificity and reading time.

BR205-ED-TUA10 Abbreviated Breast MRI: Past, Present, and Future

Station #10

Participants
Ana Paula Melo de Assis, Sao Paulo , Brazil (*Abstract Co-Author*) Nothing to Disclose
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Luana A. Flessak, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Thais Y. Kotsubo, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Nicoli T. Yoshimi, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
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Katja Pinker-Domenig, MD, New York, NY (*Abstract Co-Author*) Speakers Bureau, Siemens AG ; Advisory Board, Merantix Healthcare GmbH
Joao V. Horvat, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The purpose of this exhibit is: - To present the current status and the future applicability of abbreviated MRI. - To discuss the different abbreviated MRI protocols. - To demonstrate how the use of abbreviated MRI can reduce examination time, reading time and costs. - To show the limitations of abbreviated MRI. - To compare the differences in performance between abbreviated and full protocol MRI.

TABLE OF CONTENTS/OUTLINE

- Introduction and history of the development of abbreviated MRI. - The importance of reducing MRI costs for health systems. - The impact in clinical practice of reducing examination time and reading time. - A systematic approach to the use of abbreviated MRI on screening. - Technique of the various abbreviated MRI protocols. - Differences in sensitivity and specificity of MRI between abbreviated and full protocols. - Limitations of abbreviated MRI. - Future directions: what is on the horizon for abbreviated MRI. - Summary and conclusion.

VW73

Clinical Perspective on 3D™ Guided Breast Biopsy and Real-Time Specimen Imaging: Presented by Hologic, Inc.

Tuesday, Dec. 3 12:15PM - 1:30PM Room: South Building, Booth 5119

Participants

Debbie L. Bennett, MD, Saint Louis, MO (*Presenter*) Advisory Board, Devicor Medical Products, Inc; Speaker, Hologic, Inc

Program Information

Come and learn from this experienced radiologist's presentation and demonstration focusing on 3D™ guided breast biopsy and real-time specimen imaging. Participate in the hands-on experience utilizing the Affirm® Prone Biopsy and Brevera® Systems. Additional attendees may join for the hands-on demos after the 20 minute lecture concludes. *Adding this session to your agenda does not secure your seat in this session. Secure your seat onsite by visiting Hologic's Workshop Room # 5119 in the South Hall.*

Printed on: 10/29/20

LL23

Lunch and Learn: Where the AI 'Rubber' Meets the Road: Making Deep Learning Technology Clinically Safe and Operationally Impactful for Breast Screening: Presented by Kheiron Medical Technologies (RSVP-required)

Tuesday, Dec. 3 12:30PM - 1:30PM Room: S403A

Participants

Bonnie N. Joe, MD,PhD, San Francisco, CA (*Presenter*) Nothing to Disclose
Christopher P. Hess, MD, PhD, San Francisco, CA (*Presenter*) Research, Siemens AG; Consultant, General Electric Company;
Sharmila Majumdar, PhD, San Francisco, CA (*Presenter*) Research Grant, General Electric Company
Tatiana Kelil, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Peter D. Kecskemethy, PhD, London, United Kingdom (*Presenter*) CEO, Kheiron Medical Technologies

Program Information

Breast cancer screening remains one of the most promising areas in medical imaging to deliver the impact of AI at scale. However, building a clinically robust solution deemed safe to deploy on diverse screening populations, that also generates meaningful outcomes for radiologists and patients, remains a challenge. Join Kheiron Medical Technologies and a panel of leading breast imaging experts, researchers and radiology leaders to discuss a framework for selecting and deploying safe and impactful AI into your screening program. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

https://www.eventbrite.co.uk/e/rsna-2019-lunch-and-learn-where-the-ai-rubber-meets-the-road-registration-75265971547

Printed on: 10/29/20

VW49

Introduction to 3D ABUS Screening Workshop: Presented by GE Healthcare

Tuesday, Dec. 3 12:30PM - 1:30PM Room: South Building, Booth 5135

Participants

Kristina L. Jong, MD, Santa Barbara, CA (*Presenter*) Nothing to Disclose

Program Information

Kristina Jong, MD, Global Peer Educator, leads this introductory hands-on, interactive, Invenia 3D ABUS (automated breast ultrasound) Workshop. Attendees will review clinical cases on the Invenia™ Viewer and learn how 3D ABUS screening helps increase cancer detection in women with dense breast tissue. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

BRS-TUB

Breast Tuesday Poster Discussions

Tuesday, Dec. 3 12:45PM - 1:15PM Room: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

Participants
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Sub-Events

BR237-SD-TUB2 Radiation Dose Reduction in Digital Mammography by Image Reconstruction Using Deep Learning Algorithm: Clinical Evaluation

Station #2

Participants
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Jong Chul Ye, PhD, Daejon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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Bora Yoon III, MD,MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

PURPOSE

To investigate the diagnostic performance in detection and characterization of breast cancer on synthesized 40% dose mammographic images using the new deep learning algorithm to 40% dose and standard full dose mammographic images.

METHOD AND MATERIALS

65 patients who underwent mammography for preoperative evaluation of breast cancer were prospectively included. Bilateral mammography with standard full dose through automatic exposure control (AEC) and additionally unilateral mediolateral oblique view of cancer side with 40% dose were obtained. The proposed de-noising method is designed based on unsupervised learning with cycle consistency loss due to the difficulty of matched labels. We trained two generators (network G and F) and two discriminators (network Dx and Dy). The training set consisted of 40% dose and standard full dose mammographic images and performed cross-validation. Five breast radiologists blindly rated the 40% dose and synthesized 40% dose images in comparison with the reference standard full dose image. Quantitative assessments were made using a McNemar's or marginal homogeneity test.

RESULTS

The standard full dose, 40% dose and synthesized 40% dose images showed similar detection rates of 87.4-97.5%. The 'not acceptable' image quality rating was higher for both masses and calcifications on the 40% dose images (28.6% and 36.4%, respectively) than synthesized 40% dose images (8.9% and 21.2%, respectively, $p<0.001$). The 'better' image quality rating was significantly higher for both masses and calcifications on the synthesized 40% dose images (73.1% and 10.7%, respectively) than 40% dose images (1.9% and 2.9%, respectively; $p<0.001$).

CONCLUSION

The detection rate of synthesized 40% dose mammography using the new deep learning algorithm is comparable with standard full dose and the image quality is superior to 40% 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.

BR238-SD-TUB3 Tissue Sound Speed: A Novel Imaging Biomarker for Measuring Tamoxifen Response

Station #3

Participants
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PURPOSE

Studies have shown that a decrease in mammographic density (MD) or lowering of background parenchymal enhancement (BPE) on MRI after initiation of tamoxifen therapy predicts a favorable response in the preventive or adjuvant settings. However, performing serial mammograms poses radiation concerns, while serial MRIs carry high cost as well as risk of multiple Gadolinium doses. Previous studies have shown that tissue sound speed, derived from whole breast ultrasound tomography measurements, is a surrogate biomarker of MD. Ultrasound is ideal for performing serial measurements because it is fast and poses almost no risks. The purpose of this study was to evaluate repeated measures of the sound speed biomarker at 3, 6 and 12-months following tamoxifen initiation.

METHOD AND MATERIALS

We performed a case-control comparison involving 74 participants referred by a health professional to undergo tamoxifen therapy (cases) and 150 matched participants with no history of breast cancer (controls). The cases were scanned with ultrasound tomography at baseline (i.e. before start of tamoxifen therapy), and then at 3, 6 and 12 months after tamoxifen initiation. Controls were scanned at baseline and 12 months. In the case group, sound speed was measured pre-treatment in the contralateral breast to avoid potential influences of tumor-related changes on density. In the control group, a single randomized breast was scanned. A pairwise t-test was used to assess differences in sound speed over time and between cases and controls.

RESULTS

There was a steady decline in sound speed over the 12-month period for women undergoing tamoxifen therapy (mean(SD): -3.0(8.2) m/s; P=0.001). Furthermore, significant sound speed reductions were observed as early as 4-6 months after tamoxifen initiation (mean(SD): -2.1(6.8) m/s; P=0.008); Figure 1. In contrast, the controls demonstrated no significant change in sound speed over a 12-month period, and the difference between case-control groups was statistically significant (P=0.0009).

CONCLUSION

Breast sound speed decreases rapidly after tamoxifen initiation; further studies are needed to assess whether this can predict clinical response.

CLINICAL RELEVANCE/APPLICATION

Ultrasound tomography may have utility in monitoring breast sound speed change as a potential biomarker of clinical tamoxifen response.

BR269-SD-TUB4 Quantitative Analysis of Background Parenchymal Enhancement in Breast MRI May be Predictive of Breast Cancer Risk

Station #4

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

Higher background parenchymal enhancement (BPE) categories may increase breast cancer risk, suggesting that BPE category is a modifiable risk factor with moderate effect size but with poor to moderate inter-reader agreement. Using a semi-automated segmentation algorithm, we extracted quantitative measures of BPE to investigate the volume and intensity of enhancement most predictive of breast cancer risk.

METHOD AND MATERIALS

In this IRB approved HIPAA compliant study, we retrospectively identified 19 high-risk women without a personal history of breast cancer who underwent breast MRI and subsequently developed breast cancer. Each case was age-matched to four controls (76 controls total). From each dynamic contrast-enhanced MRI, quantitative measures of enhancement were computed on each post-gadolinium phase by averaging voxels with relative intensity change above pre-defined enhancement ratio thresholds; totaling the volume that enhances above threshold (absolute volume of BPE in cm3); and estimating the percentage of tissue that enhances above threshold relative to total breast volume (BPE%). We investigated the ability of each of these 91 characteristics to stratify cases from controls using logistic regression. Each BPE feature's predictive ability was evaluated using the hold out (80/20) cross validation method, and features were selected based on Youden's J index and area under the curve (AUC).

RESULTS

Women subsequently diagnosed with breast cancer were 3 fold more likely to have mild, moderate, or marked BPE (referent category: minimal BPE; odds ratio = 3.0; 95% confidence interval 0.92-10.0, Fisher's exact p=0.07). BPE volume measures demonstrated similar AUC across all four post-gadolinium phases (AUC 0.63-0.79). First post-gadolinium (phase 1) BPE% at the 30 and 40% enhancement ratio thresholds each demonstrated the highest AUC (0.84) (Figure) and Youden's indices (J = 0.28 and 0.23, respectively).

CONCLUSION

Quantitative BPE measures have the potential to predict subsequent breast cancer risk. Future research is warranted to quantify BPE measures in a larger cohort of diverse patients to validate our findings.

CLINICAL RELEVANCE/APPLICATION

If demonstrated to be significant predictors of risk, future research could incorporate quantitative BPE measures into risk prediction models to more accurately estimate each woman's risk of breast cancer.

BR270-SD-TUB5 Whole-Breast Malignancy Rating for MRI Using Deep Learning

Station #5

Participants
Daniel Truhn, MD, Cologne, Germany (*Presenter*) Nothing to Disclose
Christoph Haarburger, MSc, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Hannah S. Schneider, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
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Christiane K. Kuhl, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This work presents a deep learning approach to automatically rate a full, clinical-routine, multiparametric breast MRI examination with regard to the presence of malignancy. While deep learning has been applied extensively to 2-dimensional image analysis (e.g. x-ray or single CT-slices), the extension to a 3-dimensional multiparametric dataset (MRI) has proven to be challenging. Based on previous works of patch-based (i.e. cropped 2D images) classification of breast lesions, a dedicated network architecture and curriculum learning strategy was devised that results in a comprehensive deep learning analysis of a full breast MRI-examination.

METHOD AND MATERIALS

Clinically routine breast MRI scans of 2000 patients acquired at our institution were used to train the 3D convolutional neural network in a two-stage curriculum process: First, the network is pretrained on a subset of 500 patches of size 64x64x4 voxels (4 slices with dimension of ca. 38 mm each) that encompass a known breast lesion (manually marked by radiologist). Second, to make use of the far greater availability of non-annotated data, the network is enlarged to allow for an input of 512x256x32 voxels that comprise the full breast. In this stage the network is trained on 1400 MRI examinations by only being given the BIRADS score for the whole breast. The network performance is evaluated on a test set of 100 MRI examinations and its area under the curve (AUC) as well as sensitivity and specificity are compared to an experienced radiologist in the field.

RESULTS

Training of the full network in the two-stage approach takes about 6 hours on a graphical processor unit. The AUC for the presented network architecture is 0.89+-0.01 and sensitivity and specificity are 0.84 and 0.81 respectively. Sensitivity and specificity of an experienced radiologist on the test dataset were 0.92 and 0.94 respectively. Without the two-stage learning approach, training fails.

CONCLUSION

Employing an optimized training strategy and dedicated network architectures, convolutional neural networks can be trained to rate a full breast MRI examination. Expert rating is still superior.

CLINICAL RELEVANCE/APPLICATION

The fully automated rating system can be used as an adjunct diagnostic tool and may approach expert performance once trained on a larger dataset.

BR271-SD-TUB6 Developing an Artificial Intelligence Algorithm Pipeline for Predicting Malignancy Risk for Mammographic Microcalcifications Leveraging the ACR Data Science Institute (DSI) Use Case Library

Station #6

Participants
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PURPOSE

This study implements a pipeline to develop artificial intelligence (AI) algorithms to diagnose mammographic microcalcifications using the publicly-available use case authored by the Data Science Institute (DSI) breast imaging panel.

METHOD AND MATERIALS

Our pipeline, focuses on the clinical goals of the DSI use case entitled 'Classifying Suspicious Microcalcifications,' simultaneously codifying how to 1) extract relevant mammography cases using widely available National Mammography Database (NMD) fields, 2) construct AI algorithms integrating computational and clinical input, and 3) formalize clinically-relevant evaluation metrics; all designed to support proof of generalizability. We collected mammograms with microcalcifications using an NMD database of consecutive screening and subsequent diagnostic mammograpms (1/1/2006-12/31/2015) from an academic practice for women $\geq$40. Matched outcomes from a Cancer Center registry confirmed final pathology using 6 ordinal subcategories: 4 malignant categories (invasive>DCIS grade 3> DCIS grade 2> DCIS grade 1) and 2 benign categories (high risk>normal). According to the DSI use case, we developed AI algorithms to calculate malignancy risk (using 10-fold cross validation) for ROC curve comparison using the DeLong method-as an example. We also derived a binary classification (benign versus malignant) and a 6-class stratification in order to classify pathologic severity and use BI-RADS to derive generalizable metrics.

RESULTS

Our final dataset contained 10,834 images with microcalcifications and ground truth pathology: 778 cancers (385 invasive; 89 DCIS grade 1; 183 DCIS grade 2; 121 DCIS grade 3) and 10,056 benign (283 high risk; 9773 normal). An example result from our pipeline:

our Graph Neural Network algorithm achieved an area under the ROC curve of 0.65 which was statistically significantly superior to a baseline model using logistic regression (AUC = 0.52; p < 0.001). Generalizability planning includes specification of a pre-assigned threshold to use for evaluation metrics according to BI-RADS.

CONCLUSION

We demonstrate feasibility of developing an AI pipeline for realizing an important DSI use case in breast imaging.

CLINICAL RELEVANCE/APPLICATION

Assessing if microcalcifications on mammography are malignant is a clinically important pursuit. The relevant DSI use case effectively guided a promising pipeline for AI algorithm development.

BR272-SD-TUB7 Qualitative Analysis of the Intensity and Patterns of Enhancement on Contrast-Enhanced Spectral Mammography

Station #7

Participants
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Xueqin Zhang, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To investigate the relationship between histological results and the intensity and patterns of enhancement on contrast-enhanced spectral mammography (CESM) with a qualitative analysis

METHOD AND MATERIALS

CESM was conducted on patients with clinically or ultrasonically suspected breast lesions. 104 patients who had obtained pathological diagnosis were enrolled. Three radiologists interpreted the images. The intensity of enhancement was qualitatively classified as: no enhancement, mild enhancement, moderate enhancement and severe enhancement. By comparing the degree of enhancement in the two subtraction images (CC position and MLO position) from index lateral breast, the patterns of enhancement were classified as three types: ascending (type 1), steady (type 2), and descending (type 3). The intra-rater agreement and inter-rater agreement were calculated.

RESULTS

A total of 121 lesions were found in 104 patients. There were 31 breast cancers and 90 benign lesions. Most breast cancers presented with moderate enhancement or severe enhancement while most benign lesions showed no enhancement or mild enhancement. The proportion of enhancement patterns of malignant lesions was type 1, 13.3% (4 of 30); type 2, 36.7% (11 of 30); type 3, 50.0% (15 of 30). For benign cases, type 1 accounted for 28.8% (15 of 52), type 2 accounted for 63.5% (33 of 52) and type 3 accounted for 7.7% (4 of 52). Combining the enhancement intensity with enhancement patterns, the area under ROC were 0.835, and the sensitivity, specificity, and accuracy were 77.4%, 76.7%, and 76.85%, separately. There were significant differences on both the intensity and patterns of enhancement between benign and malignant groups (P<0.001). For a qualitative analysis, the intra-rater and inter-rater agreement varied from moderate to substantial.

CONCLUSION

The intensity and patterns of enhancement on CESM are related to the distribution of benign and malignant breast lesions. Qualitative analysis of enhancement characteristics is feasible to the diagnosis practice on CESM.

CLINICAL RELEVANCE/APPLICATION

The intensity and patterns of enhancement on CESM may contribute to the differential diagnosis of benign and malignant lesions.

BR206-ED-TUB8 Beware the Axillae: Presentations of Breast Cancer Recurrence in the Axilla

Station #8

Participants
Shu-Tian Chen, MD, Chiayi, Taiwan (*Presenter*) Nothing to Disclose
Rafik Zarifa, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Christine S. Lo, MBBS, Hong Kong , Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Nelly Salem, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Kathleen Horst, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Wendy B. Demartini, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Debra M. Ikeda, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

• To review recurrence of breast cancer in the axilla, management and prognosis • To illustrate cases of axillary recurrence of breast cancer with clinical presentations and imaging findings (mammogram, US, MRI, PET) and pathologic correlation. • We emphasize pitfalls, diagnostic difficulties, and differential diagnosis of masses and growing lymph nodes in the axilla after breast cancer treatment

TABLE OF CONTENTS/OUTLINE

Introduction: Breast Cancer Recurrence in the Axilla Rare Cases of Axillary Recurrence Pitfalls/Diagnostic Difficulties Management and Prognosis of Axillary Recurrence

BR207-ED-TUB9 Help Your Pathologist Help You: Successfully Arriving at a Diagnosis on Breast Biopsy

Station #9

Participants
Evguenia J. Karimova, MD, Memphis, TN (*Presenter*) Research Consultant, Intrinsic Imaging LLC
Gabrielle Baker, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Vandana M. Dialani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Valerie J. Fein-Zachary, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Rashmi Mehta, MBA, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Tejas S. Mehta, MD, MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1.Understand the steps involved in processing a breast tissue sample in the pathology department. 2. Review steps to improve accuracy of lesion sampling and appropriately identify discordant results. 3. Review important information radiologists can provide pathologists to optimize tissue diagnosis

TABLE OF CONTENTS/OUTLINE

1.Illustrate the steps involved in processing and preparing a breast biopsy tissue sample in the pathology department. 2.Provide tips for improving accuracy of lesion sampling. 3.Review what additional information is helpful to narrow down pathologic diagnosis. 4.Problem-solving: how to identify and manage discordant biopsy results. 5.Review benefits of routine interdepartmental radiology-pathology consultation. Areas of diagnostic challenges (fibroepithelial and spindle cell proliferations, extra-mammary metastases, other).

BR208-ED-TUB10 Mixed and Purely Hyperechoic Breast Lesions: A Radiologic-Pathologic Review

Station #10

Awards
Certificate of Merit

Participants
Allyson L. Chesebro, MD, Boston, MA (*Presenter*) Nothing to Disclose
M G. Kuba, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Susan Lester, MD,PhD, 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:

achesebro@bwh.harvard.edu

TEACHING POINTS

The purpose of this educational exhibit is to:1. Define echo patterns of breast lesions at ultrasound2. Present radiologic-pathologic correlation of hyperechoic breast lesions, both benign and malignant entities3. Illustrate characterization of hyperechoic breast lesions - homogeneously hyperechoic vs heterogeneously hyperechoic with radiologic-pathologic correlation4. Increase awareness of heterogeneously hyperechoic breast lesions as a manifestation of malignancy

TABLE OF CONTENTS/OUTLINE

1. Review and illustrate echo pattern at breast ultrasounda. Anechoicb. Hyperechoicc. Hypoechoicd. Complex cystic and solid2. Illustrate hyperechoic breast lesions with radiologic and pathologic correlation case examplesa. Homogeneously hyperechoic - all benign entitiesb. Heterogeneously hyperechoic - both benign and malignant entities

VW93

Imaging of Triple-negative Breast Cancer: Presented by FUJIFILM Medical Systems U.S.A., Inc.

Tuesday, Dec. 3 1:30PM - 2:30PM Room: South Building, Booth 5147

Participants

Jessica W. Leung, MD, Houston, TX (*Presenter*) Scientific Advisory Board, Subtle Medical

Program Information

Triple negative breast cancer is defined as invasive cancer that is ER, PR, and HER2 negative. This is a biologically aggressive cancer that (currently) cannot be treated with targeted therapy. It disproportionately affects young women and is associated with BRCA-1 gene mutation. At mammography, ultrasound, and MRI, this cancer typically appears as a round or oval mass. It has a poor prognosis, at least in part due to early visceral metastases. In this lecture, the molecular, clinical, and imaging features of triple negative breast cancer will be discussed.

VW50

Launching a Progressive and Prosperous ABUS Program: Presented by GE Healthcare

Tuesday, Dec. 3 2:00PM - 2:30PM Room: South Building, Booth 5135

Participants

Lisa R. Stempel, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Program Information

Learn first-hand the pearls and pitfalls of how to successfully implement Invenia ABUS into a multi-disciplinary, multi-center practice and how to improve the clinical use of ultrasound in your breast imaging practice. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

VW74

A Revolution in Localization: Presented by Hologic, Inc.

Tuesday, Dec. 3 2:00PM - 3:15PM Room: South Building, Booth 5119

Participants

Mehran Habibi, Baltimore, MD (*Presenter*) Nothing to Disclose
Lisa A. Mullen, MD, Cockeysville, MD (*Presenter*) Nothing to Disclose

Program Information

Learn from both an experienced radiologist and surgeon as they provide an overview of traditional and new localization options for patients undergoing Breast Conserving Surgery (lumpectomy) or excisional biopsy. Their knowledgeable discussion followed by hands-on experience for attendees will review the benefits of various wire and non-wire localization technologies focusing on ways to improve workflow. The hands-on portion includes phantom-placement techniques, demonstrating multiple, innovative technologies including LOCalizer™ and Viera™. *Adding this session to your agenda does not secure your seat in this session. Secure your seat onsite by visiting Hologic's Workshop Room # 5119 in the South Hall.*

Printed on: 10/29/20

VW25

More Confidence in Tomosynthesis Reading with Synthetic 2D Reading Session: Presented by Siemens Healthineers

Tuesday, Dec. 3 2:30PM - 3:40PM Room: North Building, Booth 8563

Participants

Chantal van Ongeval, MD, Leuven, Belgium (*Presenter*) Nothing to Disclose

Program Information

During this workshop you will get to experience the value that Synthetic 2D mammography (Insight 2D) can bring to tomosynthesis reading. An expert tutor will lead you through cases that will both fascinate and challenge you! All cases have been acquired with Siemens Healthineers latest 50° Wide-Angle system MAMMOMAT Revelation and are displayed on our syngo. Breast Care workstations. So you will become familiar with the value of 50° Wide-Angle Tomosynthesis and ease of use of our systems. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP

https://www.fairorg.de/Siemens-Healthineers/portal/workshop.cfm/rsna19/

Printed on: 10/29/20

VW94

Differentiating DBT Implementation in Assessment Mammography: Presented by FUJIFILM Medical Systems U.S.A., Inc.

Tuesday, Dec. 3 2:40PM - 3:40PM Room: South Building, Booth 5147

Participants

Anna Russo, Negrar, Italy (*Presenter*) Nothing to Disclose

Program Information

This interactive session begins by covering various clinical scenarios where the selection of different DBT sweep angles and views would be the most appropriate based on patient history and symptoms. The second part of this workshop will focus on Tomo-guided biopsies with consideration to sweep angles and needle approaches.

Printed on: 10/29/20

SPAI33

RSNA AI Deep Learning Lab: Beginner Class: Classification Task (Intro)

Tuesday, Dec. 3 3:00PM - 4:30PM Room: AI Showcase, North Building, Level 2, Booth 10342

AI BR CH CT GI HN IN MR NR

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

Participants

Bradley J. Erickson, MD, PhD, Rochester, MN (*Presenter*) Board of Directors, VoiceIt Technologies, LLC; Stockholder, VoiceIt Technologies, LLC; Board of Directors, FlowSigma, LLC; Officer, FlowSigma, LLC ; Stockholder, FlowSigma, LLC

Special Information

In order to get the best experience for this session, it is highly recommended that attendees bring a laptop with a keyboard and decent-sized screen. Having a Gmail account will be helpful. Here are instructions for creating and deleting a Gmail account.

ABSTRACT

This class will focus on basic concepts of convolutional neural networks (CNNs) and walk the attendee through a working example. A popular training example is the MNIST data set which consists of hand-written digits. This course will use a data set we created, that we call 'MedNIST', and consists of images of 6 different classes: Chest X-ray, Chest CT, Abdomen CT, Head CT, Head MR and Breast MRI. The task is to identify the image class. This will be used to train attendees on the basic principles and some pitfalls in training a CNN. • Intro to CNNs • Data preparation: DICOM to jpeg, intensity normalization, train vs test • How do we choose the labels? Inconsistencies... Use Fast.AI routines to classify; Validation of results: Are the performance metrics reliable? 'Extra Credit': if there is time, explore data augmentation options, effect of batch size, training set size.

SSJ01

Breast Imaging (Quantitative Imaging and CAD)

Tuesday, Dec. 3 3:00PM - 4:00PM Room: E450A

BQ BR

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

FDA Discussions may include off-label uses.

Participants
Shandong Wu, PhD, MSc, Philadelphia, PA (*Moderator*) Nothing to Disclose
Matthias Dietzel, MBA,MD, Erlangen, Germany (*Moderator*) Nothing to Disclose

Sub-Events

SSJ01-01 Multiparametric Preoperative Breast MRI for Predicting Ki-67 and Histologic Grade in Early-Stage Luminal Breast Cancer

Tuesday, Dec. 3 3:00PM - 3:10PM Room: E450A

Participants
Sung Eun Song, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Kyu Ran Cho, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) 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;
Ok Hee Woo, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Kyung Park, MD,PhD, Ansan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Deuk Jae Sung, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

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PURPOSE

To investigate whether 3T multiparametric magnetic resonance imaging (mpMRI) can predict Ki-67 proliferation index and histologic grade in stage I-II luminal breast cancer

METHOD AND MATERIALS

In this retropective study, 239 consecutive women with luminal cancers underwent mpMRI and surgery. For mpMRI model, morphologic characteristics using Breast Imaging Reporting and Data system lexicon, kinetic feature using a computer-aided diagnosis (CAD), and apparent diffusion coefficient (ADC) at diffusion-weighted imaging were evaluated by two radiologists. Performance for predicting Ki-67 and histologic grade were assessed by using logistic regression analysis and the receiver operating characteristic curve (ROC) analysis.

RESULTS

Among 239 cancers, 166 (69.5%) had low Ki-67 and 73 (30.5%) had high ki-67, and 193 (80.8%) were low grade and 46 (19.2%) were high grade. Multivariate analysis showed that intratumoral high signal intensity (odds radio [OR] = 1.844; *P* = .046), and higher washout component (OR = 1.024; *P* = .001) were associated with higher Ki-67, and the presence of axillary adenopathy (OR = 2.719; *P* = .033), intratumoral high signal intensity (OR = 2.338; *P* = .028), larger angio-volume (OR = 1.186; *P* = .001), and higher washout component (OR = 1.033; *P* = < .001) were associated with higher histologic grade. The median ADC value was 0.95 ± 0.18 x 10 -3 mm2/s and ROC analysis showed that it was impossible to differentiate Ki-67 and histologic grade using ADC values (*P* = .701 and *P* = .056).

CONCLUSION

The mpMRI- derived biomarkers using tumor morphology and kinetic feature can be used for predicting proliferation activity and histologic grade in early-stage luminal breast cancer.

CLINICAL RELEVANCE/APPLICATION

Preoperative mpMRI-derived features may be used as biomarkers that help predict proliferation index and grade in patients with luminal breast cancers, thereby enabling improved personalized treatment.

SSJ01-02 Computer-Aided Diagnosis - Extracted Kinetic Heterogeneity of Breast Cancer at Preoperative MR Imaging: Relationship to Distant Metastasis-Free Survival

Tuesday, Dec. 3 3:10PM - 3:20PM Room: E450A

Participants
Jin You Kim, MD, Busan, Korea, Republic Of (*Presenter*) 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

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PURPOSE

To investigate whether computer-aided diagnosis (CAD)-extracted kinetic features of breast cancer at preoperative magnetic resonance (MR) imaging are associated with distant metastasis-free survival in women with invasive breast cancer.

METHOD AND MATERIALS

Between November 2011 and November 2012, 283 consecutive women (mean age, 52.9 years; age range, 32-88 years) with newly diagnosed invasive breast cancer who underwent preoperative breast MR imaging were evaluated. A commercially available CAD system was used to extract the peak enhancement (highest pixel signal intensity in the first post-contrast series) and delayed enhancement profiles (washout, plateau, and persistent components of a tumor) of each breast cancer from preoperative MRI, and kinetic heterogeneity (a measure irregularities in the proportions of washout, plateau, and persistently enhancing components within a tumor) was calculated to evaluate the intratumoral heterogeneity. Cox proportional hazards models were used to reveal the associations between CAD-extracted kinetic features and distant metastasis-free survival after adjusting for clinicopathological factors.

RESULTS

In 28 (9.9%) women, distant metastasis developed at a median follow-up of 76.7 months. CAD-extracted kinetic heterogeneity was higher in women with distant metastasis than in those without distant metastasis (0.702 ± 0.197 vs 0.434 ± 0.297, P < 0.001). Multivariable Cox proportional hazards analysis showed that a higher kinetic heterogeneity (hazard ratio [HR], 17.582; 95% confidence interval [CI]: 3.852; 80.263; P = 0.009), a higher peak enhancement (HR, 1.001; 95% CI: 1.000, 1.002; P = 0.039), the presence of lymphovascular invasion (HR, 3.442; 95% CI: 1.529, 7.750; P = 0.003), and a higher histological grade (HR, 2.285; 95% CI: 1.043, 5.009; P = 0.039) were associated with poorer distant metastasis-free survival.

CONCLUSION

Higher values of CAD-extracted kinetic heterogeneity and peak enhancement at preoperative breast MR imaging are associated with poorer distant metastasis-free survival of women with invasive breast cancer.

CLINICAL RELEVANCE/APPLICATION

Kinetic heterogeneity assessed by computer-aided diagnostic (CAD) at preoperative MR imaging might serve as a quantitative biomarker of distant metastasis-free survival in women with breast cancer.

SSJ01-03 Quantitative Analysis of Ultrasonographic Feature of Invasive Breast Cancer: Correlation with Molecular Subtypes

Tuesday, Dec. 3 3:20PM - 3:30PM Room: E450A

Participants
Young Seon Kim, MD , Daegu, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jung Min Chang, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sooyeon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seung Eun Lee, Daegu, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the correlations between ultrasonographic features quantitatively assessed by a computer-aided quantification system (S-DetectTM) and molecular subtypes of breast cancer.

METHOD AND MATERIALS

An IRB-approved retrospective review was performed for 282 invasive breast cancers (<5cm) in 282 women (mean age, 53.5 years; range, 29-85 years) who underwent surgery between February 2016 and April 2017. Morphologic characteristics of breast cancer on B-mode ultrasonography (US) with respect to shape of mass, margin, orientation, echogenicity, and posterior features were measured using S-DetectTM software, and quantitative scores (0-1) of each descriptor of breast cancer were recorded. The associations between quantitative scores and tumor subtype, tumor size, and lymph node status were compared using the one-way analysis of variance test or Student's T-test.

RESULTS

Of the 282 breast cancers, 144 (51.1%) were classified as luminal A tumors, 77 (27.3%) as luminal B tumors, 22 (7.8%) as HER2-enriched tumors, and 39 (13.8%) as triple-negative tumors (ER, PR, and HER2 negative). Luminal A tumors exhibited higher irregularity scores than triple-negative tumors (mean 0.6328 vs. 0.4679, p=0.031). Luminal B tumors exhibited higher spiculated margin scores than triple-negative tumors (mean 0.1654 vs. 0.0276, p=0.026). In addition, tumors larger than 2cm in size had higher scores for irregular shape (p=0.000-0.004) than tumors smaller than 2 cm in size all tumor subtype except for HER2-enriched tumors.

CONCLUSION

Luminal A tumors and Luminal B tumors were more likely to exhibit irregular shapes and spiculated margins than triple-negative tumors. Smaller tumors tended to be rounder and more oval-shaped and to have more circumscribed margins than larger tumors in most tumors except for HER2-enriched tumors.

CLINICAL RELEVANCE/APPLICATION

Quantitative analysis of morphologic characteristics using B-mode US with the S-DetectTM software can provide useful information regarding imaging phenotypes of breast cancer.

SSJ01-04 Quantitative Analysis of MRI Response to Preoperative Stereotactic Ablative Body Radiotherapy (SABR) in Early Stage ER+ HER2- Breast Cancer Correlates with Histologic Tumor Bed Cellularity

Tuesday, Dec. 3 3:30PM - 3:40PM Room: E450A

Participants
Robert J. Weinfurtner, MD, Tampa , FL (*Presenter*) Nothing to Disclose
Michael Montejo, MD, Tampa , FL (*Abstract Co-Author*) Nothing to Disclose
Raghunand Natarajan, PhD, Tampa , FL (*Abstract Co-Author*) Nothing to Disclose
Olya Stringfield, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Mahmoud Abdalah, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Roberto Diaz, MD, Tampa , FL (*Abstract Co-Author*) Nothing to Disclose
Bethany L. Niell, MD,PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Angela R. Williams, MD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Blaise P. Mooney, MD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Dana Ataya, MD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Marilin Rosa, MD, Tampa , FL (*Abstract Co-Author*) Nothing to Disclose
Kamran A. Ahmed, MD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
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Kujtim Latifi, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Marie C. Lee, MD, Tampa , FL (*Abstract Co-Author*) Nothing to Disclose
Nazanin Khakpour, MD, Tampa , FL (*Abstract Co-Author*) Nothing to Disclose
Christine Laronga, Tampa , FL (*Abstract Co-Author*) Nothing to Disclose
Brian J. Czerniecki, MD, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

robert.weinfurtner@moffitt.org

PURPOSE

The purpose of this study is to evaluate breast MRI response to pre-operative SABR for ER+ HER2- breast cancer and determine quantitative imaging predictors of pathologic response.

METHOD AND MATERIALS

Enrolled subjects in this phase II trial of early stage ER+ HER2- breast cancer patients underwent baseline breast MRI, SABR treatment (28.5 Gy in 3 fractions), follow-up MRI 6 weeks post-SABR, and breast conserving surgery. Pre and post-SABR MRIs were individually compared. The % tumor volume remaining (%VR) and % long diameter remaining (%DR) were calculated using quantitative metrics to evaluate MRI Response. This was correlated with pathologic response, defined by % tumor bed cellularity (%TC) in the surgical specimen. MRI analysis included 3D orthogonal measurements, semi-automated segmentation volume, and quantitative microcluster segmentation analysis of the dynamic constrast T1-weighted images. Microcluster voxel analysis of the segmented tumor was performed, assigning clusters based on binary high or low maximum enhancement intensity using Otsu algorithm and by dynamic sequence of maximum enhancement. This yielded 8 microcluster volumes within the tumor for each MRI. Statistical analysis was performed using Pearson's correlation coefficients.

RESULTS

Twelve patients completed the trial, and %TC ranged from 20-80%. For MRI response, analysis of %VR using various methods had stronger correlation with %TC (R=0.788-0.892) than %DR (R=0.727, p=0.007). The %VR by 3D measurements (R=0.844, p=0.0006) and by semi-automated segmentation (R=0.829, p=0.0009) were both very strongly correlative. For quantitative microcluster analysis, while total cluster %VR had strong correlation with %TC (R=0.747, p=0.005), correlation was stronger for %VR of the high enhancement clusters (R=0.86, p=0.0003) and even higher for %VR of the first three dynamic phase high enhancement clusters (R=0.892, p=0.0001).

CONCLUSION

In patients undergoing pre-operative SABR treatment for ER+ HER2- breast cancer, quantitative analysis of %VR on MRI, including microcluster segmentation analysis, very strongly correlates with pathologic response.

CLINICAL RELEVANCE/APPLICATION

Quantitative MRI tumor analysis, including microcluster segmentation analysis comparing pre and post SABR-treated ER+ HER2- breast cancer can help predict pathologic response to preoperative radiation in low risk tumors for which pathologic complete response to neoadjuvant treatment is rare.

SSJ01-05 Pharmacokinetic Quantitative Parameters with Histogram and Texture Features on Preoperative Dynamic Contrast-Enhanced Magnetic Resonance Imaging Differentiate between Luminal A and B Molecular Subtypes of Breast Cancer

Tuesday, Dec. 3 3:40PM - 3:50PM Room: E450A

Participants
Hong Bing Luo, MD, Cheng Du , China (*Presenter*) Nothing to Disclose
Jing Ren, Cheng du, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

rohbin@163.com

PURPOSE

The aim of the present study was to use pharmacokinetic quantitative parameters with histogram and texture features on dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) to differentiate between the luminal A and luminal B molecular subtypes of breast cancer.

METHOD AND MATERIALS

We retrospectively reviewed the data of 94 patients with histopathologically proven breast cancer. The pharmacokinetic

quantitative parameters (Ktrans, Kep, and Ve) with their corresponding histogram and texture features based on preoperative DCE-MRI were obtained. The parameters were compared using the Mann-Whitney U-test between the luminal A and luminal B groups, the HER2-positive luminal B and HER2-negative luminal B groups, and the lymph node metastasis (LNM)-positive and LNM-negative groups. Receiver operating characteristic (ROC) curves were generated for parameters that presented significant between-group differences.

RESULTS

The maximum values of Ktrans, Kep, and Ve, and the mean and 90th percentile values of Ve were significantly higher in the luminal B group than in the luminal A group. Among the texture features, only skewness of Ktrans significantly differed between the luminal A and B groups. All histogram features of Ktrans were higher in the HER2-positive luminal B group than in the HER2-negative luminal B group. No parameter differed between the LNM-positive and LNM-negative groups.

CONCLUSION

Pharmacokinetic quantitative parameters with histogram and texture features obtained from DCE-MRI are associated with the molecular subtypes of human breast cancer, and may serve as potential imaging biomarkers to differentiate between the luminal A and luminal B molecular subtypes.

CLINICAL RELEVANCE/APPLICATION

(Dealing with quantitative DCE-MR and the luminal A and luminal B molecular subtypes classification in breast cancer)'Quantitative parameters with histogram and texture features can be linked to two ER-positive cancer.'

SSJ01-06 Using Machine Learning to Quantify the Distribution and Morphology of Microcalcifications to Improve Cancer Prediction

Tuesday, Dec. 3 3:50PM - 4:00PM Room: E450A

Participants
Chrysostomos Marasinou, Los Angeles, CA (*Presenter*) Nothing to Disclose
Bo Li, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
William Hsu, PhD, Los Angeles, CA (*Abstract Co-Author*) Research Grant, Siemens AG

For information about this presentation, contact:

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PURPOSE

To develop a machine learning approach to classify whether suspicious microcalcifications (MC) are malignant based on their distributional patterns.

METHOD AND MATERIALS

We used 1481 mammographic images with MC findings from a public screen-film mammography dataset (DDSM), which provided radiologist-assigned BI-RADS scores and biopsy-proven diagnoses. We developed an automated algorithm to detect MCs by rescaling the image to different resolutions and applying morphological operations. Given our interest in distributional patterns, we only considered images with three or more detected MCs, reducing the total images to 743. We used principal component analysis of the MC locations to get the directions and values of the largest possible variance and it's orthogonal. We utilized these features and the number of MCs as the basis for our quantitative description of MC distribution. Using five-fold cross validation, we trained an ensemble classifier (gradient boosting) to predict malignancy, inputting the aforementioned features along with the BI-RADS score. As a baseline, we compared the model to the predictive performance of using BI-RADS only.

RESULTS

Of the 743 studies, 403 were benign, and 340 malignant. When building a classifier solely using our MC distribution features, the model achieved an area under the curve (AUC) of 0.650 (sensitivity (SEN) 0.535, positive predictive value (PPV) 0.598). Using BI-RADS alone, the model AUC was 0.791 (SEN 0.385, PPV 0.835). When both were combined into a single model, the AUC improved to 0.802 (SEN 0.615, PPV 0.694). Increasing the minimum number of MCs to generate our features reduced the sample size but improved the AUC.

CONCLUSION

We demonstrate that using a quantitative measure of MC distribution in addition to the BI-RADS assessment adds information to predict whether suspicious MCs are malignant. Our model could be further expanded by examining additional texture features and employing deep learning techniques to discover informative features.

CLINICAL RELEVANCE/APPLICATION

MCs can be a sign of breast cancer, and the indication for biopsy is based on BI-RADS. However the morphology and appearance of MCs is affected by the overlying breast fibroglandular tissue, leading to subjective interpretations and interreader variability. We hope that by employing our approach, we can increase the accuracy of interpretation and decrease the number of unnecessary biopsies and patient anxiety.

SSJ02

Breast Imaging (Artificial Intelligence in Mammography)

Tuesday, Dec. 3 3:00PM - 4:00PM Room: E451B

AI BR

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

Participants
Hiroyuki Abe, MD, Chicago, IL (*Moderator*) Nothing to Disclose
Jessica W. Leung, MD, Houston, TX (*Moderator*) Scientific Advisory Board, Subtle Medical

Sub-Events

SSJ02-01 Training Deep Learning Models as Radiologists: Breast Cancer Classification Using Combined Whole 2D Mammography and Full Volume Digital Breast Tomosynthesis

Tuesday, Dec. 3 3:00PM - 3:10PM Room: E451B

Participants
Gongbo Liang, Lexington, KY (*Presenter*) Nothing to Disclose
Yu Zhang, Lexington, KY (*Abstract Co-Author*) Nothing to Disclose
Jinze Liu, Lexington, KY (*Abstract Co-Author*) Nothing to Disclose
Nathan Jacobs, PhD, Lexington, KY (*Abstract Co-Author*) Nothing to Disclose
Xiaoqin J. Wang, MD, Lexington, KY (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Digital beast tomosynthesis (DBT) or 3D mammography in combination with 2D mammography has emerged as a promising clinical approach to breast cancer detection but at a cost of increased interpretation time by radiologists. Numerous deep learning models have been developed with promising results in automatic classification of breast cancer. However, existing models typically focus on using either 2D or 3D mammograms. Inspired by clinical practice, we proposed novel convolutional neural networks (CNN) for breast cancer classification utilizing combined whole 2D mammogram and full volume DBT to increase the model performance.

METHOD AND MATERIALS

In this retrospective study, we collected both 2D mammograms and DBT of biopsy proven lesions (342 benign and 165 malignant) from 507 patients. The whole mammographic images were labeled as benign or malignant without lesion annotation. Instead of using DBT directly, we first converted each DBT to a dynamic image which captured the subtle changes between two successive slices. Then, the 2D mammograms and dynamic images were fed into five ImageNet pretrained deep learning networks (Alexnet, VGG, Resnet, Densenet, and Squeezenet) as feature extractors. Finally, the feature maps of both the 2D mammograms and dynamic images were fused and used in a 3D CNN classifier.

RESULTS

Based on the receiver operating characteristic (ROC) analysis of all the 507 lesions, the combined 2D and 3D mammography achieved high performance with area under the ROC curve (AUC) of 0.93 in the task of differentiation of cancer from benign lesions. This is better than the performance of the 2D or 3D mammography alone (AUC= 0.72 for 2D and 0.66 for DBT) on the same dataset in breast cancer classification. The consistently better performance (up to 40.91% increase) of the combined images was observed in all the proposed CNN models.

CONCLUSION

The increased performance of combined 2D and 3D mammogram strongly suggests that deep learning models, like radiologists, can benefit from training with the 2D and 3D mammography together. One limitation of this study is that the dataset size is small, which may limit the predicting power of the proposed model.

CLINICAL RELEVANCE/APPLICATION

With increasing adoption of DBT in clinical practice, more accurate automatic deep learning tool using combined 2D mammogram and tomosynthesis can improve breast cancer diagnostic efficiency and have meaningful impact in clinical practice.

SSJ02-02 Prospective Analysis of CNN Based Approach of Distinguishing Atypical Ductal Hyperplasia from Ductal Carcinoma in Situ in Breast

Tuesday, Dec. 3 3:10PM - 3:20PM Room: E451B

Participants
Simukayi Mutasa, MD, New York, NY (*Presenter*) Nothing to Disclose
Peter Chang, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
John Nemer, New York, 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

PURPOSE

We have previously developed and published a convolutional neural networks (CNN) based algorithm to distinguish atypical ductal hyperplasia (ADH) from Ductal Carcinoma in Situ (DCIS) using a mammographic dataset. Purpose of this is to further validate our CNN algorithm by prospectively analyzing unseen new dataset to evaluate the diagnostic performance our algorithm.

METHOD AND MATERIALS

An IRB-approved study was performed. New dataset composed of 280 unique mammographic images from 140 patients were used to test our CNN algorithm. All patients underwent stereotactic-guided biopsy of calcifications and underwent surgical excision with available final pathology. ADH group consisted of 122 images from 61 patients with the highest pathology diagnosis of ADH. DCIS group consisted of 158 images from 79 patients with the highest pathology diagnosis of DCIS. 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. Our previously developed CNN algorithm was used. Briefly, a 15 hidden layer topology was used. The network architecture contained 5 residual layers and dropout of 0.25 after each convolution. Diagnostic performance metrics were analyzed including sensitivity, specificity, accuracy and area under the ROC curve (AUC). The 'positive class' was defined as pure ADH group in this study and thus specificity represents minimizing the amount of falsely labeled pure ADH cases.

RESULTS

Area under the ROC curve (AUC) was 0.90 (95% CI ± 0.04). Diagnostic accuracy, sensitivity and specificity was 80.7%, 63.9% and 93.7% respectively.

CONCLUSION

Our CNN model prospectively distinguished pure ADH from DCIS using mammographic images with high specificity.

CLINICAL RELEVANCE/APPLICATION

Using the patients' mammographic images, our CNN algorithm can be used to predict patients with pure ADH who may be safely observed rather than undergo surgery.

SSJ02-03 Developing an Artificial Intelligence Algorithm Pipeline for Predicting Malignancy Risk for Mammographic Microcalcifications Leveraging the ACR Data Science Institute (DSI) Use Case Library

Tuesday, Dec. 3 3:20PM - 3:30PM Room: E451B

Participants
Elizabeth S. Burnside, MD,MPH, Madison, WI (*Presenter*) Research Grant, Hologic, Inc
Aditya Rungta, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Daniel L. Rubin, MD, Stanford, CA (*Abstract Co-Author*) Consultant, F. Hoffmann-La Roche Ltd
Eric Mischo, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Jennifer R. Cox, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Vikas Singh, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study implements a pipeline to develop artificial intelligence (AI) algorithms to diagnose mammographic microcalcifications using the publicly-available use case authored by the Data Science Institute (DSI) breast imaging panel.

METHOD AND MATERIALS

Our pipeline, focuses on the clinical goals of the DSI use case entitled 'Classifying Suspicious Microcalcifications,' simultaneously codifying how to 1) extract relevant mammography cases using widely available National Mammography Database (NMD) fields, 2) construct AI algorithms integrating computational and clinical input, and 3) formalize clinically-relevant evaluation metrics; all designed to support proof of generalizability. We collected mammograms with microcalcifications using an NMD database of consecutive screening and subsequent diagnostic mammograpms (1/1/2006-12/31/2015) from an academic practice for women $\geq$40. Matched outcomes from a Cancer Center registry confirmed final pathology using 6 ordinal subcategories: 4 malignant categories (invasive>DCIS grade 3> DCIS grade 2> DCIS grade 1) and 2 benign categories (high risk>normal). According to the DSI use case, we developed AI algorithms to calculate malignancy risk (using 10-fold cross validation) for ROC curve comparison using the DeLong method-as an example. We also derived a binary classification (benign versus malignant) and a 6-class stratification in order to classify pathologic severity and use BI-RADS to derive generalizable metrics.

RESULTS

Our final dataset contained 10,834 images with microcalcifications and ground truth pathology: 778 cancers (385 invasive; 89 DCIS grade 1; 183 DCIS grade 2; 121 DCIS grade 3) and 10,056 benign (283 high risk; 9773 normal). An example result from our pipeline: our Graph Neural Network algorithm achieved an area under the ROC curve of 0.65 which was statistically significantly superior to a baseline model using logistic regression (AUC = 0.52; $p < 0.001$). Generalizability planning includes specification of a pre-assigned threshold to use for evaluation metrics according to BI-RADS.

CONCLUSION

We demonstrate feasibility of developing an AI pipeline for realizing an important DSI use case in breast imaging.

CLINICAL RELEVANCE/APPLICATION

Assessing if microcalcifications on mammography are malignant is a clinically important pursuit. The relevant DSI use case effectively guided a promising pipeline for AI algorithm development.

SSJ02-04 Deep-Learned Mammographic Phenotypes Indicate Racial Differences in Breast Parenchymal Patterns

Tuesday, Dec. 3 3:30PM - 3:40PM Room: E451B

Participants
Aimilia Gastounioti, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Roshan Santhosh, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Lauren Pantalone, BS, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Christopher G. Scott, MS, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Stacey Winham, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Kathleen R. Brandt, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Karla Kerlikowske, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Celine M. Vachon, Rochester, MN (*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, Advisory Panel, iCAD, Inc; Speaker, iiCME
Despina Kontos, PhD, Philadelphia, PA (*Presenter*) Research Grant, Hologic, Inc

For information about this presentation, contact:

aimilia.gastounioti@uphs.upenn.edu

PURPOSE

To investigate racial differences in breast parenchymal patterns extracted from full-field digital mammography (FFDM) screening studies using deep learning, while also accounting for differences in age, body-mass index (BMI) and breast density.

METHOD AND MATERIALS

We analyzed a random sample of FFDM studies from 2000 self-identified African-American (AA) and 2000 Caucasian women, who underwent routine mammographic screening (Selenia Dimensions, Hologic Inc.) at our institution between September 2010 and December 2014. A deep learning model (ResNet-34 architecture) was built to learn mammographic phenotypes differentiating AA from Caucasian women, using all four standard mammographic views of the raw (i.e., 'FOR PROCESSING') imaging data from each FFDM study. To evaluate the ability of the deep-learned mammographic phenotypes to identify differences in parenchymal patterns between AA and Caucasian women while also testing for potential confounding, three Random Forest classification models were evaluated using an 80%-20% train-test split-sample approach and inputs from: (1) the deep-learned mammographic phenotypes alone, (2) the deep-learned mammographic phenotypes combined with potential confounding variables such as age, BMI, and automated area-based and volumetric percent density measures estimated with the Volpara software (v1.5.3, Volpara Health Technologies), and (3) these potential confounding variables alone. The area under the curve (AUC) of the receiver operating characteristic on the independent test set was used as performance metric to measure the ability to classify the two races based on the features evaluated.

RESULTS

The performance of the deep-learned mammographic phenotypes alone was significant (AUC = 0.88, $p<0.05$), while combining them with age, BMI and Volpara density did not change the performance (AUC = 0.88). Substantially lower race classification capacity was demonstrated when age, BMI and Volpara density were evaluated alone (AUC = 0.69, $p<0.05$).

CONCLUSION

Deep learning elucidated racial differences in mammographic parenchymal phenotypes, which can only be partially explained by factors such as age, BMI and breast density.

CLINICAL RELEVANCE/APPLICATION

Differences in parenchymal phenotypes may provide new insight on racial disparities in breast cancer's onset age and outcomes, as well as the need for adjusting breast screening guidelines by race.

SSJ02-05 Diagnostic Performances of Artificial Intelligence (AI)-Based Diagnostic Support Software for Mammography: Results Using a Standardized Test Set Built for External Validation

Tuesday, Dec. 3 3:40PM - 3:50PM Room: E451B

Participants
Sieun Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jung Hyun Yoon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Byoung Wook Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kyunghwa Han, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hye Mi Gweon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Bomi Kim, Gyeonggi-do , Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hee Jung Suh, MD, Kyungki-do , Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun-Kyung Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

lvjenny@yuhs.ac

PURPOSE

To evaluate the diagnostic performances of a artificial intelligence (AI)-based diagnostic support software for mammography when applied to a standardized test set built for external validation.

METHOD AND MATERIALS

A total of 1,986 mammograms were collected consecutively from four participating centers to construct a standardized test set for validation. Cancer diagnosis was based on pathologic diagnosis (n=1,189, 59.9%), while benign diagnosis was based on either biopsy or benign imaging features showing stability for more than 2 years follow-up (n=797, 40.1%). Mammography images were analyzed using Lunit INSIGHT for Mammography (Lunit Inc., South Korea), a deep learning-based software that provides per-breast malignancy scores with region-of-interests (ROIs) for suspicious malignant lesions on mammography. Diagnostic performances were calculated using the optimized cutoff for malignancy scores.

RESULTS

Diagnostic performances using Lunit INSIGHT for Mammography on the 1,198 cases were as follows (optimal cutoff 0.068): sensitivity 90.2%, specificity 90.9%, accuracy 90.2%, and AUC 0.960, respectively. Diagnostic performances were significantly higher in mammographically-fatty breasts than dense breasts: 95.2%, 93.4%, 94.3%, 0.978 vs 88.6%, 87.7%, 88.3%, and 0.947, respectively, and in cancer size >2cm than <2cm: 96.7%, 90.1%, 92.5%, 0.981 vs 85.6%, 90.1%, 87.8%, 0.939, respectively.

CONCLUSION

The AI-based diagnostic support software for mammography showed high diagnostic performances in general, including cases of mammographically-dense breasts and small cancers. Further validation studies using standardized test sets are anticipated to prove the clinical feasibility of various diagnostic support softwares in real-world practice.

CLINICAL RELEVANCE/APPLICATION

The artificial intelligence-based diagnostic support software for mammography showed high diagnostic performances when applied to a standardized test set constructed for validation, proving its potential to provide guidance in mammography interpretation in real-world practice.

SSJ02-06 Data-Driven Imaging Biomarker for Breast Cancer Screening in Mammography: Prediction of Tumor Invasiveness in Mammography

Tuesday, Dec. 3 3:50PM - 4:00PM Room: E451B

Participants
Hyeonseob Nam, Seoul, Korea, Republic Of (*Presenter*) Employee, Lunit Inc
Hyo-Eun Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, Lunit Inc
Ki Hwan Kim, MD,PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, Lunit Inc
Hak Hee Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun-Kyung Kim, MD, 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

For information about this presentation, contact:

bkhan@skku.edu

PURPOSE

To assess feasibility of data-driven imaging biomarker in mammography (DIB-MMG; an imaging biomarker derived from large-scale mammography data based on deep learning technology) whether prediction of tumor invasiveness is applicable on mammography - discrimination of ductal carcinoma in situ (DCIS), DCIS with microinvasion (DCIS-MI), and invasive ductal carcinoma (IDC).

METHOD AND MATERIALS

A total of 151,764 exams of 4-view mammograms were collected from multiple institutions for developing DIB-MMG, where 31,776 were cancer (confirmed by biopsy), 49,644 were benign (confirmed by biopsy or at least 1 year of follow-up imaging), and 70,344 were normal exams (confirmed by at least 1 year of follow-up imaging). Surgical assessment of tumor invasiveness (459 DCIS, 373 DCIS-MI, and 6,365 IDC) was collected for 7,197 out of 31,776 cancer exams. A separate set of 777 cancer exams (46 DCIS, 49 DCIS-MI, 682 IDC) were used for evaluation. Previously, we assessed the feasibility of DIB-MMG as a diagnostic-support tool for breast cancer screening in mammography. In this study, we further investigated whether DIB-MMG is applicable to predict tumor invasiveness in mammography. DIB-MMG-TI (i.e. Tumor Invasiveness) was developed via two stages of training - 1) training with diagnosis labels (normal, benign, cancer), followed by 2) fine-tuning with invasiveness labels (DCIS, DCIS-MI, IDC) on the subset of cancer exams. We exploited the location of cancer lesions (6,229 among 7,197 exams) for the purpose of attention (i.e. attention mechanism in AI) in order to predict the invasiveness in more effective way.

RESULTS

AUC was summarized on two tasks: 1) discrimination of IDC from DCIS and DCIS-MI, and 2) discrimination of DCIS from DCIS-MI and IDC. For each task, per-exam AUC of DIB-MMG-TI on 777 exams of validation dataset was 0.781 and 0.690 respectively, while per-breast AUC for each task was 0.775 and 0.690. Fig.1 shows examples.

CONCLUSION

This study showed that discrimination of DCIS-MI from DCIS is more difficult than that from IDC in mammography. Experimental results showed that DIB-MMG-TI is feasible to discriminate IDC from the rest. Further clinical validation with observer performance study is needed.

CLINICAL RELEVANCE/APPLICATION

With further clinical validation, DIB-MMG-TI can be used as a preoperative diagnostic-support tool for prediction of tumor invasiveness in mammography.

VW51

Automating Breast Ultrasound: A Live Experience: Presented by GE Healthcare

Tuesday, Dec. 3 3:00PM - 3:30PM Room: South Building, Booth 5135

Participants

Kristina L. Jong, MD, Santa Barbara, CA (*Presenter*) Nothing to Disclose

Program Information

This 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. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

VW52

Advanced ABUS Screening Workshop: The 3D Coronal View: Presented by GE Healthcare

Tuesday, Dec. 3 3:30PM - 4:30PM Room: South Building, Booth 5135

Participants

Georgia Giakoumis-Spear, MD, Evanston, IL (*Presenter*) Nothing to Disclose

Program Information

This advanced hands-on, interactive, Invenia ABUS Workshop will show attendees how to efficiently navigate the 3D coronal plane to highlight potential abnormalities and streamline ultrasound screening workflow. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

VW75

Implementing Contrast Enhanced Digital Mammography into your Practice: Presented by Hologic, Inc.

Tuesday, Dec. 3 3:45PM - 5:00PM Room: South Building, Booth 5119

Participants

Nila H. Alsheik, MD, Park Ridge, IL (*Presenter*) Nothing to Disclose

Program Information

Listen as an experienced radiologist shares how to implement contrast enhanced digital mammography (CEDM) into your practice, followed by a faculty-guided review of CEDM cases. *Adding this session to your agenda does not secure your seat in this session. Secure your seat onsite by visiting Hologic's Workshop Room # 5119 in the South Hall.*

Printed on: 10/29/20

VW95

Contrast-enhanced Digital Mammography as an Adjunct to MRI: Presented by FUJIFILM Medical Systems U.S.A., Inc.

Tuesday, Dec. 3 4:00PM - 5:00PM Room: South Building, Booth 5147

Participants

Anna Russo, Negrar, Italy (*Presenter*) Nothing to Disclose

Program Information

Though digital mammography (FFDM) has improved contrast resolution and dynamic range, it still appears to exhibit weaker performance in dense breasts. This workshop, based on a recently-completed clinical trial, will discuss how Contrast Enhanced Digital Mammography (CEDM) may represent a further improvement in cancer detection sensitivity; similar to other contrast-enhanced techniques (CT and MRI), overcoming the performance limitations of 2D that are due to overlapping tissue.

Printed on: 10/29/20

RC415

The Newly Diagnosed Cancer: Different Viewpoints

Tuesday, Dec. 3 4:30PM - 6:00PM Room: E451A

BR MR US

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

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

For information about this presentation, contact:

zuleyml@upmc.edu

LEARNING OBJECTIVES

1) Review the role of ultrasound, MRI, and contrast enhanced mammography in the evaluation of disease extent in the newly diagnosed breast cancer patient. 2) Recognize the advantages and limitations of these three imaging modalities in the assessment of patients' response to neoadjuvant chemotherapy. 3) Be familiar with the evolving management of the axilla.

Sub-Events

RC415A Role of MRI

Participants
Constance D. Lehman, MD,PhD, Boston, MA (*Presenter*) Research Grant, General Electric Company Medical Advisory Board, General Electric Company

RC415B The Newly Diagnosed Cancer: Different Viewpoints: The Role of Ultrasound

Participants
Regina J. Hooley, MD, Weston, CT (*Presenter*) Consultant, Hologic, Inc

For information about this presentation, contact:

regina.hooley@yale.edu

RC415C Role of CEM

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

For information about this presentation, contact:

zuleyml@upmc.edu

Printed on: 10/29/20

VW53

Meet the Expert: Experiences with ABUS: Presented by GE Healthcare

Tuesday, Dec. 3 4:30PM - 5:00PM Room: South Building, Booth 5135

Participants

Marc F. Inciardi, MD, Westwood, KS (*Presenter*) Faculty, General Electric Company; Consultant, Qview Medical, Inc
Susan G. Roux, MD, Monterey, CA (*Presenter*) Nothing to Disclose

Program Information

Discover how ABUS can help you personalize breast imaging and become more proactive about breast care. Please join members of the GE Healthcare ABUS Team and expert ABUS Users for an interactive session. This will be a great opportunity to learn more about automated breast ultrasound and speak with other clinicians about their experiences using ABUS. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

ED001-WE

Breast Wednesday Case of the Day

Wednesday, Dec. 4 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
Jody C. Hayes, MD, Southlake, TX (*Abstract Co-Author*) Nothing to Disclose
Stephen J. Seiler, MD, Dallas, TX (*Abstract Co-Author*) Consultant, Delphinus Medical Technologies, Inc; Consultant, Seno Medical Instruments, Inc
Natalie G. Stratemeier, MD, Oklahoma City, OK (*Abstract Co-Author*) Nothing to Disclose
Meghan Woughter, MD, Temple, TX (*Abstract Co-Author*) Spouse, Vice President, nThrive, Inc
Oyindamola Akinseye, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Susan O. Holley, MD,PhD, Raleigh, NC (*Abstract Co-Author*) Nothing to Disclose
Ronald J. Dolin, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Dayna Levin, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Shannon Lanzo, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Sean A. Maratto, MD, Philadelphia, PA (*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.

Printed on: 10/29/20

RC515

BI-RADS Interactive Challenge (Interactive Session)

Wednesday, Dec. 4 8:30AM - 10:00AM Room: E451A

BR MR US

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

Participants
Carol H. Lee, MD, Guilford, CT (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

zuleyml@upmc.edu

Special Information

This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

LEARNING OBJECTIVES

1) Identify cases for which the BI-RADS assessment may be unclear. 2) Apply the appropriate BI-RADS descriptors and categories to breast imaging studies.

Sub-Events

RC515A Mammography

Participants
Carol H. Lee, MD, Guilford, CT (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify areas of confusion in applying BI-RADS to mammograms. 2) Assess instances of inappropriate BI-RADS assessment to mammograms. 3) Apply appropriate descriptors and assessment categories to mammograms.

RC515B Ultrasound

Participants
Paula B. Gordon, MD, Vancouver, BC (*Presenter*) Stockholder, OncoGenex Pharmaceuticals, Inc ; Stockholder, Volpara Health Technologies Limited; Scientific Advisory Board, Real Imaging Ltd; Scientific Advisory Board, DenseBreast-info, Inc; Scientific Advisor, Dense Breasts Canada

LEARNING OBJECTIVES

1) Show interesting cases that include ultrasound images will be shown; audience participation will be invited.

RC515C MRI

Participants
Wendy B. Demartini, MD, Stanford, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize and describe clinically relevant findings. 2) Apply appropriate assessment categories. 3) Use interpretation strategies that improve diagnostic performance.

VW54

AI-based Decision Support for Diagnostic Breast Ultrasound: Presented by GE Healthcare

Wednesday, Dec. 4 10:00AM - 10:30AM Room: South Building, Booth 5135

Participants

Michael Washburn, MS, Wauwatosa, WI (*Presenter*) Nothing to Disclose

Program Information

Clinicians can interpret up to one in three cases differently. How can they reduce variability in BI-RADS categorization to achieve greater consistency and confidence in the decision-making process? This new proprietary algorithm automatically classifies user-selected region(s) of interest (ROIs) containing a breast lesion into four BI-RADS-aligned categories (Benign, Probably Benign, Suspicious, Probably Malignant), and displays a continuous graphical confidence level indicator of where the lesion falls across all categories. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

VW04

AI-based Mammography Reading: Self-guided Reading Session: Presented by Siemens Healthineers

Wednesday, Dec. 4 10:15AM - 5:00PM Room: North Building, Booth 8563

Program Information

You will learn about the benefits of the AI-based Transpara™* decision-support tool from ScreenPoint Medical. It has been integrated with the advanced visualization software syngo. Breast Care* to support 2D and 3D mammography reading. Together, they provide interactive decision support with an overall exam score to help prioritize reading. **syngo*.Breast Care VB40 and Transpara™ for 3D are currently under development; they are not for sale in the U.S. Their future availability cannot be guaranteed. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP

https://www.fairorg.de/Siemens-Healthineers/portal/workshop.cfm/rsna19/

Printed on: 10/29/20

VW08

50° Wide-angle Tomosynthesis and Contrast-enhanced Mammography Self-guided Reading Sessions: Presented by Siemens Healthineers

Wednesday, Dec. 4 10:15AM - 5:00PM Room: North Building, Booth 8563

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 challenging cases with a solution enables you to develop and test your reading skills. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP

https://www.fairorg.de/Siemens-Healthineers/portal/workshop.cfm/rsna19/

Printed on: 10/29/20

AI41

AI Theater: How the Winning Algorithm of the DREAM Challenge Will Help You Screen Breast Cancer Earlier and More Accurately: Presented by Therapixel

Wednesday, Dec. 4 10:30AM - 10:50AM Room: AI Showcase, North Building, Level 2, Booth 10724

Participants

Pierre Fillard, PhD, Yvette, France (*Presenter*) Nothing to Disclose

Program Information

Our passionate team transformed the winning algorithm of the 2017 DREAM challenge in excellent product. Not only we have improved it, but also provided the best possible user experience to ensure patients fully benefit from AI-driven technology.

Printed on: 10/29/20

MSES42

Essentials of Breast Imaging

Wednesday, Dec. 4 10:30AM - 12:00PM Room: S100AB

BR

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

Sub-Events

MSES42A Abbreviated Breast MRI: How to Get Started

Participants
Christiane K. Kuhl, MD, Aachen, Germany (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

ckuhl@ukaachen.de

MSES42B Localization of Non-palpable Breast Lesions: 2019

Participants
Laurie R. Margolies, MD, New York, NY (*Presenter*) Research Consultant, FUJIFILM Holdings Corporation; Research Consultant, Imago Corporation

For information about this presentation, contact:

laurie.margolies@mountsinai.org

LEARNING OBJECTIVES

1) Identify multiple methods to localize non-palpable breast lesions. 2) Compare wire and seed localization techniques. 3) Assess the pros and cons of different localization techniques.

ABSTRACT

Screen detected breast findings often undergoe image directed biopsy and when required subsequent localization and excision. Various methods for localization of non-palpable breast findings have been developed since the birth of screening mammography and include wire localizations, radioactive and non-radioactive seed localizations. This presentation will discuss the need for, the history of and the various localization methods available to today's breast imager.

MSES42C Biopsy and Perioperative Management of Breast Lesions

Participants
Eva M. Fallenberg, MD, Munich, Germany (*Presenter*) Research Grant, Bayer AG; Research Grant, Siemens AG; Research Grant, General Electric Company; Speaker, Siemens AG; Speaker, General Electric Company; Speaker, Bayer AG; Speaker, Guerbet SA;

LEARNING OBJECTIVES

1) Develop an understanding of the impact/rational of correct local staging for operation and systemic therapy decisions. 2) Differentiate advantages and disadvantages of different imaging modalities for local staging and will be able to choose the adequate one. 3) Identify the most appropriate biopsy method in the assessment of unclear or suspicious breast lesions in an individual patient.

MSES42D Digital Breast Tomosynthesis in a Diagnostic Algorithm

Participants
Dragana Djilas-Ivanovic, MD, PhD, Novi Sad, Serbia (*Presenter*) Nothing to Disclose

SSK01

Breast Imaging (Tomosynthesis Screening)

Wednesday, Dec. 4 10:30AM - 12:00PM Room: E451B

BR

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

Participants
Sarah M. Friedewald, MD, Chicago, IL (*Moderator*) Consultant, Hologic, Inc; Research Grant, Hologic, Inc;
Catherine S. Giess, MD, Wellesley, MA (*Moderator*) Nothing to Disclose

Sub-Events

SSK01-01 Interval Breast Cancer Following Use of Digital Breast Tomosynthesis in a Population-Based Screening Program for Breast Cancer

Wednesday, Dec. 4 10:30AM - 10:40AM Room: E451B

Participants
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Solveig S. Hofvind, Oslo, Norway (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To compare rates and characteristics of interval breast cancer among women screened with digital breast tomosynthesis in combination with synthetic mammograms (DBT) and women screened with standard digital mammography (DM), in a population-based screening program for breast cancer.

METHOD AND MATERIALS

The national screening program for breast cancer is population-based, offering women aged 50-69 biennial mammographic screening. Our study population included 94,075 women screened 2014-2015; 35,303 women screened with DBT (study group) and 58,772 women screened with DM (control group). The rates of screen-detected breast cancer were 9.4/1000 and 6.1/1000, respectively. The women in the study population were followed for interval breast cancer two years after their screening examination. Rates and histopathological data (tumor type, histologic grade, diameter, lymph node status and ER/PR/Her2/Ki67 status) were analyzed. We used chi-square test and t-test to test for statistical significance. A p-value of <0.001 was considered statistically significant after the Bonferroni correction.

RESULTS

We observed an interval breast cancer rate of 2.0/1000 (68/35,303) in the study group and 1.5 (88/58,772) in the control group (p=0.115). No statistical significant differences were observed in histopathological tumor characteristics between the study and the control group.

CONCLUSION

Despite of a higher rate of screen-detected breast cancer among women screened with DBT compared with DM, we observed no statistical significant differences in rates or histopathological tumor characteristics of interval breast cancer between the groups.

CLINICAL RELEVANCE/APPLICATION

Despite an increased rate of screen-detected breast cancer for screening with DBT compared with DM shown in studies, no difference in rates of interval breast cancer was observed.

SSK01-02 Interval Cancers after Tomosynthesis plus Digital Mammography or Digital Mammography Breast Cancer Screening: The Reggio Emilia Tomosynthesis Randomized Trial

Wednesday, Dec. 4 10:40AM - 10:50AM Room: E451B

Participants
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PURPOSE

The RETomo trial was a two-arm test-and-treat randomized controlled trial comparing digital breast tomosynthesis (DBT) plus digital mammography (DM) versus DM alone for breast cancer screening. We present interim analysis on interval cancers after the first round.

METHOD AND MATERIALS

Women (45-70 yo) presenting for a screening mammography, and previously screened with DM, were asked to participate and, if willing, randomised to the experimental arm (DBT+DM) or to the control arm (DM), both with two projections and double reading (NCT02698202). Women were assessed according to the decision at DBT+DM. Detection rate, recall rate, and interval cancer are reported. All women were followed up to 30 months from recruitment or up to second round.

RESULTS

From March 2014 to March 2016, 9779 women were recruited to the DM+DBT arm of the study, and 9787 women were recruited to the DM arm. Recall rate was 3.5% in both experimental and control arm; detection rate, including ductal carcinoma in situ (DCIS), was 8.6 per 1000 (84) and 4.5 per 1000 (44), respectively (relative detection rate 1.68, confidence interval [CI]: 1.22-2.30). Interval cancers were 17 in both arms, corresponding to an overall rate of 1.8/1000 (95% CI 1.1-2.9), including 1 DCIS in the DM+DBT arm and 2 in the DM arm. Among women younger than 50yo, followed with annual mammography, the interval cancers were 2 (rate of 0.7/1000; 95% CI 0.1-2.4) and 6 (rate of 2.1/1000; 95% CI 0.8-4.5) in the experimental and control arm, respectively.

CONCLUSION

These are the first results from a randomised trial reporting interval cancer intervals after DM+DBT compared to DM alone screening. The introduction of DBT to DM in screening strongly increased the detection rate, but had no impact on interval cancer rate, suggesting that screen detected and interval cancers come from different populations of lesions with different growth speed, but also imkplying that high sensitivity can lead to overdiagnosis.

CLINICAL RELEVANCE/APPLICATION

Our results suggest caution in introducing DBT in screening before health benefits have been demonstrated. Only pooling data on advanced cancer incidence and mortality from all ongoing trials can answer.

SSK01-03 Early Performance Measures Among Women Screened with DBT after a Prior DBT or a Prior DM, in a National Screening Program

Wednesday, Dec. 4 10:50AM - 11:00AM Room: E451B

Participants
Solveig S. Hofvind, Oslo, Norway (*Presenter*) Nothing to Disclose
Anders S. Danielsen, Oslo, Norway (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To investigate performance measures among women screened with digital breast tomosynthesis including synthesized mammography (DBT) after prior screening in a randomized controlled trial (RCT) with either DBT or standard digital mammography (DM).

METHOD AND MATERIALS

TB-2 (Tomosynthesis in X) is a prospective cohort study offering DBT to all women attending the screening unit in X. TB-2 is being performed in the consecutive screening round of TB-1, a RCT evaluating DBT versus DM. The studies are being performed as a part of BreastScreen Y, a population based program offering mammographic screening to women aged 50-69 biennially. During the first year of TB-2 (2018), 4657 women were screened with DBT after DBT, and 4659 with DBT after DM. Frequencies and proportions of consensus, recall, screen-detected breast cancer (invasive and ductal carcinoma in situ), and positive predictive values of recalls (PPV-1) and biopsies (PPV-2) were analyzed. One-sided Z tests were used to test whether the proportions within the DBT after DBT arm differed from those observed within the DBT after DM arm. A p-value of <0.05 was considered statistically significant

RESULTS

A total of 8.3% (387/4757) of the DBT after DBT screening exams were discussed at consensus compared to 8.5% (397/4759) for DBT after DM (p=0.36). The percentage of recalled women was 4.5% (211/4547) for DBT after DBT versus 5.0% (232/4758) for DBT after DM, (p=0.15). The number of breast cancers was 0.69% (32/4757) for DBT after DBT and 1.03% (48/4759) for DBT after DM (p=0.0364). PPV-1 and 2 were 20.7% (48/232) and 38.1% (48/126) for DBT after DBT, and 15.2% (32/221) and 20.7% (32/101) for DBT after DM (PPV-1: p=0.07; PPV-2: p=0.16).

CONCLUSION

Screening with DBT after DM yielded a high number of screen-detected breast cancers, which is in keeping with results from previous studies. Whether this increased detection is beneficial for women and society remains unclear.

CLINICAL RELEVANCE/APPLICATION

DBT detected more breast cancer than standard DM. Further studies investigating the tumor characteristics and aggressiveness of

DBT detected more breast cancer than standard DM. Further studies investigating the tumor characteristics and aggressiveness of these extra cancers are needed to offer women personalized treatment.

SSK01-04 Implementation of Digital Breast Tomosynthesis (DBT) in a Large Academic Oncology Center: Analysis of Screening Mammography Performance Metrics

Wednesday, Dec. 4 11:00AM - 11:10AM Room: E451B

Participants
Sona A. Chikarmane, MD, Newtonville, MA (*Presenter*) Nothing to Disclose
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Ronilda Lacson, MD, PhD, Brookline, MA (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To evaluate screening mammography performance metrics of digital breast tomosynthesis (DBT) compared to 2D full field digital mammography (FFDM) in patients' with prior history of breast cancer at a large academic oncology center.

METHOD AND MATERIALS

This HIPAA compliant, retrospective study consisted of consecutive female patients with a personal history of breast cancer treated with lumpectomy with or without radiation or mastectomy who underwent screening FFDM from October 2014-September 2016 or screening DBT from February 2017-December 2018 at an academic oncology center. An institutional breast cancer registry identified cancer diagnoses. Primary outcomes of recall rate (RR), cancer detection rate (CDR), and positive predictive value (PPV1) were compared between FFDM and DBT groups. Natural language processing was used to obtain patient and image characteristics including breast density, current or prior imaging findings from the most recent prior imaging examination, and BI-RADS category of the current screening examination.

RESULTS

There were 7282 examinations in the FFDM cohort and 4913 examinations in the DBT cohort during their study periods. Screening mammography performance metrics for FFDM included 9.7% (704/7282) recall rate, 6.3% (44/704) PPV1, and 6.0/1000 (44/7282) CDR and for DBT included 7.5% (369/4913) recall rate, 7.0% (26/369) PPV1 and 5.3/1000 (26/4913) CDR. There was a significant decrease in RR with DBT (p=0.0004) but no significant change in PPV1 (p=0.61) or CDR (p=0.59) between groups.

CONCLUSION

In patients' with a personal history of breast cancer, DBT significantly reduced recall rates while maintaining CDR and PPV1s.

CLINICAL RELEVANCE/APPLICATION

Integration of DBT in screening of breast cancer survivors can reduce recall rates while maintaining other screening mammography performance metrics.

SSK01-05 Digital Breast Tomosynthesis Slab Thickness: Impact on Reader Performance and Interpretation Time

Wednesday, Dec. 4 11:10AM - 11:20AM Room: E451B

Participants
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PURPOSE

To evaluate the impact of digital breast tomosynthesis (DBT) slab thickness on reader performance and interpretation time.

METHOD AND MATERIALS

This IRB-approved, HIPAA compliant prospective reader study was performed at an NCI-Designated Cancer Center. Four fellowship-trained breast imagers (R1-R4) interpreted 122 DBT patient exams containing standard MLO and CC views with no prior exams or clinical history. Cases were presented using a standard protocol (10 mm slabs, 1 mm planes, synthetic 2D) and an experimental protocol (6 mm slabs, synthetic 2D) with a crossover design and 6-week washout period between sessions. Interpretation times were harvested from the workstation. Comparisons were made using t-tests or non-parametric tests for continuous variables, chi-square tests or Fisher's exact tests for categorical variables, and ROC curves for diagnostic performance.

RESULTS

Eleven exams were unilateral. Among 233 breasts, mammographic findings and final diagnoses included 45 masses (25 IDC, 1 DCIS,

19 benign), 22 groups of calcifications (3 IDC, 9 DCIS, 10 benign), 18 architectural distortions (11 IDC, 3 ILC, 1 DCIS, 3 benign), 14 asymmetries (2 IDC, 12 benign), and no finding in 134. Intrareader differences for observed findings were not significantly different between standard and experimental protocols (p>0.83). For detection of malignancy, area under the ROC curve (with 95% CI) was similar using standard and experimental protocols for all 4 readers: R1 [0.71 (0.65, 0.77) vs 0.69 (0.61, 0.76); p=0.81], R2 [0.82 (0.73, 0.90) vs 0.79 (0.70, 0.87); p=0.69], R3 [0.86 (0.79, 0.92) vs 0.90 (0.85, 0.96); p=0.52], and R4 [0.80 (0.71, 0.88) vs 0.82 (0.75, 0.90); p=0.79]. Mean reduction in interpretation time using the experimental protocol was 0.45 minutes or 11.2% (4.0 + 1.7 min vs 3.6 + 1.5 min; p<0.0001), and was statistically significant for 3/4 readers (p<0.005).

CONCLUSION

An experimental DBT reconstruction protocol using 6 mm slabs without 1 mm planes was associated with similar perception of specific findings and unchanged overall diagnostic performance compared with the standard protocol, and required less interpretation time.

CLINICAL RELEVANCE/APPLICATION

DBT is associated with longer interpretation time than 2D mammography. As DBT use increases, alternate reconstructions may help shorten interpretation time while maintaining reader performance.

SSK01-06 Effect of Age, Race and Screening Frequency on Recall Rates by Screening Mammogram Modality: Findings from a Learning Health System

Wednesday, Dec. 4 11:20AM - 11:30AM Room: E451B

Participants
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PURPOSE

Health systems seeking to maximize screening efficiency and optimize effectiveness need to balance the benefits of screening mammography (cancer detection) with recall and false positive rates. This analysis examines the effect of age, race and screening frequency on recall rates in a large US cohort.

METHOD AND MATERIALS

A big data platform was used to integrate EMR, RIS, and tumor registry data into a learning health system. This analysis included 575,180 screens from 257,597 women, performed 2015-2017, at 58 facilities across 3 large healthcare organizations. Women were defined as 2+ screens if they had 2 or more screens that were at least 9 months apart. Women were defined as 1-screen if they had no evidence of a screening mammogram in the one year prior to and at any time after the first observed exam; women with index screening mammograms within 12 months of the end of the study period were excluded. Women in 1-screen cohort include both prevalent and incident exams and thus represent screeners without an apparent recent prior exam. EMR records were used to identify women as either African American (AA), Caucasian (C), Asian (A) or Other (O).

RESULTS

Nearly a quarter of the women (N=57,418; 22.3%) met criteria for 1-screen and 200,179 for 2+ screens. Recall rates were significantly higher among women with 1-screen compared to 2+ screens, both overall and within each age and race category. There was a dramatic decrease in recall rate in the 2+ screen group vs the 1-screen group, particularly for DBT vs DM, after adjustment for age, breast density and institution (p<0.01), across all races (except O) and ages: 2+ screen groups (AA:7.00 vs 7.78%, C:7.38 vs 7.61%, A:7.33 vs 8.90%, O:6.75 vs 7.25%, Overall=7.31 vs 7.68%) vs 1-screen (AA:15.28 vs 18.14%, C: 15.43 vs 17.33%, A: 16.43 vs 21.64%, O:12.45 vs 15.45%, Overall=15.33 vs 17.62%).

CONCLUSION

While age and race are strong determinants of recall rates, screening frequency and screening modality have an even greater total impact. Initiatives to encourage compliance with annual screening mammography in women ages 40 and older, particularly with DBT, may help health systems optimize breast cancer screening programs while minimizing harms.

CLINICAL RELEVANCE/APPLICATION

Adherence to routine screening, and use of digital breast tomosynthesis, reduces recall rates and minimizes potential harms associated with screening mammography, across all strata of age and race.

SSK01-07 How to Resolve Tomosynthesis-Detected Architectural Distortion to Avert Biopsy

Wednesday, Dec. 4 11:30AM - 11:40AM Room: E451B

Participants
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AG; Advisory Board, Seno Medical Instruments, Inc; ; ;
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PURPOSE

Architectural distortion (AD) is a feature raising suspicion of malignancy. Superimposed tissue may obscure AD on 2D, that is unmasked on a 1-mm DBT slice. After conversion to DBT, our recalls for AD have increased. With concern for overdetection, our purpose was to investigate how DBT detected AD can potentially be resolved on diagnostic examinations to avoid biopsy.

METHOD AND MATERIALS

After IRB approval, our proprietary database was used to map imaging findings (IF) that prompted a recall (11/2014-01/2017). Then we compared 3 month before and after transition to DBT. To study AD after transition, we identified all DBT screening-recalled diagnostic studies with AD as the main IF. Two breast imagers reviewed examinations to determine whether AD was seen on one or both DBT screening views, had US correlatives, and was resolved on diagnostic. For all biopsied AD, path reports were reviewed. For all resolved AD, FN rate w/in a 2 year timeframe were determined.

RESULTS

Comparing 10,387 screens before with 11,170 after transition to DBT, AD recalls accounted for a relative increase of 45.6%. After transition, we identified 40 cases w/ AD as the main IF recommended for biopsy. 15/40 (38%) screen-detected ADs, were one view only (7 CC and 8 MLO), and 7/15 (47%) w/ US correlates. Histologies were: 2 (5%) ILC, gr. 1 (1 w/ US corr.); 1 (2%) DCIS, gr. 2; 13 (32%) RSs, 6/13 (46%) w/ US corr. and 2 (15%) RS with atypias (1 w/ ADH and FEA, and 1 w/ FEA and LCIS); and 18 (45%) benign histologies of fibrosis, sclerosing adenosis, columnar cell change, apocrine metaplasia, and PASH. 6/13 (46%) RSs were excised with no upgrades. Classic LCIS was found in 2 cases. None of the diagnostic resolved cases were FN in a 2 year time period.

CONCLUSION

An increase in AD-recalled screening cases after transition to DBT may result from greater conspicuity of AD on DBT. No cancers were found in one-view-only AD w/o an US correlate. Fibrosis may be a possible concordant response to inflammation or trauma explaining subtle AD perceived on DBT. In diagnostic AD resolved cases no FN were found. With increasing DBT experience, breast imagers may need to reevaluate the management of AD to judge the need for biopsy, to determine concordance, and possibly to influence a decrease in FP while maintaining CDR.

CLINICAL RELEVANCE/APPLICATION

Determining the ways how to resolve DBT detected AD on diagnostic examinations may decrease the biopsy rate without affecting CDR.

SSK01-08 Screening Downstages Breast Cancer at Detection for Most Women but Some Need More Intensive Screening Regimen

Wednesday, Dec. 4 11:40AM - 11:50AM Room: E451B

Participants
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PURPOSE

To explore clinical and imaging characteristics of screening detected vs. symptomatic female breast cancer.

METHOD AND MATERIALS

We included 231 consecutive female breast cancer (BC) cases: 142 screening detected and 89 symptomatic BC (lump 81%, focal pain 9%, nipple discharge 6%, skin changes 4% cases) between April 2017 and March 2018. All screening mammography employed Digital Breast Tomosynthesis (DBT). Diagnostic mammography used DBT and Full-field Digital Mammography. Diagnostic ultrasound was performed as appropriate. BC was diagnosed via ultrasound-guided or DBT-guided vacuum-assisted core needle biopsy (CNB). Demographic, imaging and pathology (CNB and surgical) data were collected and analyzed using the independent samples T-test and Pearson Chi-square.

RESULTS

Women with screening detected BC were not significantly (p=ns) different from women with symptomatic BC in the following: Age (mean age, 62.8 vs. 61.3 years), Mammographically dense breasts (49% vs. 55%). Compared with symptomatic BC, cases of screening detected BC had a significant (p<.05) association with: Smaller invasive tumors (13.5 vs. 24.2 mm) and more minimal cancers (60% vs. 18%), Lower grade tumors (32% vs. 13% G1; 33% vs. 47% G3), Fewer node positive cases (11% vs. 49%), Longer interval from prior mammogram (33 vs. 17.7 months), Prior mammogram within past 11-24 months (70% vs. 21%). Women older than 40 years with symptomatic BC were more likely to have never had a mammogram compared to those with screening detected BC (36% vs. 1.4%, p<.05). 17% of symptomatic BC were diagnosed within 10 months of a prior negative mammogram (interval BC). Interval BC had a tendency to be larger and higher grade compared with all other cancers, however the differences

did not reach statistical significance due to a small sample size.

CONCLUSION

Screening detected BC had more favorable prognostic features than symptomatic BC, and the latter was associated with a shorter interval from a prior mammogram, including interval BC diagnosis.

CLINICAL RELEVANCE/APPLICATION

Routine screening DBT allows for detection of majority of BC at an earlier stage prior to symptoms. However, 17% of symptomatic BC diagnosed as interval BC (within 10 months of negative DBT) suggests that certain women may benefit from more intensive screening regimen. Further sudy of this population is warranted.

SSK01-09 The Potential Impact on Dose When Digital Breast Tomosynthesis (DBT) is Used in the Diagnostic Workup of Asymmetric Densities at Screening Assessment

Wednesday, Dec. 4 11:50AM - 12:00PM Room: E451B

Participants
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Laura Hargreaves, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Digital Breast Tomosynthesis (DBT) as a screening tool has improved the cancer detection rate and reduced the false positive rate. We wanted to assess the impact of DBT on dose when assessing asymmetric densities.

METHOD AND MATERIALS

All women recalled following an abnormal screening mammogram were asked to participate. All had triple assessment performed which involves clinical examination, additional mammographic views and targeted ultrasound of the breast and a biopsy if required. Performed between 13/11/2015 and 29/07/2016, this was an IRB approved prospective study. The DBT study was read within 6 weeks of the assessment clinic. The number of additional mammographic views and dose in mGy was recorded. The dose of the DBT examination was recorded. Statistical analysis: Dose was analysed in a mixed design, 2 x 2 ANOVA looking at dose with and without DBT (within cases).

RESULTS

1,470 women attended for screening assessment and 835 women consented to take part. 810 cases had complete data on dose & screening outcome. 248 cases were recalled for an asymmetric density in 247 women. 11 cancers were identified. There was a significant effect of the use of DBT, $F(1,246) = 69.17$, $p < .0001$, $\omega = .53$ (within cases): mean dose without DBT ($M = 8.0$, $SD = 5.3$) was higher than with DBT ($M = 5.9$, $SD = 3.0$). There was an interaction between the use of DBT and whether or not a biopsy was taken $F(1,246) = 12.96$, $p < .0001$, $\omega = .22$. When a biopsy was taken but Tomosynthesis/Ultrasound investigation indicated a biopsy was not necessary, mean dose was also higher without DBT ($M = 11.1$, $SD = 7.3$) than dose with DBT ($M = 5.5$, $SD = 1.6$). However, when a biopsy was taken that Tomosynthesis/Ultrasound investigation agreed should have taken place, there was no significant difference in dose without DBT ($M = 9.8$, $SD = 5.5$) and dose with DBT ($M = 9.1$, $SD = 5.1$).The reduction in the number of films used, associated with the use of DBT, was analysed in a one way, between cases ANOVA looking at whether cases were biopsied or not. The overall reduction in the number of films used, associated with the use of DBT, was 4.3 ($SD = 2.1$). .

CONCLUSION

DBT in assessment has the potential to reduce the dose and number of additional mammographic images required in the diagnostic work up of asymmeric densities.

CLINICAL RELEVANCE/APPLICATION

DBT in the diagnostc work up of asymmetric densities results in a reduction in the dose and number of biopsies performed.

SSK02

Breast Imaging (Ultrasound)

Wednesday, Dec. 4 10:30AM - 12:00PM Room: E450A

BR US

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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Michael A. Cohen, MD, Atlanta, GA (*Moderator*) Nothing to Disclose

Sub-Events

SSK02-01 A Novel Imaging Biomarker for Monitoring Response to Neoadjuvant Chemotherapy

Wednesday, Dec. 4 10:30AM - 10:40AM Room: E450A

Participants
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PURPOSE

PET and MRI studies have shown that imaging biomarkers can be used to characterize response of tumors to Neoadjuvant chemotherapy (NAC) and predict pathological outcomes. However, serial PET and MRI exams are time consuming, carry high cost and are associated with risks such as exposure to Gadolinium or radiation. Our previous studies have shown that tissue sound speed, derived from ultrasound tomography (UST) measurements, is an imaging biomarker that can be used to track tumor changes in the breast. Since ultrasound is relatively inexpensive, the purpose of this study was to evaluate sound speed as a reliable and cost-effective imaging biomarker for assessing NAC.

METHOD AND MATERIALS

Twenty-one patients undergoing neo-adjuvant chemotherapy for invasive breast cancer, were serially examined with UST throughout their treatment. The two parameters measured were the volume (V) and the volume averaged sound speed (VASS) of the tumor. Response curves of VASS and V were plotted for each study participant. Pathology results were used to classify participants as complete or partial responders based on whether they achieved complete pathologic response (pCR) or not. The response curves were then averaged together within each group. The trend in the data was assessed by determining the Spearman correlation coefficient for changes in VASS and V. A t-test was used to determine if the response curves were statistically different between the two groups.

RESULTS

In the partial response group, VASS and V showed a gradual change with time while the complete response group showed a much steeper change with time (Figure 1). The difference between the two groups was significant ($p<0.01$) for all parameters. Furthermore, large drops in V and VASS in the first 3 weeks of treatment appeared to be predictive of pCR, though this finding was not prospective.

CONCLUSION

Our study demonstrates that UST can be used to monitor NAC and that the partial vs complete responders could be separated based on how V and VASS changed with time. A future larger study will test the predictive power of UST prospectively.

CLINICAL RELEVANCE/APPLICATION

UST has potential for non-invasive, rapid identification of partial vs complete responders in women undergoing NAC without the use of either a radiotracer or gadolinium. Clinical decision making would improve by transitioning non-responders to alternative treatment quickly and by demonstrating effective response to NAC.

SSK02-02 Precision Imaging: Early Ultrasound Evaluation (US) to Identify Excellent Responders to Neoadjuvant Chemotherapy (NAC) in Patients (pts) with Triple Negative Breast Cancer (TNBC)

Wednesday, Dec. 4 10:40AM - 10:50AM Room: E450A

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PURPOSE

TNBC is a heterogeneous disease with distinct molecular subtypes that convey diverse clinical behavior and response to chemotherapy. The aim of this study is to determine if early US after two cycles of NAC has the potential to identify excellent responders to standard NAC averting need for costly genomic profiling and selecting patients with lower likelihood to achieve pathologic complete response (pCR) for targeted therapeutic trials.

METHOD AND MATERIALS

107 patients enrolled in "A randomized triple Negative Breast Cancer Enrolling Trial to Confirm Molecular Profiling Improves Survival" (ARTEMIS; NCT02276443) had US with three-dimensional measurements at baseline and after 2 cycles of Adriamycin-based NAC. Pathologic response was assessed at the time of surgery after completing anthracycline/taxane-based NAC. The relationship between pCR and primary tumor volume reduction (PTVR) by US was evaluated using recursive partitioning and ROC analysis.

RESULTS

Overall, 40% (43/107) of pts achieved pCR. Recursive partitioning showed that in patients with PTVR after 2 cycles >=73% pCR was 23/31 (74%). If the PTVR was < 73%, only 20/76 (26%) pts had pCR. In pts with <73% PTVR, the baseline volumetric size of the primary tumor (BTVS) further influenced pCR. If BTVS was < 35cm, 32% (19/59) had pCR, and if >=35 cm, only 6% had pCR (1/17) ($P < 0.0001$). The percentage of TVR after 2 cycles was also predictive of pCR (AUC = 0.79, 95% CI = 0.70, 0.88, $p < 0.0001$).

CONCLUSION

Early US exam after 2 cycles can identify the subgroup of TNBC with excellent response to standard NAC. Reduction in percent tumoral volume may predict patients with higher likehood to achieve pCR. An exploratory cut point of 73% PTVR will be tested in a validation study.

CLINICAL RELEVANCE/APPLICATION

Early US exam after 2 cycles can identify the subgroup of TNBC with excellent response to standard NAC, eliminating need for expensive genomic profiling and avoiding toxicity of investigational targeted therapy.

SSK02-03 Predicting Pathologic Complete Response with Ultrasound Tumor Characteristics in Triple Negative Breast Cancer Patients

Wednesday, Dec. 4 10:50AM - 11:00AM Room: E450A

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PURPOSE

To investigate which pretreatment and midtreatment ultrasound breast tumor characteristics are predictive of pathologic complete response (pCR) status in triple negative breast cancer (TNBC) patients treated with neoadjuvant chemotherapy

METHOD AND MATERIALS

As a substudy of an active, single-institution, IRB-approved clinical trial of Stage I-III TNBC patients, this imaging analysis included the first 125 patients who underwent surgery. Ultrasound was performed on all patients before (pretreatment) and after (midtreatment) completion of four cycles of AC (Adriamycin and cyclophosphamide) chemotherapy. Patients subsequently received taxane-based chemotherapy or an investigational therapy as guided by midtreatment response. Review of ultrasound images was performed while blinded to pathology results (i.e., pCR versus non-pCR) from definitive surgery. Tumor size was based on the largest dimension on ultrasound. Tumors with a nonmass finding of abnormal, altered echotexture compared to surrounding breast tissue were described as 'infiltrative'. The appearance of the tumor at midtreatment was designated as 'mass', 'architectural distortion', 'flat tumor bed', or 'clip only/no visible tumor bed'. Midtreatment response pattern was described as 'complete', 'concentric shrinkage', 'fragmented', 'stable' or 'progression'. Logistic regression analyses were performed with p values less than 0.05 considered statistically significant.

RESULTS

Mean patient age was 53 years, range 27-77. Fifty-five of 125 patients (44%) achieved pCR while 70 of 125 (56%) had non-pCR. On pretreatment ultrasound, tumors that were <= 5 cm in size (p=0.029) or tumors that did not have an associated infiltrative/nonmass appearance (p=0.0081) were more likely to achieve pCR. On midtreatment ultrasound, tumors which no longer had the appearance of a space-occupying mass (p<0.0001) or tumors that showed a complete or concentric shrinkage response pattern were more likely to result in pCR (p=0.010).

CONCLUSION

Ultrasound pretreatment tumor size, associated nonmass/infiltrative component assessed at pretreatment, midtreatment tumor appearance and tumor response pattern at midtreatment are variables that may be useful to predict pCR in TNBC.

CLINICAL RELEVANCE/APPLICATION

Ultrasound can be an accessible, informative tool during pretreatment and midtreatment to identify TNBC patients who are less likely to achieve pCR and may benefit from investigational therapies.

SSK02-04 Screening Ultrasonography-Detected Category 4A Breast Masses with a Decision-Making Support Software Based on Deep Learning as an Alternative to Biopsy

Wednesday, Dec. 4 11:00AM - 11:10AM Room: E450A

Participants
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PURPOSE

To evaluate the additional value of a decision-making support software based on deep learning (S-DetectTM) in B-mode ultrasonography (US) for analyzing screening US-detected breast masses.

METHOD AND MATERIALS

This Institutional Review Board approved retrospective review of three institutional databases identified 246 women (median age: 45 years; range 20-83 years) with clinically and mammographically occult screening US-detected breast masses scheduled for biopsy. The masses were examined by an ultrasound machine (RS80A with Prestige, Samsung Medison, Co., Ltd.) equipped with S-DetectTM. BI-RADS final assessment categories on B-mode, and the quantitative scores of each descriptor on a continuous scale of 0 to 1 on S-DetectTM were collected. The area under the receiver operating characteristic curves (AUCs) of each descriptor of S-DetectTM were analyzed, and the added values of combining S-DetectTM to B-mode with respect to AUCs, sensitivity, and positive predictive value (PPV) were assessed.

RESULTS

Among 246 breast masses, 205 were benign and 41 were malignant (30 IDC, 7 DCIS, 2 ILC, 1 mucinous, 1 adenoid cystic carcinoma). There were 205 category 4A, 20 category 4B, 14 category 4C, and 7 category 5. The PPVs for category 4A, 4B, 4C,

and 5 on B-mode alone were 6.8%, 40.0%, 85.7%, and 100%, respectively. In differentiating benign and malignant masses using the S-DetectTM software, quantitative scores of not-circumscribed margin, irregular shape, and not-parallel orientation showed higher AUC values (0.754-0.800) than those of echogenicity and posterior features (0.544-0.692). Furthermore, by downgrading BI-RADS 4A masses with a not-circumscribed margin score < 0.000228, irregular shape score < 0.031686, or not-parallel orientation score < 0.000092 to BI-RADS 3, 50 false-positive biopsies could be avoided, without losing sensitivity. The PPV of category 4A increased to 9.0% after adding quantitative information.

CONCLUSION

The quantitative scores of not-circumscribed margin, irregular shape, and not-parallel orientation were important in analyzing US-detected masses, and adding this information to B-mode US could decrease unnecessary benign biopsies.

CLINICAL RELEVANCE/APPLICATION

The quantitative values measured by S-DetectTM of the morphological characteristics of masses on B-mode could decrease false-positive biopsies caused by screening US, although validation is needed.

SSK02-05 Added Value of Vascular Index Using Superb Microvascular Imaging for Evaluation of Breast Masses: Comparison with Grayscale Ultrasound

Wednesday, Dec. 4 11:10AM - 11:20AM Room: E450A

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PURPOSE

The purpose of this study is to evaluate the added value of vascular index using superb microvascular imaging for evaluation of breast masses in comparison with grayscale ultrasound (US).

METHOD AND MATERIALS

This prospective study was approved by the institutional review board, and informed consent was obtained. Between August 2018 and December 2018, a total of 70 breast masses (36 malignant and 34 benign) in consecutive 70 patients were evaluated with grayscale US and superb microvascular imaging (SMI). Two breast radiologists analysed grayscale US alone and combination of grayscale US and SMI using BI-RADS scale. They also independently measured the vascular index based on SMI. Diagnostic performance of grayscale US alone and combination of grayscale US and SMI was reported and compared. Vascular index was compared between benign and malignant masses and the optimal cut-off value was determined. We also assessed the interobserver variability in imaging analyses and vascular index between radiologists.

RESULTS

Interobserver variability in imaging analyses and vascular index was almost perfect (range of intraclass correlation coefficients, 0.932-0.947). Vascular index was higher among the malignant breast masses than benign lesions, with statistical significance (P<0.001). The optimal cut-off value of vascular index in discriminating between malignant and benign breast masses was 2.95 with a sensitivity of 86.1% and a specificity of 91.2%. The diagnostic performance of grayscale US alone and combination of grayscale US and SMI were 0.824 and 0.912 for reader 1 (P=0.028), and 0.795 and 0.853 for reader 2 (P=0.101), respectively.

CONCLUSION

Vascular index using SMI showed better diagnostic performance in distinguishing malignant from benign breast masses, with high interobserver variability.

CLINICAL RELEVANCE/APPLICATION

Our study indicates that the combined use of grayscale US and SMI with vascular index can improve the characterization of breast masses.

SSK02-06 Can We Learn Easier Breast Tumor Differentiation with Quantitative Speed-of-Sound Biomarkers? Comparison of Deep Learning of B-mode and Speed-of-Sound Images Using Conventional Ultrasound

Wednesday, Dec. 4 11:20AM - 11:30AM Room: E450A

Participants
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PURPOSE

Speed of Sound (SoS) is a quantitative diagnostic biomarker (meters per second) which correlates with tissue microstructure. Current SoS systems are dedicated and require breast immersion in a water bath. Our purpose is to obtain SoS maps from a conventional pulse-echo ultrasound (US) system, and to use a deep learning software (DLS), based on SoS texture, to correctly classify benign and malignant breast tissues.

METHOD AND MATERIALS

As part of an on-going HIPPA-compliant study, 27 women with histologically proven solid breast lesions (13 carcinoma, 14 benign) were examined. SoS were compared with 308 healthy breast segments in 106 women without abnormal findings. A laptop US system with a linear probe was used for B-mode and SoS-US imaging (UF-760 AG, Fukuda Denshi). Local phase aberrations in intrinsic reflections (speckle) of breast tisuse were measured with images acquired from different angular directions, and SoS images were reconstructed. SoS and B-mode texture was analyzed with a DLS (ViDi Suite v2.0.) trained with 60% of the images, and classification accuracy was evaluated in the remaining images.

RESULTS

A significant SoS increase ($p<0.001$) is observed in malignant lesions (carcinoma) with respect to benign lesions (79% fibroadenoma, 21% other). A SoS increase cut-off value of 42 m/s provided Accuracy (Ac) =81.5% for malignant/benign lesion differentiation, and Ac=96.0% for carcinoma and breast segments without lesions of different ACR densities (64% a&b, 36% c&d). The SoS differences between benign lesions and lesion-free segments were not significant ($p>0.05$). In comparison SoS texture analysis with DLS achieves Ac=83.4% for differentiation of benign/malignant lesion, Ac=99.0% for malignant lesion/lesion-free segments and Ac=98.0% for benign lesion/lesion-free. In comparison, B-mode DLS for the same region of interest respectively achieved Ac=50%, Ac=100%, Ac=100%. Malignant lesions that were not correctly classified with a SoS cut-off (e.g. a mucinosis carcinoma) were correctly classified with SoS DLS.

CONCLUSION

DLS of quantitative SoS maps improves differentiation of breast tumors with respect to a single cut-off value. For a reduced lesion dataset, DLS texture analysis of SoS was superior to B-mode ultrasound.

CLINICAL RELEVANCE/APPLICATION

Breast cancer differentiation with B-mode ultrasound is currently based on subtle geometric and texture features, which require extensive sonographic training experience or large lesion datasets for machine learning. On the other hand, SoS-US is a quantitative imaging modality, which provides an objective lesion assessment with reduced training data (or even a single image). The integration on SoS-US as an add-on feature on clinical ultrasound systems has potential to improve and facilitate breast diagnostics.

SSK02-07 Analysis of the Preoperative Axillary Ultrasound in 685 Women with T1 Breast Cancer: Can We Move Away from Sentinel Lymph Node Biopsy in Women with Early Breast Cancer?

Wednesday, Dec. 4 11:30AM - 11:40AM Room: E450A

Participants
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PURPOSE

The involvement of axillary lymph nodes is critical for appropriate treatment of breast cancer, and its evaluation is currently a hot topic of controversy across breast units. We aim to evaluate the negative predictive value (NPV) and specificity of axillary ultrasound (AUS) in the exclusion of metastatic axillary lymph node in study participants with early breast cancer.

METHOD AND MATERIALS

Preoperative AUS was performed in women with T1 breast cancer, enrolled in our Institute, as a part of a multicenter randomized prospective trial. NPV and specificity were calculated for different histologic groups: all histologic evidence of tumor including micrometastases and isolated tumoral cells (ITC), then only those with metastases, and next only those with metastases >3 mm.

RESULTS

Preoperative AUS in 685 consecutive study participants (mean age: 49±10 years) resulted in 33/685 (4.8%) of false positive and 53/343 (15.5%) of false negative, which is reduced to 28/343 (8.1%) excluding ITC and micrometastases and to 17/343 (4.9%) considering only metastases >3 mm. Overall NPV was 597/650 (92%, 95%CI, 90-94%) including all cases of positivity to histopathological examination. Excluding ITC and micrometastases, the NPV was 620/650 (95%%, 95%CI, 94-97%). Finally, including metastases that can be detected by AUS (namely, metastases >3 mm) alone, the NPV was 628/650 (97%, 95%CI, 95-98%). Specificity of AUS in our population was 628/685 (95%, 95%CI, 93-97%).

CONCLUSION

Our results show that in women with early breast cancer, the AUS may represent an effective, non-invasive diagnostic tool for axillary staging. Considering the high NPV and specificity, AUS allows to select those women who could benefit from observation

alone as a treatment approach.

CLINICAL RELEVANCE/APPLICATION

Currently, the oncological community moves away from sentinel lymph nodes biopsy and our results confirmed the role of AUS as a non-invasive, low-cost, easily available and accurate modality for preoperative staging of the axilla, in women with early breast cancer.

SSK02-08 Adjunctive Automated Breast Ultrasound Has Better Diagnostic Performance for Breast Cancer than Hand-Held Ultrasound

Wednesday, Dec. 4 11:40AM - 11:50AM Room: E450A

Participants
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PURPOSE

Adjunctive ultrasonography improves diagnosis of breast cancer. Automated breast ultrasound system(ABUS) can overcome the operator dependency and lack of standardization of Hand-held ultrasound(HHUS). We aimed to evaluate and compare the clinical value of adding HHUS or ABUS to mammography(MG) in the diagnostic workflow of breast cancer among Chinese women.

METHOD AND MATERIALS

1266 female outpatients aged 40 to 69 years old were enrolled in this hospital-based multi-center study. All the women underwent HHUS, ABUS and MG, Breast Imaging-Reporting and Data System(BI-RADS) was used to imaging interpretation and mammographic breast density assessment. Lesions classified as BI-RADS 4 or 5 by any of three modalities were defined as suspicious findings and were referred to biopsy for diagnosis. Clinical performance of different strategy was compared in terms of sensitivity, specificity and area under the curve(AUC) of receiver operating characteristics, using McNemar's test and nonparametric Z test.

RESULTS

323 breast cancer cases were detected in our study. 958 out of 1266 women were classified as having dense breast. Increased sensitivity and AUC as well as decreased specificity were observed when adding HHUS or ABUS to MG(all P<0.001). Compared with the combination of MG and HHUS, the combination of MG and ABUS had almost same sensitivity (0.988v.s. 0.985, p=1.000), higher specificity (0.876 v.s. 0.857, p=0.003) and higher AUC(0.932 v.s. 0.921, p=0.018). Same trend was observed when HHUS or ABUS was only added to women with dense breast(p=1.000, 0.004 and 0.011, respectively). In addition, compared with adding ABUS to all participants, adding ABUS to women with dense breast decreased the sensitivity(0.969 v.s. 0.988,p=0.031) while increased the specificity (0.884 v.s. 0.876, p=0.008), leading to a nonsignificant increase in AUC(0.927 v.s. 0.932, p=0.213).

CONCLUSION

Adding ultrasonography to MG can improve breast cancer diagnosis. Adjunctive ABUS have significant better diagnostic performance compared with adjunctive HHUS.

CLINICAL RELEVANCE/APPLICATION

The sensitivity of mammography in women with dense breast is limited in clinical practice. Adding ulrtasonography, especially ABUS, can improve diagnosis, and overcome the operator dependency.

SSK02-09 Efficiency of Technologist-Performed Hand-Held Whole Breast Ultrasound for Screening Women with Dense Breast Tissue

Wednesday, Dec. 4 11:50AM - 12:00PM Room: E450A

Participants
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PURPOSE

Technologist-performed hand-held screening whole breast ultrasound (WBUS) has been performed at our institution since 2009 in

women with dense breast tissue. With new federal breast density notification legislation in the United States, more facilities will be interested in offering this service to patients. The purpose of this study was to understand the workflow details around this practice in terms of time requirement for both technologists and radiologists and final outcome of cases.

METHOD AND MATERIALS

For a one month period (2/1/19 - 2/28/19) WBUS performed following a normal tomosynthesis screening mammogram at four sites (tertiary cancer center and 3 out-patient satellite offices) were prospectively recorded. Twenty-seven mammography technologists cross-trained in breast sonography performed all exams. Dedicated breast radiologists were present on-site to check cases and re-scan if necessary. Technologists recorded images of four quadrants, the retroarerolar area, and axilla as well as documented any findings of interest. Data recorded for each exam included technologist scanning time, need for re-check by radiologist, radiologist scanning time, reason for re-check, and final BI-RADS score. Technologists identifiers were not recorded to reduce bias.

RESULTS

616 exams were performed: 602 bilateral and 14 unilateral. The average scanning time for bilateral exams was 12.5 minutes (range 4-34), and for unilateral exams was 5.1 (range 2-7). A re-check was performed in 67 cases (10.8%) and radiologist scanning time averaged 3.3 minutes (range 1-10). Reasons for re-check included complicated cyst/fibrocystic changes (18), mass/masses (13), normal fibroglandular tissue/artifact (12), suspicious mass (5), scars/prior biopsy (4), prominent lymph nodes (3), fat necrosis (1), recheck prior finding (1), implant rupture (1), improved image capture (1) and unrecorded (8). Final BI-RADS was BI-RADS 1/2: 96.6%, BI-RADS 3: 2.6%, BI-RADS 4/5: 0.8%.

CONCLUSION

Technologist-performed hand-held WBUS is time efficient, requiring just over 12 minutes scanning time per case. As the majority of cases are normal and do not require re-check, radiologist time involvement is minimal.

CLINICAL RELEVANCE/APPLICATION

Technologist-performed hand-held WBUS is an efficient method to provide adjuvant screening to women with dense breast tissue.

Printed on: 10/29/20

VW76

Increase Confidence and Improve Workflow Efficiencies with High Resolution Imaging Technology: Presented by Hologic, Inc.

Wednesday, Dec. 4 10:30AM - 11:45AM Room: South Building, Booth 5119

Participants

Linda R. Greer, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

Program Information

Discover how transitioning to Clarity HD® high-resolution imaging with Intelligent 2D® synthesized 2D images and 3DQuorum® may increase reading confidence, improve workflow efficiency while decreasing patient dose. The session includes high-resolution images with 3DQuorum® for attendees to view during the hands-on case-review. *Adding this session to your agenda does not secure your seat in this session. Secure your seat onsite by visiting Hologic's Workshop Room # 5119 in the South Hall.*

Printed on: 10/29/20

VW96

Integrating Tomosynthesis into your Breast Imaging Practice: Presented by FUJIFILM Medical Systems U.S.A., Inc.

Wednesday, Dec. 4 10:30AM - 11:30AM Room: South Building, Booth 5147

Participants

Laurie L. Fajardo, MD,MBA, Park City, UT (*Presenter*) Consultant, Hologic, Inc; Consultant, FUJIFILM Holdings Corporation;

Program Information

This educational program provides an opportunity to learn about the benefits of Digital Breast Tomosynthesis (DBT) for detecting / diagnosing breast cancer, and the interpretation and workflow considerations for implementing DBT into a breast imaging practice. During this session, there will be a review of various DBT system designs, recent technology improvements, future developments, evidence of DBT clinical performance improvements / metrics, and a presentation on challenging lesions and pathologies.

Printed on: 10/29/20

VW55

Introduction to 3D ABUS Screening Workshop: Presented by GE Healthcare

Wednesday, Dec. 4 11:00AM - 12:00PM Room: South Building, Booth 5135

Participants

Kristina L. Jong, MD, Santa Barbara, CA (*Presenter*) Nothing to Disclose

Program Information

Kristina Jong, MD, Global Peer Educator, leads this introductory hands-on, interactive, Invenia 3D ABUS (automated breast ultrasound) Workshop. Attendees will review clinical cases on the Invenia™ Viewer and learn how 3D ABUS screening helps increase cancer detection in women with dense breast tissue. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

VW28

More Confidence in Tomosynthesis Reading with Synthetic 2D Reading Session: Presented by Siemens Healthineers

Wednesday, Dec. 4 11:40AM - 12:50PM Room: North Building, Booth 8563

Participants

Chantal van Ongeval, MD, Leuven, Belgium (*Presenter*) Nothing to Disclose

Program Information

During this workshop you will get to experience the value that Synthetic 2D mammography (Insight 2D) can bring to tomosynthesis reading. An expert tutor will lead you through cases that will both fascinate and challenge you! All cases have been acquired with Siemens Healthineers latest 50° Wide-Angle system MAMMOMAT Revelation and are displayed on our syngo. Breast Care workstations. So you will become familiar with the value of 50° Wide-Angle Tomosynthesis and ease of use of our systems. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP

https://www.fairorg.de/Siemens-Healthineers/portal/workshop.cfm/rsna19/

Printed on: 10/29/20

VW97

Ongoing Measures against Breast Density Issues on Screening Mammography in Japan: Presented by FUJIFILM Medical Systems U.S.A., Inc.

Wednesday, Dec. 4 11:40AM - 12:10PM Room: South Building, Booth 5147

Participants

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

Program Information

Mammography is the only breast cancer screening test that has been proven to reduce the mortality all over the world. However, the sensitivity is inversely proportional to breast density. As FDA proposes adding breast density reporting to MQSA, the Japanese mass media is making breast density issues a hot topic in screening mammography. This session will discuss Japan's breast cancer screening programs and its ongoing measures against breast density.

Printed on: 10/29/20

BRS-WEA

Breast Wednesday Poster Discussions

Wednesday, Dec. 4 12:15PM - 12:45PM Room: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Nisha Sharma, MBChB, Leeds, United Kingdom (*Moderator*) Nothing to Disclose

Sub-Events

BR239-SD-WEA1 Utility and Outcomes of Digital Mammography for Imaging Asymptomatic Autologous Flap Reconstructions after Mastectomy

Station #1

Participants
Ryan D. Navarro, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Jessica H. Hayward, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Elissa R. Price, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Bonnie N. Joe, MD,PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Amie Y. Lee, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

ryan.navarro@ucsf.edu

PURPOSE

Literature on mammography for detection of asymptomatic malignancy after mastectomy with autologous flap reconstruction is limited with the two largest studies to date finding variable cancer detection rates of 1.5/1000 and 0/1000. The aim of this study is to evaluate the utility of digital mammography for detecting asymptomatic malignancy within an autologous flap reconstruction after mastectomy.

METHOD AND MATERIALS

An IRB-approved retrospective database review was performed of all digital mammograms performed on autologous flap reconstructions at our academic breast imaging facility between 1/1/2009 and 9/1/2017. Exclusion criteria included implant reconstruction, clinical signs or symptoms within the reconstructed breast, diagnostic work-up or follow-up of a previously identified lesion within the reconstructed breast, or less than 1 year of clinical or imaging follow-up. Radiology reports with a negative examination were defined as BI-RADS 1 or 2 and a positive examination as BI-RADS 0, 4, or 5. Malignant outcomes were determined by pathology results. Interval cancers were defined as malignant diagnoses within one year of a negative mammogram.

RESULTS

Final study cohort comprised of 600 digital mammograms performed in 193 flap reconstructions. Mean patient age was 59 years (range 36-84 years). Majority of exams (98.1%; 589) were negative, assigned a BI-RADS 1 or 2 on the mastectomy side. Eleven exams (1.8%) were positive, assigned a BI-RADS 0, 4, or 5. After diagnostic work-up of all BI-RADS 0 exams, 9 cases had a final recommendation for biopsy, 3 of which yielded malignant pathology. Among the negative mammograms, one interval cancer was identified, which was a recurrence in the deep axilla detected on PET-CT and not within the field of view of mammography. Overall, digital mammography yielded a cancer detection rate of 0.5%, NPV of 99.8%, PPV2 of 33.3%, sensitivity of 75% and specificity of 98.6%.

CONCLUSION

Asymptomatic recurrence in the flap reconstruction does occur, with mammography demonstrating a cancer detection rate of 0.5% (5 per 1000 exams). This is comparable to current national benchmarks for cancer detection from mammographic screening in the general U.S. population.

CLINICAL RELEVANCE/APPLICATION

Some women status post autologous reconstruction may benefit from routine imaging of the flap but larger studies may better inform which subset of women would benefit most from routine screening.

BR240-SD-WEA2 Breast Invasive Ductal Carcinoma: Preoperative Predictive Ki-67 Index Based on Radiomics of MRI

Station #2

Participants
Shaowu Wang, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Yu Zhang, PhD,MD, Dalian, China (*Presenter*) Nothing to Disclose
Yifeng Zhu, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Jingjing Cui, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yan Jia, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yue Dai, Dalian, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study is to develop a radiomics model for predicting the Ki-67 proliferation index in patients with invasive ductal breast cancer through magnetic resonance imaging (MRI) preoperatively.

METHOD AND MATERIALS

128 patients who were clinicopathologically diagnosed with invasive ductal breast cancer were recruited. This cohort included 32 negative Ki67 expression (Ki67 proliferation index <14%) and 96 cases with positive Ki67 expression (Ki67 proliferation index >/=14%). All patients had undergone diffusion-weighted imaging (DWI) MRI before surgery on a 3.0T MRI scanner. Radiomics features were extracted from apparent diffusion coefficient (ADC) maps which were obtained by DWI-MRI from patients with invasive ductal breast cancer. 80% of the patients were divided into training set to train radiomics model, and the rest into test set to evaluate its performance. The least absolute shrinkage and selection operator (LASSO) was used to select radiomics features, then the Logistic Regression (LR) model was established using 5-fold cross-validation to predict of the Ki-67 index.

RESULTS

Quantitative imaging features (n=1029) were extracted from ADC maps, and 11 features were selected to construct the LR model. Good identification ability was exhibited by the ADC-based radiomics model, with areas under the receiver operating characteristic curves (AUC) values of 0.75±0.08, accuracy of 0.71 in training set and 0.72, 0.70 in test set.

CONCLUSION

The ADC-based radiomics model is a feasible predictor for the Ki-67 index in patients with invasive ductal breast cancer. Therefore, we proposed that three-dimensional imaging features from ADC maps could be used as candidate biomarker for preoperative prediction the Ki-67 index noninvasively.

CLINICAL RELEVANCE/APPLICATION

The MRI-based radiomics model is a feasible predictor for Ki-67 index in patients with invasive ductal breast carcinoma and is recommended in the preoperative prediction of Ki-67 index.

BR241-SD-WEA3 Using Generative Adversarial Networks (GANs) to Synthesize and Remove Lesions in X-Ray Mammograms Improves AI-Based Cancer Detection

Station #3

Participants
Eric Wu, Cambridge, MA (*Presenter*) Employee, DeepHealth, Inc
Kevin Wu, Cambridge, MA (*Abstract Co-Author*) Employee, DeepHealth, Inc
A. Gregory Sorensen, MD, Belmont, MA (*Abstract Co-Author*) 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
William Lotter, PhD, Cambridge, MA (*Abstract Co-Author*) Officer, DeepHealth Inc

For information about this presentation, contact:

eric.wu@deep.health

PURPOSE

Machine learning has shown great promise in cancer detection in x-ray mammography; however, these approaches are typically dependent on large numbers of malignant and normal examples. Data collection is challenging in screening applications, where the amount of normal examples greatly outnumber abnormals, which can cause overfitting and under-utilization of the available data, and thus hindering ultimate performance. Here, we explore using the machine learning approach known as generative adversarial networks (GANs) as a data augmentation strategy for synthesizing and removing lesions in mammogram images to supplement the original training set.

METHOD AND MATERIALS

We started with the Optimam Mammography Image Database, a publically available FFDM x-ray mammography dataset from the UK. We use 16000 images for training (800 with cancer ROIs), 2400 for validation (120 with cancer ROIs), and 6000 for testing (800 with cancer ROIs). We created a custom GAN model to synthesize lesions (5000 masses and 5000 calcifications) or remove lesions (5000 normals) onto random patches cropped from mammograms. We then trained a ResNet-50 neural network model using a sampling proportion of 50% synthetic data and 50% real data, and evaluated performance on entirely real data from the testing dataset. Performance is quantified using the area under a receiver operating characteristic curve (AUROC). To determine whether the synthetic data affected performance, we compared this new model trained on both real and synthetic data to a baseline model trained only on real data.

RESULTS

The classifier trained on the GAN-augmented dataset achieved an AUROC of 0.853 on the test set of real data, compared to 0.829 AUROC for the model trained on only real data, for a difference of 0.024 ($p < 1e-8$). Visual inspection of the GAN outputs suggests that the GAN is indeed capable of realistically inserting and removing lesions in the mammogram patches.

CONCLUSION

Synthetically generated data using GANs improved the performance of a model trained on both real and synthetic data over a model trained only on real data. This suggests that data augmentation with appropriately designed GANs could be a valuable method for improving the performance of AI-based cancer detection in mammograms.

CLINICAL RELEVANCE/APPLICATION

Improved classification accuracy of machine learning models applied to mammography increases their potential for effective clinical deployment.

BR273-SD-WEA4 3D Printing of Whole Breast and Individual Breast Tissue Types based on Transmission Ultrasound

Station #4

Participants
Bilal Malik, PhD, Novato, CA (*Presenter*) Employee, QT Ultrasound Labs
Nasser Pirshafiey, Novato, CA (*Abstract Co-Author*) Officer, QT Ultrasound
John C. Klock, MD, Novato, CA (*Abstract Co-Author*) Officer, QT Ultrasound, LLC
Rajni Natesan, MD, MBA, Houston, TX (*Abstract Co-Author*) Officer, QT Ultrasound Labs

PURPOSE

Studies demonstrate that the use of 3D printed models can improve preoperative surgical planning and enhance patient-provider communication. We present a pilot program of a 3D printed breast anatomy using transmission ultrasound (TU). Our 3D printed models allow for differentiation of normal breast tissue, including the skin, fat, and fibroglandular tissues, as well as delineation of underlying masses in selected cases.

METHOD AND MATERIALS

We have performed non-invasive 3D TU imaging of whole in vivo breasts immersed in a water bath, with patients imaged in the prone position. The image reconstruction of the projection data results in co-registered 3D reflection, speed-of-sound, and attenuation images. We use machine learning at a voxel level to quantitively differentiate and segment breast tissues types. These tissue types are then 3D printed into respective anatomy models.

RESULTS

We have developed a fully-automated breast segmentation algorithm using reflection, speed-of-sound, and attenuation tissue characteristics that operate on transmission ultrasound images. The machine learning algorithm employs image voxel values from the co-registered images to classify breast tissue types: skin, fat, and fibroglandular tissues. We have validated this classifier on whole-breast TU images to provide a color-coded classification of the breast tissue volume and outline the presence of breast masses in selected cases, followed by 3D printing of individual tissue types.

CONCLUSION

Transmission ultrasound can generate whole-breast image volumes that can be objectively segmented and color-coded by tissue type. This unique ability to individually image 3D segmented breast tissue volumes provides a potentially clinically useful technology for 3D printed models.

CLINICAL RELEVANCE/APPLICATION

3D printing of individual breast tissue types based on TU imaging has a wide range of potential clinical benefits, including preoperative surgical planning and improved patient-provider communication.

BR274-SD-WEA5 Low Dose Molecular Breast Imaging (MBI) in Multidisciplinary Patient Care: Initial Clinical Experience

Station #5

Participants
Conellia Ha, MD, Rockville Centre, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

conellia.ha@chsli.org

PURPOSE

The aim of this study was to retrospectively evaluate the potential benefits of low dose molecular breast imaging (MBI) in the context of the diagnostic surgical setting to evaluate women with a prior history of breast cancer and/or equivocal mammography finding or positive mammography finding.

METHOD AND MATERIALS

MBI was performed on 93 patients at our center between March 2017 and June 2018. Patients ranged in age from 30-79 years with an average age of 57.9 years. All of the patients underwent bilateral MBI scanning after intravenous injection of 8mCi Tc-99m-sestamibi. Imaging acquisition was initiated within 5 minutes using the LumaGEM dual head, planar, solid state digital system with cadmium zinc telluride (CZT) technology. Standard cranio-caudal and medio-lateral oblique views of each breast were obtained.

RESULTS

We are reporting on 63 patients, 64 at the breast level (1 bilateral case). Thirty patients were excluded from this analysis because they do not yet have reference standard. Twenty two subjects (35%) had a prior history of breast cancer. Breast density was reported by interpreting radiologist as C or D in 66.7% (42/63). Nineteen subjects (30.1%) had histologic confirmation of current breast cancer, 6 of these had biopsy prior to MBI. MBI was used to evaluate extent of disease in these patients. MBI was positive in 100% of pre-biopsy histologic confirmed cancers (13/13) Mammography was positive in 91.7% (11/13), and equivocal in 16.7% (2/13). MBI downgraded BIRADS in 10 cases (15.8%).

CONCLUSION

Low dose MBI is an effective adjunct imaging modality in the surgical setting to evaluate patients who present with prior history of breast cancer or current mammographic findings. It is also a valuable tool to evaluate disease extent in newly diagnosed patients.

CLINICAL RELEVANCE/APPLICATION

Metabolic information about breast cancer can be a critical and integral part of clinical care for patients as part of an individualized, multidisciplinary breast care approach.

BR275-SD-WEA6 Morbidity of Breast Cancer as a Function of Screening Interval: Annual versus Biennial

Station #6

Participants
Sarah Moorman, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Akshat C. Pujara, MD, Ann Arbor, MI (*Abstract Co-Author*) Institutional Grant, General Electric Healthcare
Michelle D. Sakala, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Colleen H. Neal, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Katherine E. Maturen, MD, Ann Arbor, MI (*Abstract Co-Author*) Royalties, Reed Elsevier; Royalties, Wolters Kluwer nv; ;
Leigh Swartz, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Heidi Egloff, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Mark A. Helvie, MD, Ann Arbor, MI (*Abstract Co-Author*) Institutional Grant, General Electric Company; Institutional Grant, IBM Corporation

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PURPOSE

To compare breast cancer tumor characteristics and treatment regimens among women undergoing annual vs biennial screening mammography.

METHOD AND MATERIALS

This IRB-approved, HIPAA compliant retrospective study was performed at an NCI-Designated Cancer Center. Query of a breast imaging database yielded 490 consecutive patients diagnosed with breast cancer during 2016 and 2017. Of these, 232 were women aged 40-84 years undergoing annual or biennial screening with mammographically or clinically detected cancer. Annual screening was defined as 9-15 months; biennial screening as 21-27 months. Records were reviewed for patient demographics, tumor characteristics, and treatment regimens. Comparison between annual and biennial screening cohorts was conducted using t-tests or Wilcoxon rank-sum test for continuous variables and chi square or Fisher's exact tests for categorical variables.

RESULTS

Mean age at cancer diagnosis among 232 patients was 62 + 10 years. 171/232 (74%) cancers were invasive. Screening frequency was annual in 200/232 (86%) patients and biennial in 32/232 (14%). There were no significant differences in baseline characteristics between annual and biennial groups, including age, menopausal status, hormone replacement use, high risk status, family history, or race. Annual screening resulted in fewer late stage presentations (AJCC Stage 2, 3, or 4) than biennial [annual 48/200 (24%) vs biennial 14/32 (44%); p=0.02] and fewer interval cancers [annual 21/200 (11%) vs biennial 12/32 (38%); p<0.001]. Biennial screening was associated with larger mean tumor size at presentation (annual 1.4 + 1.2 cm vs biennial 1.8 + 1.6 cm; p=0.04). There was a trend towards larger median tumor size in the biennial group (annual 1.1 cm, SD 1.2 cm; biennial 1.2 cm, SD 1.6 cm; p=0.09). Compared with annual screening, biennial screening showed a trend for greater use of ALND [annual 24/200 (12%) vs biennial 6/32 (19%)] and chemotherapy [annual 55/200 (28%) vs biennial 12/32 (38%)].

CONCLUSION

Most women received annual rather than biennial screening. Biennial mammographic screening was associated with greater frequency of advanced stage disease and interval cancer.

CLINICAL RELEVANCE/APPLICATION

Biennial screening was associated with advanced stage breast cancer compared with annual screening. These results may be helpful in decision-making regarding frequency of breast cancer screening.

BR276-SD-WEA7 Comparative Radiomics Analysis of Contrast-Enhanced Mammography and Magnetic Resonance Imaging for Differentiation of Tumor Invasiveness, Hormone Receptor Status, and Tumor Grade in Breast Cancer Patients

Station #7

Participants
Maria Adele Marino, MD, Messina, Italy (*Presenter*) Nothing to Disclose
Doris Leithner, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Daly B. Avendano, MD, Monterrey, Mexico (*Abstract Co-Author*) Nothing to Disclose
Elizabeth A. Morris, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Katja Pinker-Domenig, MD, New York, NY (*Abstract Co-Author*) Speakers Bureau, Siemens AG ; Advisory Board, Merantix Healthcare GmbH
Maxine S. Jochelson, MD, New York, NY (*Abstract Co-Author*) Speaker, General Electric Company; Consultant, Bayer AG

PURPOSE

To investigate and compare the potential of radiomics analysis of contrast-enhanced mammography (CEM) and magnetic resonance imaging (MRI) of the breast for the differentiation of invasive vs non-invasive cancer, hormone receptor status and tumor grade.

METHOD AND MATERIALS

In this IRB-approved HIPAA compliant retrospective data analysis 48 female patients with 49 histopathologically proven breast cancers who underwent pre-treatment CEM and breast MRI were analyzed. There were 45 invasive and 4 ductal carcinoma in situ. Among the invasive cancers: 40 were hormone-receptor positive (HR+) and 5 hormone-receptor negative (HR-). There were 5 Grade (G) 1 (DCIS=1; invasive cancers=4); twenty-three G2 (DCIS=2; invasive cancers=21) and twenty-one G3 (DCIS=1; invasive cancers=20). 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). 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.

RESULTS

MRI radiomics analysis yielded the following classification accuracies for differentiation of invasive/non-invasive breast cancers: Fisher: 90% (COM); POE: 88% (COM), MI: 88% (COM), of HR+ vs. HR- breast cancers: Fisher: 76.1%; POE: 80.4% ; MI: 82.6% , and of low grade (G1+G2) vs. G3 invasive cancers: Fisher: 77.8% (RUN); POE: 71.1% (pred. COM); MI: 73.3% (COM). CEM achieved the following accuracies for differentiation of invasive versus non-invasive breast cancers: Fisher: 92% (RUN); POE: 90% (COM); MI: 88% (COM), of Low grade (G1+G2) vs. G3 invasive cancers: 75.6% (WAV+RUN+COM); POE: 77.8% (RUN); MI: 64.4% (WAV+COM). For differentiate HRpos vs. HRneg: Fisher: 76.1% (COM); POE: 80.4% (pred. COM); MI: 82.6% (COM).

CONCLUSION

Radiomics analysis of MRI has the potential for non-invasive differentiation of invasive vs non-invasive cancer, hormone receptor status and grade with similar accuracies being achieved with CEM.

CLINICAL RELEVANCE/APPLICATION

Radiomics analysis with CEM and MRI achieve similar results

BR209-ED-WEA8 An Unusual Package From Amazon: Atypical Breast Cancers

Station #8

Participants
Jorge L. Huayanay, MD, Lima, Peru (*Presenter*) Nothing to Disclose
Jorge Huayanay, MD, Lima, Peru (*Abstract Co-Author*) Nothing to Disclose
Henry Guerra, Lima, Peru (*Abstract Co-Author*) Nothing to Disclose
Mark Guelfguat, DO, Clifton, NJ (*Abstract Co-Author*) Nothing to Disclose

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jorge87210@hotmail.com

TEACHING POINTS

The major teaching points of the exhibit are: Illustrate mammographic and sonographic features of rare breast cancer types. Review imaging appearance and histopathologic correlation of unusual and rare breast cancers. Emphasize diagnostic difficulties, potential pitfalls and differential diagnoses of these entities.

TABLE OF CONTENTS/OUTLINE

The goals of this exhibit are to: Provide a pictorial review of diverse imaging appearances of rare breast neoplasms. Discuss specific imaging and pathological characteristics of several rare and unusual primary breast cancers. Familiarize the audience with rare breast neoplasms, thereby helping in formulation of complete differential diagnosis. Subtypes of Ductal Carcinoma illustrated in this exhibit: Medullary carcinoma of the breast Papillary carcinoma of the breast Mucinous carcinoma of the breast Tubular carcinoma of the breast Malignant Neoplasms of Stromal Origin illustrated in this exhibit: Breast angiosarcoma Breast rhabdomyosarcoma Phyllodes tumor

BR210-ED-WEA9 Breast Cancer Imaging and Risk Profiles in Women with Moderate Risk Genetic Mutations: A Case-Based Review

Station #9

Participants
Melanie Wegener, MD, New York, NY (*Presenter*) Nothing to Disclose
Yiming Gao, MD, 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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TEACHING POINTS

Advances in multi-gene panel testing have resulted in identification of populations at higher-than-average risk for breast cancer. As a result, some updated guidelines recommend more intensive screening regimens, including MRI. However, few imaging based studies describe features of lesions associated with these moderate risk groups. In this case based review, we will consider more commonly encountered moderate genetic risk mutations, discuss screening and diagnostic breast imaging scenarios in these individuals, and explore breast cancer risk and breast cancer detection in this population.

TABLE OF CONTENTS/OUTLINE

1. Define "moderate risk genetic mutation" 2. Review clinical manifestations of moderate risk genetic mutations 3. Discuss breast cancer risk 4. Detail guidelines for breast cancer screening in populations with moderate risk genetic mutations 5. Case based evaluation of multi-modality breast imaging in women with moderate risk genetic mutations (ATM, CHEK2, Neurofibromatosis 1, PALB2, NBN). i. Mutation types and breast cancer risk ii. Imaging based literature iii. Breast imaging pearls/pitfalls iv. Specific imaging considerations 1. NF1 and radiation exposure 2. NF1 and confounding lesions (i.e., neurofibromas) 3. ATM and common benign confounders (fibroadenomas)

BR211-ED-WEA10 Test Yourself! MR Evaluation of Response to Neoadjuvant Therapy

Station #10

Awards
Identified for RadioGraphics

Participants
Beatriu Reig, MD, New York, NY (*Presenter*) Nothing to Disclose
Alana A. Lewin, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Laura Heacock, MD, MS, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Hildegard B. Toth, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Samantha L. Heller, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

Yiming Gao, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Linda Moy, MD, New York, NY (*Abstract Co-Author*) Grant, Siemens AG; Support, Lunit Inc ; Support, iCad, Inc; Support, FAIR Facebook; Advisory Board, Lunit Inc; Advisory Board, iCad, Inc

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TEACHING POINTS

Causes of over-estimation of residual disease: Fibrosis or post treatment change may enhance and be mistaken for residual tumor Mucinous or necrotic tumors may appear as residual masses although there is no viable tumor Causes of under-estimation of residual disease Cancers manifesting as nonmass enhancement may be underestimated due to their nonconcentric shrinkage pattern Residual disease may be seen only on late phases of contrast-enhanced MRI Lobular cancers are more likely to be underestimated due to their growth pattern Taxane-containing chemotherapy regimens decrease overall vascularity and may cause decrease or resolution in enhancement despite residual disease

TABLE OF CONTENTS/OUTLINE

Brief intro: Rationale and indications for neoadjuvant chemo and endocrine therapies Self-test: MR imaging response to therapy with pathology correlation Causes of over- and under-estimation of residual tumor Paradigm change: can surgery be avoided in patients with excellent response to neoadjuvant therapy? Ongoing trials predicting pathologic response by imaging and/or needle biopsy.

Printed on: 10/29/20

VW77

Clinical Perspective on 3D™ Guided Breast Biopsy and Real-Time Specimen Imaging: Presented by Hologic, Inc.

Wednesday, Dec. 4 12:15PM - 1:30PM Room: South Building, Booth 5119

Participants

Debbie L. Bennett, MD, Saint Louis, MO (*Presenter*) Advisory Board, Devicor Medical Products, Inc; Speaker, Hologic, Inc

Program Information

This experienced Radiologist's presentation and demonstration focuses on 3D™ guided breast biopsy and real-time specimen imaging. Come for a hands-on experience utilizing the Affirm® Prone Biopsy and Brevera® Systems. *Adding this session to your agenda does not secure your seat in this session. Secure your seat onsite by visiting Hologic's Workshop Room # 5119 in the South Hall.*

Printed on: 10/29/20

VW98

DBT: Why Another Technology to Detect the Same Disease?: Presented by FUJIFILM Medical Systems U.S.A., Inc.

Wednesday, Dec. 4 12:20PM - 1:20PM Room: South Building, Booth 5147

Participants

Shilpa V. Lad, MD, Ottawa, ON (*Presenter*) Faculty, C. R. Bard, Inc; Faculty, FUJIFILM Holdings Corporation

Program Information

Through a hands-on review of 2D as well as 3D Tomosynthesis images in screening and diagnostic cases, this workshop will highlight the signs of benign as well as malignant breast lesions seen on 3D Tomosynthesis where 2D mammograms were equivocal or negative. This workshop will also demonstrate synthetic 2Dimages have the potential to replace 2D mammograms for dose reduction, and introduce cases using Contrast Enhanced Mammography to highlight the importance of cost-effective functional imaging as a problem solving tool.

Printed on: 10/29/20

VW56

Practice Guidelines for ABUS, Automated Breast Ultrasound: Presented by GE Healthcare

Wednesday, Dec. 4 12:30PM - 1:00PM Room: South Building, Booth 5135

Participants

Georgia Giakoumis-Spear, MD, Evanston, IL (*Presenter*) Nothing to Disclose

Program Information

In changing times of FDA legislative mandates and informed patients, learn how Invenia ABUS proves to be a true, effective adjunctive screening tool for detection of breast cancer in women with dense breast tissue. Clinical relevance, practice guidelines and how to successfully implement ABUS into clinical practice will be reviewed. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

BRS-WEB

Breast Wednesday Poster Discussions

Wednesday, Dec. 4 12:45PM - 1:15PM Room: BR Community, Learning Center

MK MR US BQ IR AI BR

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Nisha Sharma, MBChB, Leeds, United Kingdom (*Moderator*) Nothing to Disclose

Sub-Events

BR242-SD-WEB1 Role of the Anchoring and Adjustment Heuristic in Radiological Decision-Making

Station #1

Participants
Fallon Branch, MS, Augusta, GA (*Presenter*) Nothing to Disclose
Jay Hegde, PhD,MS, Augusta, GA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The anchoring and adjustment heuristic is a 'rule of thumb' that subjects, including medical experts, sometimes use in decision-making, where they start with an initial, anchoring judgment, and adjust it as necessary to accommodate the available perceptual and cognitive information. To elucidate the role of this heuristic in radiological decision-making, we characterized the relative influences of the visual evidence in mammograms vs. cognitive factors such as an a priori, anchoring effect of the belief that a given image contains a cancer.

METHOD AND MATERIALS

We used a task paradigm in which we systematically manipulated the aforementioned visual and cognitive factors. At the beginning of each trial, subjects (12 practicing radiologists, including 6 mammography specialists) were presented a random number that they were told was another radiologist's estimated probability (% chance) that the upcoming mammogram contained a cancer. Subjects then reported, using an on-screen slider, their perceived probability that the upcoming mammogram contained a cancer ('1st report'). Subjects then viewed the mammogram for various durations (200ms to 60s, depending on the trial) and used the slider to report the probability that the given mammogram actually contained a cancer ('2nd report'). We analyzed the contribution of various factors to the subjects' 2nd report.

RESULTS

We found that the 2nd report was highly correlated with the first (r= 0.39, df =142, p <<0.05). No other factor, including (but not limited to) the actual cancer status of the mammogram or viewing duration, significantly contributed to the 2nd report (general linear model; t<0 and p>0.05 for all other factors). Together, our results indicate that under certain circumstances, anchoring cognitive information such as a priori beliefs about a given image can have a biasing effect that adjustments based on the visual evidence in the mammogram cannot necessarily overcome.

CONCLUSION

Our results suggest that when a radiologist providing a second opinion is aware of the putative prior opinion, the prior opinion can have a significant anchoring effect, thus biasing the radiologist's decision.

CLINICAL RELEVANCE/APPLICATION

Blinding the radiologist providing a second opinion to the first opinion may help reduce the biasing effects of the anchoring and adjustment heuristic.

BR243-SD-WEB2 Management and Outcomes of One-View Architectural Distortions Seen on Screening Breast Tomosynthesis

Station #2

Participants
Hannan Saad, MD, Detroit, MI (*Presenter*) Nothing to Disclose
Alexis Davenport, MD, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
David M. Pinkney, MD, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Gurpriya K. Gupta, MD, Birmingham, MI (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The objective of our study was to determine the outcomes of one-view architectural distortions described on screening Digital Breast Tomosynthesis (DBT).

METHOD AND MATERIALS

For this single institution retrospective study, screening Digital Breast Tomosynthesis reports from October 15, 2015 to January 1, 2019 that included one-view architectural distortion as a finding were reviewed. Associated additional imaging studies and pathology results, if available, were also reviewed. Patients were excluded if no diagnostic imaging was performed or if the patient was still undergoing active surveillance of the lesion.

RESULTS

106 cases met inclusion criteria. 61/106 (57.5%) were no longer seen at diagnostic workup and characterized as BI-RADS 1. 8 cases were assigned BI-RADS 3 initially, 5 of which were downgraded to BI-RADS 1 after follow up or MRI was performed, and 3 of which were eventually biopsied. 37 cases were assigned BI-RADS 4. In total, 34/106 (32.1%) cases ultimately underwent core needle biopsy (6 were canceled at the time of biopsy as the finding was no longer appreciated). Of these, 24 were benign (70.6%), 6 were high risk (17.6%; 0/6 upgraded at surgical excision), and 4 were malignant (11.8%). Overall malignancy rate was 4/106 (3.8%). 74 cases underwent sonographic evaluation. 2/4 (50.0%) malignancies had ultrasound correlates, and there was a higher likelihood of malignancy if an ultrasound correlate was present (2/24, 8.3%) versus without an ultrasound correlate (2/50, 4.0%).

CONCLUSION

One-view architectural distortions seen on screening tomosynthesis have a low malignancy rate (3.8%). Furthermore, the presence of an ultrasound correlate demonstrated a higher likelihood of malignancy as opposed to without an ultrasound correlate.

CLINICAL RELEVANCE/APPLICATION

One-view architectural distortions on screening tomosynthesis can present a diagnostic dilemma. Knowledge of malignancy rates and associated imaging findings will help guide management at workup.

BR244-SD-WEB3 Correlation of Female Hormone Levels with Quantitative BPE and ADC Values in Breast Cancer Patients: The Effect of BPE and ADC Values on Cancer Detectability

Station #3

Participants
Seulgi You, MD, Suwon, Korea, Republic Of (*Presenter*) Nothing to Disclose
Dayoung Kim, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Taeyang Ha, MD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Taehee Kim, MD, PhD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Doo Kyoung Kang, MD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the relationship between female hormone levels and background parenchymal enhancement (BPE) or apparent diffusion coefficient (ADC) values of normal breast parenchyma and to analyze the effect of BPE and ADC values on cancer detectability.

METHOD AND MATERIALS

From November 2016 to December 2018, 237 malignant lesions in 164 breast cancer patients who underwent preoperative MRI and female hormone testing were included in our study. For quantitative analysis of BPE, we used semi-automated in-house software with MATLAB. From each voxels of whole breast, the software calculated BPE using following equations: [(signal intensity (SI) at 1 min 30 sec after contrast injection - baseline SI) / baseline SI] x 100 %. The detectability of breast cancer was scored 2 (excellent), 1 (fair), or 0 (not detectable) by two radiologists in consensus.

RESULTS

The progesterone level was significantly correlated with mean values ($r=0.226$, $p=0.004$), median values ($r=0.207$, $p=0.008$), 90th percentile values ($r=0.244$, $p=0.002$) and 10th percentile values ($r=0.171$, $p=0.029$) of quantitative BPE. There was no significant correlation between the estrogen and quantitative BPE parameters ($p>0.05$). ADC value was not significantly correlated with both estrogen and progesterone (all p values >0.05). Spearman rank test showed there was significant correlation between the detectability and BPE grade ($r= -0.36$, $p<0.001$) on contrast-enhanced image or ADC values ($r=-0.315$, $p<0.001$) on diffusion-weighted image. Of 5 lesions with score 0 on contrast-enhanced image, 3 lesions were score 2 on DWI and 1 lesion was score 1. Of 26 lesions with score 1 on contrast-enhanced image, 13 lesions were score 2 and 14 lesions were score 1 on DWI.

CONCLUSION

Quantitative BPE values were significantly correlated with progesterone level. The detectability of breast cancer depends on both BPE grade on contrast-enhanced image and ADC grade on DWI. DWI could be useful in the case of breast cancer that is not well visible on contrast-enhanced image.

CLINICAL RELEVANCE/APPLICATION

The detectability of breast cancer depends on both BPE grade on contrast-enhanced image and ADC grade on DWI. DWI could be useful in the case of breast cancer that is not well visible on contrast-enhanced image.

BR277-SD-WEB4 Are There Differences in 18F-FDG PET-MRI Imaging Biomarkers of Contralateral Healthy Tissue between Patients with Benign and Malignant Breast Lesions?

Station #4

Participants
Doris Leithner, MD, Frankfurt Am Main, Germany (*Presenter*) Nothing to Disclose
Thomas H. Helbich, MD, Vienna, Austria (*Abstract Co-Author*) Research Grant, Medicor, Inc ; Research Grant, Siemens AG ; Research Grant, C. R. Bard, Inc; Research Grant, Guerbet SA; Research Grant, Novomed GmbH
Blanca Bernard-Davila, MPH,MS, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Maria Adele Marino, MD, Messina, Italy (*Abstract Co-Author*) Nothing to Disclose
Daly B. Avendano, MD, Monterrey, Mexico (*Abstract Co-Author*) Nothing to Disclose

Danny F. Martinez, BSC,MSc, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Maxine S. Jochelson, MD, New York, NY (*Abstract Co-Author*) Speaker, General Electric Company; Consultant, Bayer AG
Panagiotis Kapetas, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Pascal A. Baltzer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Alexander Haug, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Elizabeth A. Morris, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Katja Pinker-Domenig, MD, New York, NY (*Abstract Co-Author*) Speakers Bureau, Siemens AG ; Advisory Board, Merantix Healthcare GmbH

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PURPOSE

To evaluate whether there are differences in multiparametric 18F-fluorodeoxyglucose positron emission tomography - magnetic resonance imaging (18F-FDG PET-MRI) biomarkers of contralateral healthy breast tissue between patients with benign and malignant breast tumors.

METHOD AND MATERIALS

In this IRB-approved HIPAA-compliant prospective single-institution study, 141 women with imaging abnormality on mammography or sonography (BI-RADS 4/5) were included and underwent combined 18F-FDG PET-MRI of the breast at 3T including dynamic contrast-enhanced MRI (DCE-MRI) and diffusion-weighted imaging (DWI). The following imaging biomarkers were recorded in all patients for the contralateral tumor-free breast: 18F-FDG breast parenchymal uptake (BPU), mean apparent diffusion coefficient (ADCmean), DCE-MRI background parenchymal enhancement (BPE) and amount of fibroglandular tissue (FGT), as well as BPU, BPE and FGT of the ipsilateral diseased breast. Appropriate statistical tests were used to assess differences in imaging biomarkers between patients with benign and malignant lesions.

RESULTS

There were 100 malignant and 41 benign lesions. BPE was minimal in 61, mild in 56, moderate in 19, and marked in 5 patients. BPE differed significantly (P<0.001) between patients with benign and malignant lesions, with patients with cancer showing decreased BPE in the contralateral tumor-free breast. A borderline significant difference was observed for FGT (P=0.055). BPU for patients with mild BPE was 1.5, for mild BPE 1.9, for moderate BPE 2.2, and for marked BPE 1.9. BPU differed significantly between patients with benign (mean, 1.9) and malignant lesions (mean, 1.8) (P<.001). ADCmean did not differ between groups (P=0.19). In both groups, no differences in imaging biomarkers between contralateral healthy and ipsilateral diseased breast were found, excluding a potential stealing phenomenon of the diseased breast with respect to vascularity and metabolic activity.

CONCLUSION

Differences in multiparametric 18F-FDG PET-MRI biomarkers, obtained from contralateral tumor-free breast tissue, exist between patients with benign and malignant breast tumors. Contralateral BPE, BPU, and FGT are decreased in breast cancer patients.

CLINICAL RELEVANCE/APPLICATION

BPE and BPU may potentially serve as imaging biomarkers for the presence and risk of malignancy.

BR278-SD-WEB5 Whole Breast Tissue Characterization with Ultrasound Tomography

Station #5

Participants
Neb Duric, PhD, Novi, MI (*Abstract Co-Author*) Officer, Delphinus Medical Technologies, Inc
Peter J. Littrup, MD, Rochester Hills, MI (*Abstract Co-Author*) Founder, CryoMedix, LLC Research Grant, Galil Medical Ltd Research Grant, Endo International plc Consultant, Delphinus Medical Technologies, Inc
Cuiping Li, PhD, Plymouth, MI (*Presenter*) Delphinus Medical Technologies, Inc
Rachel F. Brem, MD, Washington, DC (*Abstract Co-Author*) 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

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PURPOSE

Hand held ultrasound (HHUS) provides localized diagnostic information of tissue stiffness and elasticity. Screening requires global assessment of tissue properties for which HHUS is not suitable while automated breast ultrasound (ABUS) does not measure elasticity. This study is the first to evaluate imaging of tissue stiffness throughout the breast using the technique of ultrasound tomography (UST).

METHOD AND MATERIALS

Patients with findings on mammography and/or HHUS during the time period of January, 2018 to March 2018, were scanned with UST and with HHUS elastography. Patient were selected on the basis of having dense breasts and the most common benign breast masses, as well as cancers. A total of 50 women with breast masses were imaged with UST (16 cancers, 16 fibroadenomas and 18 cysts). HHUS was available for 26 of the 50 cases. Pathology and/or radiology reports were used as the ground truth for verifying lesion type and lesion location. Lesion localization on UST images was provided by a board-certified radiologist. The Spearman correlation coefficient was used to characterize agreement between the UST and HHUS measurements.

RESULTS

UST demonstrated the ability to measure tissue stiffness throughout the breast and to characterize lesion stiffness in all 50 patients. Examples are shown in Figure 1. Fifteen of the 16 cancers were characterized as "stiff" by the UST method. Eight fibroadenomas were found to be mixed (range of colors), 4 were stiff (red) and 4 were found to be soft (blue). Of the 18 cysts, 17 were found to be soft while 1 was found to be mixed. With HHUS elastography, 8 cancers and 3 fibroadenomas were found to be stiff, 5 fibroadenomas were mixed and all 10 cysts were soft. The Spearman correlation coefficient for the UST-HHUS comparison,

for the subset of 26 cases, was 0.89.

CONCLUSION

The study demonstrates that stiffness characterization of lesions using UST is feasible and accurate. Furthermore, it is shown that this approach measures tissue stiffness throughout the volume of the breast, something that is currently not possible with other ultrasound devices.

CLINICAL RELEVANCE/APPLICATION

Measuring tissue stiffness throughout the whole breast is not currently available clinically. The addition of this information in a screening environment has the potential to reduce call backs and biopsies by utilizing stiffness to improve specificity.

BR279-SD-WEB6 A Radiogenomics Approach to Predicting Immune and Stromal Cell Line Invasion in Breast Cancer Lesions

Station #6

Participants
Ryan M. Hausler, BS, Pittsburgh, PA (*Presenter*) Nothing to Disclose
Shandong Wu, PhD, MSc, Philadelphia, PA (*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

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PURPOSE

Studies have shown that prognostic outcomes of tumors are not only linked with genetic and epigenetic factors within cancerous cells, but also with the extent of infiltrating immune and stromal cells in the tumor microenvironment. In this study, we aim to investigate machine learning models utilizing dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) features to predict the presence of eight immune and two stromal cell populations within breast cancer lesions.

METHOD AND MATERIALS

This study uses the paired imaging and genetic data of 73 breast cancer patients, from two different institutions, provided by The Cancer Imaging Archive and The Cancer Genome Atlas. Radiomic features were extracted from the tumor area of the DCE-MRIs. Tumor Segmentation was manually performed by a panel of experienced radiologists. The set of 199 radiomic features described size, morphological, kinetic, and textural properties of the tumors. Cell line infiltration was quantified using the gene expression profile with the MCP-counter software. Univariate linear relationships were measured for every radiomic feature cell line abundance combination. An extreme gradient boosting machine learning algorithm was used to predict high or low cell line infiltration using radiomic features as the predictive variables. Ten different models were created to predict each cell line. Classification performance was measured via area under the ROC curve (AUC) by 1) using leave one out cross validation on the 40 patients from Institution A and 2) independent test on the 33 patients from Institution B.

RESULTS

Several significant univariate relationships were found between radiomic features and the abundance of fibroblasts in the lesion. The machine learning models yielded cross-validation AUCs ranging from 0.5 to 0.83. The independent test on data from Institution B yielded AUCs ranging from 0.5 to 0.68.

CONCLUSION

Radiomics analysis of breast DCE-MRI is a promising approach to predicting infiltration of various immune and stromal cell lines into breast cancer lesions, with a varying range of accuracies. There appears to be links between macro radiomic phenotypes and microscopic cellular events occurring in breast cancer tumors.

CLINICAL RELEVANCE/APPLICATION

Nuanced radiological descriptors may be informative of microscopic properties of tumors. Breast DCE-MRI radiomics may provide a non-invasive biomarker to help identify responders to immunotherapy.

BR280-SD-WEB7 Screening Mammography with Digital Breast Tomosynthesis in Women Aged 40-54: Is It Effective or Harmful?

Station #7

Participants
Maryam Etesami, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Laura J. Horvath, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Michelle Y. Giwerc, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Liane E. Philpotts, MD, Madison, CT (*Abstract Co-Author*) Consultant, Hologic, Inc

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PURPOSE

Appropriate starting age for mammogram screening has been a controversial subject in the recent years considering its potential harms and benefits. Digital breast tomosynthesis (DBT) reduces false positive recalls while increasing cancer detection and can be a more effective screening tool. In this study we present the performance metrics of DBT mammogram screening in women aged 40-54.

METHOD AND MATERIALS

We retrospectively reviewed all screening mammograms with DBT in women aged 40-54 in 4 breast imaging centers (one academic

We retrospectively reviewed all screening mammograms with DBT in women aged 40-54 in 4 breast imaging centers (one academic center and 3 outpatient sites) from 5/1/2012 to 4/3/2018. DBT was offered to all women at no additional cost. Screening performance metrics and characteristics of detected cancers were compared between 3 age groups of 40-44 (group A), 45-49 (group B), and 50-54 (group C).

RESULTS

Total of 52360 DBT screening mammograms (14757 in group A, 17649 in group B, and 19954 in group C) were included. Recall rate (RR) was 11.4%, 8.6%, 7.5% in groups A, B, and C, respectively with significant difference between all groups ($p<0.001$). However, RR of baseline mammograms in each group were not significantly different. Cancer detection rate (CDR) was 2.8, 4.1, and 4.6 per 1000 mammograms in groups A, B, and C, respectively without significant difference ($p>0.05$). Biopsy rates in 3 groups were not significantly different (1.4%, 1.5%, and 1.4% in groups A, B, and C, respectively). Cancers detected were 79%, 73%, and 75% invasive in groups A, B and C, respectively ($p>0.05$). Thirty percent of invasive cancers in group A were poorly differentiated compared to 11% and 17% in groups B and C ($p>0.05$). Thirty percent of invasive cancers in group A were HER2+ or triple negative for hormone receptors compared to 17% in each group of B and C ($p>0.05$). Of women with invasive cancers in group A, 80% did not have axillary lymph node metastasis which was similar to 79% in each group of B and C.

CONCLUSION

Screening mammogram with DBT in women aged 40-44 and 45-49 has CDR comparable with age 50-54. The RR is higher in younger women, but RR of baseline mammograms is similar between 3 age groups. The majority of screen-detected cancers in women aged 40-49 are invasive and high grade, but without axillary lymph node involvement.

CLINICAL RELEVANCE/APPLICATION

DBT screening in women aged 40-49 is effective with minimal false positives. Delaying screening may only shift higher RR of baseline mammograms to older women while losing the opportunity to detect aggressive cancers at early stage.

BR212-ED-WEB8 Stromal Fibrosis: A Diagnostic Challenge for Radiologists

Station #8

Participants
Flavia B. Sarquis, MD, Villa Ballester, Argentina (*Presenter*) Nothing to Disclose
Lucia I. Beccar Varela, MD, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose
Mariano Lamattina, MD, Capital Federal, Argentina (*Abstract Co-Author*) Nothing to Disclose
Paola Pucci, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Soledad Nocetti, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Florencia Melendez, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Bernardo O. Blejman, MD, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Stromal fibrosis of the breast is an increasingly benign condition with diagnostic difficulties both from the point of view mammographic and sonographic and the anatomic- pathological correlation. After reading this education exhibit the radiologist will know: Definition, classification and multiple terms used to describe this finding The imaging features of stromal fibrosis of the breast. The challenges of diagnosing an entity with multiple forms of manifestation, which makes the categorization many as BIRADS 4. The importance of histological characterization of this lesion in all cases.

TABLE OF CONTENTS/OUTLINE

Introduction Stromal fibrosis may present as a palpable mass or a clinically occult imaging-detected abnormality. The pathogenesis of stromal fibrosis remains unknown. Multimodality imaging features and Image Interpretation. Biopsy-proven cases: The major dilemma lies in the case of radiologic-pathologic discordance. Appropriate management and follow up. Conclusions.

BR213-ED-WEB9 Putting the Pieces Together: Multimodality Review of Puzzling Benign Breast Lumps

Station #9

Participants
Brian J. Guarnieri, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose
Charmi Vijapura, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Rifat A. Wahab, DO, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Mary C. Mahoney, MD, Cincinnati, OH (*Abstract Co-Author*) Researcher, General Electric Company

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TEACHING POINTS

Discuss the appropriate initial diagnostic work up and management for palpable breast lumps. Recognize common and rare causes of benign vascular, traumatic, systemic, and infectious breast lumps. Characterize mammographic and ultrasound imaging findings of these lesions.

TABLE OF CONTENTS/OUTLINE

Work Up: Clinical Presentation ACR Appropriateness Criteria for palpable breast lumps Discuss Cases and Imaging Findings Vascular True and false aneurysm Mondor's Disease Multiple skin hemangiomas Enlarged vessels Traumatic Fat necrosis/Oil cysts Epidermal inclusion cyst Keloids Systemic Neurofibromatosis Amyloidosis Diabetic Mastopathy Infectious Abscess Granulomatous mastitis Mammary duct ectasia

BR214-ED-WEB10 **Trials and Tribulations in the Early Implementation of an Abbreviated Screening Breast MR Program**

Station #10

Awards

Magna Cum Laude

Participants
Samantha P. Zuckerman, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Susan Weinstein, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Elizabeth S. McDonald, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Katrina Korhonen, 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, Advisory Panel, iCAD, Inc; Speaker, iiCME

For information about this presentation, contact:

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TEACHING POINTS

- Supplemental breast cancer screening with MR is more sensitive than supplementing digital mammography (DM) or tomosynthesis (DBT) with US. - For patients who do not meet the level of elevated lifetime risk to qualify for routine, screening breast MR, abbreviated MR (AB-MR) may be a cost effective alternative for supplemental screening. - Implementing an AB-MR screening program requires the cooperation of multiple stakeholders. - Reviewing true positive, false positive, and true negative biopsy cases from a clinically implemented AB-MR supplemental screening program may help inform others in their implementation efforts.

TABLE OF CONTENTS/OUTLINE

- Review the evidence for supplemental screening with AB-MR compared to other modalities (i.e., ultrasound, CEDM, MBI, and DBT). - Define patient criteria for a successful AB-MR clinical program. - Review lessons learned from the early implementation of a clinical AB-MR program including marketing, scheduling, operational and financial considerations. - Review early screening outcomes. - Present case-based examples of AB-MR (i.e., true negatives and positives, and false positives and negatives

Printed on: 10/29/20

VW29

The Benefits of 50° Wide-angle Tomosynthesis: Presented by Siemens Healthineers

Wednesday, Dec. 4 1:05PM - 2:15PM Room: North Building, Booth 8563

Participants

Steven J. Saulsbury, MD, Le Mars, IA (*Presenter*) Nothing to Disclose

Program Information

During this hands-on workshop, you will learn more about evaluating breast tomosynthesis data. A reading expert will guide you through cases that will both fascinate and challenge you! All cases have been acquired with Siemens Healthineers 50° Wide-Angle Tomosynthesis technology and can be read on our advanced visualization software syngo. Breast Care. You will become familiar with the value of 50° Wide-Angle Tomosynthesis images and the ease-of-use of our reading solutions. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP

https://www.fairorg.de/Siemens-Healthineers/portal/workshop.cfm/rsna19/

Printed on: 10/29/20

AI47

AI Theater: iCAD's Advancements in Mammography for Cancer Detection and Risk Prediction: Presented by iCAD, Inc.

Wednesday, Dec. 4 1:30PM - 1:50PM Room: AI Showcase, North Building, Level 2, Booth 10724

Participants

Senthil Periaswamy, PhD, Nashua, NH (*Presenter*) Vice President, iCAD, Inc

Printed on: 10/29/20

VW57

Advanced 3D ABUS Reading Workshop: Interesting Cases: Presented by GE Healthcare

Wednesday, Dec. 4 1:30PM - 2:30PM Room: South Building, Booth 5135

Participants

Lisa R. Stempel, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Program Information

Interesting cases will be shared in this advanced hands-on, interactive Invenia ABUS (automated breast ultrasound) Workshop. Learn more about the unexpected benefits - beyond screening - of implementing ABUS into your clinical practice. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

VW99

Fujifilm's Breast Biopsy Solutions: Presented by FUJIFILM Medical Systems U.S.A., Inc.

Wednesday, Dec. 4 1:30PM - 2:30PM Room: South Building, Booth 5147

Participants

Shilpa V. Lad, MD, Ottawa, ON (*Presenter*) Faculty, C. R. Bard, Inc; Faculty, FUJIFILM Holdings Corporation

Printed on: 10/29/20

VW78

A Revolution in Localization: Presented by Hologic, Inc.

Wednesday, Dec. 4 2:00PM - 3:15PM Room: South Building, Booth 5119

Participants

Mehran Habibi, Baltimore, MD (*Presenter*) Nothing to Disclose
Lisa A. Mullen, MD, Cockeysville, MD (*Presenter*) Nothing to Disclose

Program Information

Learn from both an experienced radiologist and surgeon as they provide an overview of traditional and new localization options for patients undergoing Breast Conserving Surgery (lumpectomy) or excisional biopsy. Their knowledgeable discussion followed by hands-on experience for attendees will review the benefits of various wire and non-wire localization technologies focusing on ways to improve workflow. The hands-on portion includes phantom-placement techniques, demonstrating multiple, innovative technologies including LOCalizer™ and Viera™. *Adding this session to your agenda does not secure your seat in this session. Secure your seat onsite by visiting Hologic's Workshop Room # 5119 in the South Hall.*

Printed on: 10/29/20

VW100

Imaging of Triple-negative Breast Cancer: Presented by FUJIFILM Medical Systems U.S.A., Inc.

Wednesday, Dec. 4 2:50PM - 3:50PM Room: South Building, Booth 5147

Participants

Jessica W. Leung, MD, Houston, TX (*Presenter*) Scientific Advisory Board, Subtle Medical

Program Information

Triple negative breast cancer is defined as invasive cancer that is ER, PR, and HER2 negative. This is a biologically aggressive cancer that (currently) cannot be treated with targeted therapy. It disproportionately affects young women and is associated with BRCA-1 gene mutation. At mammography, ultrasound, and MRI, this cancer typically appears as a round or oval mass. It has a poor prognosis, at least in part due to early visceral metastases. In this lecture, the molecular, clinical, and imaging features of triple negative breast cancer will be discussed.

Printed on: 10/29/20

SPAI43

RSNA AI Deep Learning Lab: Beginner Class: Classification Task (Intro)

Wednesday, Dec. 4 3:00PM - 4:30PM Room: AI Showcase, North Building, Level 2, Booth 10342

AI BR CH CT GI HN IN MR NR

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

Participants

Bradley J. Erickson, MD, PhD, Rochester, MN (*Presenter*) Board of Directors, VoiceIt Technologies, LLC; Stockholder, VoiceIt Technologies, LLC; Board of Directors, FlowSigma, LLC; Officer, FlowSigma, LLC ; Stockholder, FlowSigma, LLC

Special Information

In order to get the best experience for this session, it is highly recommended that attendees bring a laptop with a keyboard, a decent-sized screen. Having a Gmail account will be helpful. Here are instructions for creating and deleting a Gmail account.

ABSTRACT

This class will focus on basic concepts of convolutional neural networks (CNNs) and walk the attendee through a working example. A popular training example is the MNIST data set which consists of hand-written digits. This course will use a data set we created, that we call 'MedNIST', and consists of images of 6 different classes: Chest X-ray, Chest CT, Abdomen CT, Head CT, Head MR and Breast MRI. The task is to identify the image class. This will be used to train attendees on the basic principles and some pitfalls in training a CNN. • Intro to CNNs • Data preparation: DICOM to jpeg, intensity normalization, train vs test • How do we choose the labels? Inconsistencies... Use Fast.AI routines to classify; Validation of results: Are the performance metrics reliable? 'Extra Credit': if there is time, explore data augmentation options, effect of batch size, training set size.

Printed on: 10/29/20

SSM01

Breast Imaging (Functional Imaging)

Wednesday, Dec. 4 3:00PM - 4:00PM Room: E451B

BR

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

Participants
Matthias Dietzel, MBA,MD, Erlangen, Germany (*Moderator*) Nothing to Disclose
Mami Iima, MD, PhD, Kyoto, Japan (*Moderator*) Nothing to Disclose

Sub-Events

SSM01-01 Role of 18F-FDG Uptake on PET/CT in Identifying Androgen Receptor Expression and Prognostic Factors in Triple-Negative Breast Cancer

Wednesday, Dec. 4 3:00PM - 3:10PM Room: E451B

Participants
Hyo-jae Lee, Gwangju, Korea, Republic Of (*Presenter*) Nothing to Disclose
So Yeon Ki, Jeollanam-do, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyo Soon Lim, MD, Gwangju, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jong Eun Lee, Gwangju, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

N/C

PURPOSE

To investigate the relationship between 18F-FDG uptake and androgen receptor (AR) expression in triple-negative breast cancer (TNBC).

METHOD AND MATERIALS

Between May 2015 and May 2017, 110 patients (mean age, 53.5 years) with primary TNBC (mean, 25.7mm; range, 4-75 mm) were retrospectively categorized into AR+ (n = 25) and AR- (n = 85) groups by using immunohistochemical staining and underwent 18F-FDG PET/CT for staging. Maximum standardized uptake (SUVmax) value on PET/CT and clinicopathologic features including age, size of tumor, lymph node metastasis, histological grade of tumor, histological type, Ki-67, associated ductal carcinoma in situ (DCIS) component, p53 overexpression, and basal marker (CK5/6, CK14, EGFR) expression by immunohistochemical staining were compared between the two groups. In addition, the correlation between SUVmax and prognostic factors was assessed.

RESULTS

Mean SUVmax was significantly higher in AR- (9.9 ± 5.5) group than in AR+ (7.2 ± 4.8) group (P = .025). AR- group was significantly younger (P =.001) and showed significantly more histological grade 3 (P = .025) and Ki-67 proliferation rate (>14%) of TNBC (P < .001). There were positive correlations between SUVmax and Ki-67 (Spearman's rho = 0.240, P = .012), histological grade (Spearman's rho = 0.252, P = .008), and the size of tumor (Spearman's rho = 0.455, P < .001). There were negative correlations between SUVmax and AR (Spearman's rho = -0.215, P = .024) and associated DCIS component (Spearman's rho = -0.261, P = .006). In a multiple regression analysis, the size of tumor (P = .001) was significantly associated with SUVmax.

CONCLUSION

18F-FDG uptake was significantly higher in AR- group than in AR+ group and correlated with larger tumor size in TNBC.

CLINICAL RELEVANCE/APPLICATION

Suspected from SUVmax on PET/CT before biopsy in terms of androgen receptor status could help to expedite management of triple-negative breast cancer.

SSM01-02 Investigation of Breast Cancer Detectability Using Total Breast PET Imager

Wednesday, Dec. 4 3:10PM - 3:20PM Room: E451B

Participants
Suranjana Samanta, BEng,MS, St.Louis, MO (*Presenter*) Nothing to Disclose
Jianyong Jiang, St. Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Alan Register, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Timothy Turkington, PhD, Durham, NC (*Abstract Co-Author*) Consultant, Data Spectrum Corporation
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PURPOSE

Whole-body PET/CT has low sensitivity in the detection of small breast cancers due to its limited image resolution and system sensitivity which led to the development of positron emission mammography(PEM) systems. Most PEM systems employ a planar or a ring geometry to surround a breast. A ring geometry provides high resolution and high sensitivity, but is incapable of imaging the axilla. The planar geometry provides more flexibility in detector placement but has lower sensitivity and image quality. In both cases, the sensitivity of the system approaches zero for tissues near or beyond the chest wall. To overcome this limitation, we propose a novel geometry that can image both breasts with high resolution and sensitivity with an extended imaging field-of-view (FOV) that also includes the entire torso and axilla.

METHOD AND MATERIALS

The scanner consists of a racetrack-like geometry that surrounds two breasts along with a rectangular front panel and a curved back panel. The detectors in the racetrack and front panel consist of 2x2x6 mm3 (double layer DOI) LSO crystals while the back panel consists of 3.95x5.3x25 mm3 LSO crystals. We used GATE to simulate this system and a GPU-based list-mode reconstruction program to characterize the system performance with Time-of-Flight (ToF) information.

RESULTS

The sensitivity images of standard PET system, ring and flat-type PEM systems and our proposed geometry are compared. Body phantom with different tumor sizes and contrast are reconstructed for different systems. Results show superior sensitivity for the latter and demonstrate a large imaging FOV that can detect all lesions with good image quality.

CONCLUSION

The proposed system has high sensitivity and can significantly improve resolution as compared to whole-body PET system and achieve a larger imaging FOV, including the entire torso and axilla, than typical PEM systems. Detailed system design and characteristics will be presented.

CLINICAL RELEVANCE/APPLICATION

Radiotracer-based molecular imaging can complement conventional breast imaging technologies such as mammography and MRI to improve the overall diagnostic accuracy.Total Breast PET Imager offers the benefits of conventional PEM system (high resolution and high sensitivity) and whole-body PET scanner (large imaging FOV) for improved detectability of breast cancer.

SSM01-03 Evaluation of Contrast Enhanced Digital Mammography in the Preoperative Staging of Breast Cancer: Large-Scale Single-Center Experience

Wednesday, Dec. 4 3:20PM - 3:30PM Room: E451B

Participants
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PURPOSE

The aim of this retrospective study was to evaluate the diagnostic performance of Contrast-enhanced Digital Mammography (CEDM) in the preoperative staging of breast cancer and to evaluate the effects of this new technique on the surgical management of all patients and of the various subgroups.

METHOD AND MATERIALS

Data have been collected from a cohort of 326 patients affected by breast cancer who were diagnosed in our department between December 2016 and January 2019. All patients underwent CEDM and subsequent surgical excision (SE). The results of preoperative staging with CEDM and surgical management were correlated with histopathological results, considered as the gold standard. The diagnostic performance of CEDM in the identification of the index lesion and of additional homo and contralateral lesions was evaluated. The authors also analyzed any possible changes in surgical management of the patients due to CEDM findings and the diagnostic performance of CEDM in various subgroups i.e. women with age 50 or less and greater than 51; patients with dense breast (BI-RADS C and D) and non-dense (BI-RADS A and B), palpable index lesion or not.

RESULTS

CEDM sensivity in detecting index cancer was 98.8% (322/326). For detection of secondary cancer in the ipsilateral or contralateral breast CEDM sensivity, specificity, positive and negative predictive values and accuracy were 93%, 98%, 90%, 98% and 97% respectively. The ROC Curve comparing CEDM to the gold standard showed an area under the curve (AOU) of 0.955. CEDM changed type of surgery planned before the examination in 18.4% of the cases, 17,2% of these due to true-positive findings and 2,8% to false-positive findings. CEDM has led to 17,8% of additional biopsies, of these 53,5% proved to be malignant and 46,5% were benign.

CONCLUSION

Cedm has demonstrated a very high diagnostic performance in preoperative breast cancer staging and often leads to a more strict and appropriate surgical planning.

CLINICAL RELEVANCE/APPLICATION

This study supports the Cedm as a promising alternative to magnetic resonance imaging in the surgical planning of patients with breast cancer.

SSM01-04 Contrast-Enhanced Mammography: Does Acquisition Time Matter?

Wednesday, Dec. 4 3:30PM - 3:40PM Room: E451B

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PURPOSE

The technique for contrast enhanced mammography (CEM) was developed based on subtraction angiography and temporal subtraction techniques. Our purpose was to determine at what time points cancers are best visualized on CEM based on already acquired cases, to drive a future larger prospective study refining CEM technique.

METHOD AND MATERIALS

This HIPAA compliant IRB approved reader study included 40 consecutive cancer containing CEM exams from February 17th 2016 to November 8th 2018. Cases were included if cancer was seen on both CC and MLO views, cancer was not yet biopsied, and only up to two sites of cancer were present. Bilateral CC and MLO recombined images were presented side-by-side to 4 fellowship-trained breast imagers. Radiologists provided interpretations of background parenchymal enhancement (BPE) and rated CC and MLO projections for cancer visibility, confidence in margins, and conspicuity of the finding as compared with BPE using a 5-point Likert scale. Objective measure of cancer conspicuity was determined using region-of-interest calculations of cancer versus BPE to determine a contrast-to-noise ratio (CNR).

RESULTS

Data from one reader is available for this abstract. CC views were performed first in all cases. After contrast administration, the median times for the CC and MLO views were 2:20 and 4:25, respectively. 15 patients (37.5%) had low (minimal and mild) BPE and 25 (62.5%) had high (moderate and marked) BPE. Mean visibility difference for CC (4.4 ±0.9) and MLO (4.1 ±1.2) views was significantly significant (p=0.008). Mean confidence in margins for CC (4.2 ±1.3) and MLO (4.0 ±1.3) was not significantly different (p=0.14). Mean conspicuity of cancer relative to BPE for CC (4.3 ±0.9) and MLO (3.9 ±1.2) was significantly different (p=0.002). CNR on CC (mean 3.9, median 3.5) and MLO (mean 4.0, median 3.8) were not significantly different (p=0.89).

CONCLUSION

There is improved cancer visibility and conspicuity of cancer relative to BPE on earlier CC views. This suggests post-contrast images may be optimized by imaging earlier after contrast administration. However, additional reader results are necessary and will be included in this presentation.

CLINICAL RELEVANCE/APPLICATION

There is improved cancer visibility and conspicuity of cancer relative to BPE on earlier CC views. This suggests post-contrast images may be optimized by imaging earlier after contrast administration.

SSM01-05 Are There Differences in 18F-FDG PET-MRI Imaging Biomarkers of Contralateral Healthy Tissue between Patients with Benign and Malignant Breast Lesions?

Wednesday, Dec. 4 3:40PM - 3:50PM Room: E451B

Participants
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PURPOSE

To evaluate whether there are differences in multiparametric 18F-fluorodeoxyglucose positron emission tomography - magnetic resonance imaging (18F-FDG PET-MRI) biomarkers of contralateral healthy breast tissue between patients with benign and malignant breast tumors.

METHOD AND MATERIALS

In this IRB-approved HIPAA-compliant prospective single-institution study, 141 women with imaging abnormality on mammography or sonography (BI-RADS 4/5) were included and underwent combined 18F-FDG PET-MRI of the breast at 3T including dynamic contrast-enhanced MRI (DCE-MRI) and diffusion-weighted imaging (DWI). The following imaging biomarkers were recorded in all patients for the contralateral tumor-free breast: 18F-FDG breast parenchymal uptake (BPU), mean apparent diffusion coefficient (ADCmean), DCE-MRI background parenchymal enhancement (BPE) and amount of fibroglandular tissue (FGT), as well as BPU, BPE and FGT of the ipsilateral diseased breast. Appropriate statistical tests were used to assess differences in imaging biomarkers between patients with benign and malignant lesions.

RESULTS

There were 100 malignant and 41 benign lesions. BPE was minimal in 61, mild in 56, moderate in 19, and marked in 5 patients. BPE differed significantly (P<0.001) between patients with benign and malignant lesions, with patients with cancer showing decreased BPE in the contralateral tumor-free breast. A borderline significant difference was observed for FGT (P=0.055). BPU for patients with mild BPE was 1.5, for mild BPE 1.9, for moderate BPE 2.2, and for marked BPE 1.9. BPU differed significantly between patients with benign (mean, 1.9) and malignant lesions (mean, 1.8) (P<.001). ADCmean did not differ between groups (P=0.19). In both groups, no differences in imaging biomarkers between contralateral healthy and ipsilateral diseased breast were found, excluding a potential stealing phenomenon of the diseased breast with respect to vascularity and metabolic activity.

CONCLUSION

Differences in multiparametric 18F-FDG PET-MRI biomarkers, obtained from contralateral tumor-free breast tissue, exist between patients with benign and malignant breast tumors. Contralateral BPE, BPU, and FGT are decreased in breast cancer patients.

CLINICAL RELEVANCE/APPLICATION

BPE and BPU may potentially serve as imaging biomarkers for the presence and risk of malignancy.

SSM01-06 Evaluation of a Low-Dose Contrast-Enhanced Mammography System Compared to Contrast-Enhanced Breast MRI in the Assessment Setting

Wednesday, Dec. 4 3:50PM - 4:00PM Room: E451B

Participants
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PURPOSE

To evaluate the diagnostic performance of a low-dose contrast enhanced mammography (L-CEM) in women with suspicious findings on conventional imaging, and compare it to contrast-enhanced magnetic resonance imaging (CE-MRI) of the breast.

METHOD AND MATERIALS

The ethics committee approved this prospective, single center study and all patients gave written informed consent. Women with suspicious findings on conventional imaging (mammography, tomosynthesis and ultrasound) and no contraindications for L-CEM or CE-MRI were invited to participate in the study. The L-CEM system performs the acquisition without anti-scatter grid and a sowtware based scattered correction is than applied to the images. Three off-site, blinded readers evaluated the images according to BI-RADS lexicon in a randomized order, each in two separate reading sessions. Histology served as a gold standard. Lesion detection rate, sensitivity, specificity, negative and positive predictive values (NPV, PPV) were calculated and compared with multivariate statistics. Average glandular dose per view was measured (AGD).

RESULTS

Included were 80 patients (mean age 54.3 years, standard deviation 11.2) with 93 lesions (32 benign, 61 malignant). Sensitivity (L-CEM 65.6%-90.2%; CE-MRI 83.6%-93.4%, P=0.086) and NPV (L-CEM 59.6%-71.4%; CE-MRI 63.0%-76.5%, P=0.780) did not differ. Specificity (L-CEM 46.9%-96.9%; CE-MRI 37.5%-53.1, P=0.001) and PPV were significantly higher with L-CEM (L-CEM 76.4%-97.6%; CE-MRI 73.3%-77.3% P=0.007). Detection rate was significantly higher with CE-MRI (92.5%-94.6%) compared to L-CEM (79.6%-91.4%, P=0.014). Variations between readers were significant for sensitivity and NPV, but not for specificity. Accuracy of L-CEM was as good as for CE-MRI (75.3%-76.3% versus 72.0%-75.3%, P=0.514). AGD dose per view ranged according to the breast thickness from 1,074 mGy to 2,49 mGy.

CONCLUSION

L-CEM showed a high sensitivity and accuracy in women with suspicious findings on conventional imaging. Compared to CE-MRI, L-CEM has the potential to increase specificity and PPV. Based on our results, low-dose CEM might help reducing unnecessary follow up and false positive biopsies while increasing cancer detection comparably to CE-MRI.

CLINICAL RELEVANCE/APPLICATION

L-CEM could help reducing unnecessary follow up and false positive biopsies, while increasing cancer detection in an extent

comparable to CE-MRI, with a dose up to 70% less than a full dose CEM.

SSM02

Breast Imaging (Radiomics)

Wednesday, Dec. 4 3:00PM - 4:00PM Room: E451A

AI BR

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

FDA Discussions may include off-label uses.

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Sub-Events

SSM02-01 Radiomics Signatures of DCE-MRI Combined with Clinicopathologic Characteristics for Preoperative Prediction of Axillary Lymph Node Metastasis in Breast Cancer

Wednesday, Dec. 4 3:00PM - 3:10PM Room: E451A

Participants
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PURPOSE

To explore the use of noninvasive dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) and clinicopathologic risk factors based on radiomics for preoperative prediction of axillary lymph node metastasis (ALN) in breast cancer.

METHOD AND MATERIALS

The prediction model was developed in a primary cohort that consisted of 215 patients who was diagnosed with breast cancer(ALN Metastasis (+): 54; ALN Metastasis (-): 161). Radiomic features were extracted from the early and late stage of DCE-MRI of breast cancer. The primary cohort was randomly divided into two independent subsets: a training set (80%, 171 patients with 43 positive SLN) and a validation set (20%, 44 patients with 11 positive SLN). A total of 2058 candidate radiomics features(1029 for each stage) that were extracted from DCE-MRI images of the above two stages. 9 radiomics features were selected from 2058 features using 10-fold cross-validation LASSO model. We incorporated the radiomics signature and independent clinicopathologic risk factors. A random forest classifier was also built using union features. The performance of the classifier was assessed with the area under the ROC curve (AUC), sensitivity, specificity and precision of training set and validation set.

RESULTS

The prediction model using DCE-MRI radiomics alone achieved a AUC of 0.846(95% CI [0.740-0.935]), and the sensitivity, specificity and precision respectively were 0.64, 0.88, and 0.64 in the independent validation set. While the combination of DCE-MRI radiomic features with clinicopathologic characteristics achieved a high AUC of 0.912 (95% CI [0.819-0.979]) in the independent validation set, and the sensitivity, specificity and precision were 0.91, 0.88, and 0.71, respectively, which outperformed the prediction model using DCE-MRI radiomics alone.

CONCLUSION

This study presents a radiomics analysis based on DCE-MRI that incorporates the radiomics signature could be conveniently used to facilitate the preoperative individualized prediction of ALN metastasis in patients with breast cancer, especially when it combines with clinicopathologic characteristics can improved the prediction performance.

CLINICAL RELEVANCE/APPLICATION

The subsequent analysis of radiomics features can provide potential noninvasive biomarkers for clinical-decision support, it may be used to predict the axillary lymph node metastasis of breast cancer before operation.

SSM02-02 Do Preoperative Dynamic Radiomic Features Based on Pharmacokinetic Modeling Dynamic Contrast-Enhanced Magnetic Resonance Imaging Correlate with Prognostic Factors in Breast Cancer?

Wednesday, Dec. 4 3:10PM - 3:20PM Room: E451A

Participants
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PURPOSE

To correlate preoperative dynamic radiomic features based on PK-DCE-MRI with prognostic factors of breast cancer.

METHOD AND MATERIALS

224 patients histopathologically proven breast cancer were retrospectively reviewed. 97 dynamic radiomic features including 22 pharmacokinetic quantitative parameters (Ktrans, Kep and Vp) with corresponding histogram features and 75 texture features were obtained. These features were compared using the Mann-Whitney U-test between every two groups defined of pathologic and immunohistochemical prognostic factors. Binary logistic regressions were applied to classify these prognostic factors, and ROCs were plotted to determine the performance.

RESULTS

4, 21, 4 of 97 radiomic features between DCIS versus IDC, LN metastasis negative versus positive, and histologic grade nonhigh versus high groups were statistically different respectively ($p<0.05$). The sensitivity and specificity of regression models for IDC, LN metastasis positive and histologic grade high identification were 55.2% and 84.2%, 77.5% and 45.9%, 64.7% and 58.7%. 22, 23, 33, 18, 6, 3 of 97 radiomic features were statistically different ($p<0.05$) between ER negative versus ER positive, PR negative versus PR positive, HER2 negative versus HER2 positive, Ki-67 low versus high, EGFR negative versus positive, and CK5/6 negative versus positive groups respectively. The sensitivity and specificity of comprehensive models for ER, PR, HER2, Ki-67, EGFR, CK5/6 identification were 39.9% and 84.8%, 46.1% and 71.1%, 57.8% and 82.1%, 59.6% and 71.7%, 92.3% and 68.2%, 51.5% and 72.2% respectively .

CONCLUSION

Dynamic radiomic features based on PK-DCE-MRI may serve as potential imaging biomarkers for prognosis prediction in breast cancer .

CLINICAL RELEVANCE/APPLICATION

(dealing with Radiomics based on DCE-MRI and breast cancer prognosis prediction) ' Preoperative dynamic radiomic features based on PK-DCE-MRI may serve as potential imaging biomarkers for prognosis prediction in breast cancer.

SSM02-03 Breast Cancer Molecular Subtype Prediction Using Radiomic Signature on Two-Dimensional Synthetic Mammography from Digital Breast Tomosynthesis

Wednesday, Dec. 4 3:20PM - 3:30PM Room: E451A

Participants
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PURPOSE

To predict molecular subtype of breast cancer using radiomic signature extracted from two-dimensional synthetic mammography reconstructed from digital breast tomosynthesis (DBT).

METHOD AND MATERIALS

From December 2015 to July 2016, 150 patients with newly diagnosed pathologically confirmed breast cancer who had undergone preoperative DBT were identified and assigned to the training set. Specifically, 50 consecutive patients were enrolled in the training set for each molecular subtype (luminal A+B, luminal; HER2-positive, HER2; triple negative, TN). A temporally independent validation cohort consisted of consecutive 71 patients with breast cancer between August 2016 and September 2016 (50 luminal, 9 HER2, and 12 TN). Total of 129 radiomic features was extracted from the craniocaudal (CC) and mediolateral oblique (MLO) view of the synthetic mammography. The performances of three binary radiomic classifications for each subtype were measured using the area under the receiver operating characteristic curve (AUC). The radiomic classification model was built using the elastic-net with ten-fold cross-validation and validated in the independent validation cohort.

RESULTS

The three radiomic models were built from the selected 21 features for TN vs non-TN, 19 for HER2 vs non-HER2 and 67 for luminal vs non-luminal. In the training set, the radiomic models yielded an AUC of 0.834 for TN, 0.842 for HER2, and 0.941 for luminal subtypes. In the validation cohort, the radiomic models yielded an AUC of 0.838 for TN, 0.556 for HER2, and 0.645 for luminal subtypes. With the optimal cut-off value of radiomics signature, sensitivity, and specificity of the models in the validation cohort were 83.3% and 79.7% for TN, 11.1% and 79.0% for HER2, 44.0% and 66.7% for luminal subtypes, respectively.

CONCLUSION

The radiomic signature derived from the synthetic mammography from DBT showed high performance in distinguishing between TN and non-TN breast cancer. However, it showed poor performances in distinguishing the other subtypes.

CLINICAL RELEVANCE/APPLICATION

The radiomic signature from the synthetic 2D mammography of the DBT may serve as a biomarker to distinguish TN subtype of breast cancer and may affect the direction of treatment.

SSM02-04 Multiparametric MR Imaging Radiomics Predicts the Recurrence Risks Derived from Oncotype DX Gene Signatures in Estrogen Receptor Positive Breast Cancer

Wednesday, Dec. 4 3:30PM - 3:40PM Room: E451A

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PURPOSE

The Oncotype DX score (ODX) plays a pivotal role for risk stratification in Estrogen receptor (ER) positive breast cancer patients, where only high-risk patients exhibit significant benefit from adjuvant chemotherapy. This study assessed how multiparametric MR imaging radiomics can be used to stratify ER positive breast cancer patients in high versus low (Exp-1), high versus intermediate to low (Exp-2), and low versus intermediate to high (Exp-3) ODX risks, respectively.

METHOD AND MATERIALS

This study was approved by the local IRB and written consent were obtained from 124 ER positive breast cancer patients who underwent research MR imaging. ODX predictors of the primary tumors were obtained from RNA microarray gene assay. Radiomic features were extracted from multiparametric MR images including T1 weighted images (WIs), pharmacokinetic maps derived from a perfusion sequence (4.49sec/phase for 75 phases), T2 WIs (post contrast T2, T2c), and DCE images (90sec/phase for 4 phases). Extreme gradient boosting (XGBoost) was used for the three prediction tasks (Exp 1 - 3). Leave-one-out cross validation and area under the receiver operating characteristic curve (AUC) were conducted to access classification performance.

RESULTS

There were 51 low, 26 intermediate, and 47 high ODX risk patients. Among all different combinations of sequences, T2c+DCE achieves the highest AUC for Exp-1 (0.83, 95%CI: 0.75-0.91), and Exp-2 (0.78, 95%CI: 0.69-0.85), respectively, whereas T2c yields the highest AUC for Exp-3 (0.74, 95%CI: 0.65-0.83). These results underscore the importance of T2c+DCE for stratifying high-risk from either low or intermediate/low-risk patients. In contrast, T2c alone enables the best prediction of low-risk from intermediate to high risk patients. The identified important features for risk stratification include T2 max signal, early and delayed enhancement texture. Comparing to previously reported results where only DCE was employed, adding T2c features improve the prediction performance of AUC by 11-15% in risk prediction.

CONCLUSION

Multiparametric MR radiomics with T2c and DCE sequences shows promise for recurrence risk prediction in ER positive breast cancer patients.

CLINICAL RELEVANCE/APPLICATION

In addition to DCE features, the inclusion of features extracted from T2W images further improve recurrence risk prediction in ER positive breast cancer patients.

SSM02-05 Diagnosis of Benign and Malignant Breast Lesions on DCE-MRI Using Radiomics and Deep Learning with Peri-Tumor Tissue

Wednesday, Dec. 4 3:40PM - 3:50PM Room: E451A

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PURPOSE

To evaluate the diagnostic accuracy of lesions detected on DCE-MRI using ROI-based, radiomics and deep learning methods considering peri-tumor tissues.

METHOD AND MATERIALS

Retrospective cases from 91 malignant and 62 benign lesions were used for training. Fuzzy-C-means clustering and region growing were applied for tumor segmentation, and from which the tumor volume and mean DCE parameters were measured. DCE contained 6 frames, and three parametric maps (F2-F1, F3-F1, and F6-F3) were generated. A total of 99 texture and histogram parameters were calculated for each case, and 15 were selected using random forest to build a radiomics model. Deep learning was

implemented using ResNet50, evaluated with 10-fold cross-validation in training set. The tumor alone, smallest bounding box, and 1.2, 1.5, 2.0 times enlarged boxes were used as inputs to investigate the diagnostic impact of peri-tumor tissue. ROC curve was generated based on the predicted per-slice malignancy probability. For per-lesion diagnosis, the highest probability among all slices of one lesion was used. The developed models from the training set were tested in prospective cases collected in recent 6 months (48 malignant, 26 benign). In addition, T2 was used to replace F3-F1 in ResNet to investigate its diagnostic role.

RESULTS

The diagnostic accuracy was 76% using ROI-based, 84% using radiomics, and 86% using ROI+radiomics models. In deep learning using per-slice basis, the AUC was comparable for tumor alone, smallest and 1.2 times box (0.97-0.99), significantly higher than 1.5 and 2.0 times box (0.86 and 0.71, $p < 0.001$). For per-lesion diagnosis, the highest accuracy of 91% was achieved when using the smallest bounding box. The accuracy in the testing dataset were worse in per-slice basis, but when the results were combined to give per-lesion diagnosis, the accuracy only decreased slightly to 89%. When replacing F3-F1 with T2, the specificity was improved from 81% to 85%, and accuracy to 91%.

CONCLUSION

Deep learning using ResNet50 achieved a high diagnostic accuracy. Including small amount of peri-tumor tissue adjacent to tumor led to a higher accuracy compared to using tumor alone or larger boxes.

CLINICAL RELEVANCE/APPLICATION

Deep learning using ResNet algorithm by including adjacent peri-tumor tissue as input yielded a high differential diagnostic accuracy around 90%, and when T2 was considered specificity was improved.

SSM02-06 Quantitative versus Qualitative Ultrasonographic Feature Analysis in Associating with Clinicopathological and Immunohistochemical Characteristics of Triple-Negative Invasive Breast Carcinomas

Wednesday, Dec. 4 3:50PM - 4:00PM Room: E451A

Participants
Jiawei Li, PhD,MD, Shanghai, China (*Presenter*) Nothing to Disclose
Zhou Fang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Jin Zhou, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Cai Chang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Yi Guo, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Yuanyuan Wang, PhD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Ultrasonographic features are associated with clinicopathological and immunohistochemical characteristics of triple-negative breast cancer (TNBC). To predict the biological property of TNBC, the performance using quantitative high-throughput sonographic feature analysis was compared with that using qualitative feature assessment.

METHOD AND MATERIALS

We retrospectively reviewed ultrasound images, clinical, pathological and immunohistochemical data of 156 patients who were pathologically diagnosed as TNBC. According to the histological grade, Ki67 expression level and human epidermal growth factor receptor 2 (HER-2) score, all patients were divided to two groups. The qualitative sonographic features assessment included shape, margin, posterior acoustic pattern and calcification based on the Breast Imaging Reporting and Data System (BI-RADS). Quantitative sonographic features were acquired based on the computer aided radiomics analysis. The breast cancer masses were automatically segmented from the surrounding breast tissues by deep convolution neural network. From each ultrasound image, 460 radiomics features in terms of intensity, morphology, texture and wavelet decomposition were extracted. As shown in Figure 1, sparse representation and support vector machine (SVM) were used to determine the high-throughput sonographic features that were highly correlated to clinicopathological and immunohistochemical data of TNBC. The performance using sonographic features to predict biological property of TNBC was represented by area under curve (AUC) of the receiver operating characteristic (ROC) curve.

RESULTS

In the qualitative assessment, regular tumor shape, no angular or spiculated margin, posterior acoustic enhancement and no calcification were used as the independent sonographic features for TNBC. Using the combination of these four features to predict the histological grade, Ki67, and HER2, the AUC was 0.678, 0.717 and 0.668, respectively. The number of high-throughput features that are highly associated with biological properties was 40 for histological grade (AUC 0.794), 60 for Ki67 level (AUC 0.882), and 125 for HER2 score (AUC 0.978).

CONCLUSION

High-throughput ultrasonographic features are superior to qualitative ultrasound features in predicting biological behavior of TNBC.

CLINICAL RELEVANCE/APPLICATION

High-throughput ultrasonographic features have the potential to differentiate TNBCs with aggressive biological property.

VW58

ABUS in China: Progress on the Multicenter Study: Presented by GE Healthcare

Wednesday, Dec. 4 3:00PM - 3:30PM Room: South Building, Booth 5135

Participants

Mengmeng Jia, Beijing, China (*Presenter*) Research support, General Electric Company

Program Information

A multicenter hospital-based study was conducted in China to evaluate the diagnostic performance of automated breast ultrasound system (ABUS) for breast cancer diagnosis, by comparing with hand-held ultrasound and mammography. Based on the promising results from this study, a screening study was proposed. In this lecture, the speaker will introduce the results of the diagnostic study, and report the progress of the ongoing screening project. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

VW101

DBT Based on Clinical Evidence (Session in SPANISH): Presented by FUJIFILM Medical Systems U.S.A., Inc.

Wednesday, Dec. 4 4:00PM - 5:00PM Room: South Building, Booth 5147

Participants

Javier A. Romero, MD, Bogota, Colombia (*Presenter*) Speakers Bureau, Novartis AG Speakers Bureau, Bristol-Myers Squibb Company

Program Information

Desde su aprobación por FDA en 2011, las publicaciones sobre los beneficios de la tomosíntesis son sustanciales. El incremento en la detección de cáncer invasivo y la disminución en el rellamado han sido suficientemente evaluados, además su aplicación en evaluación de asimetrías, distorsiones de la arquitectura mamaria, evaluación de masas, localización de lesiones, disminución en proyecciones adicionales tienen gran impacto en la práctica diaria. Revisaremos casos de estas aplicaciones y revisión de la literatura.

Printed on: 10/29/20

VW59

Advancing Breast Care Globally with ABUS through Clinical Research: Presented by GE Healthcare

Wednesday, Dec. 4 4:00PM - 5:00PM Room: South Building, Booth 5135

Participants

Tanya M. Carrillo, BA, Wauwatosa, WI (*Moderator*) Nothing to Disclose
Georgia Giakoumis-Spear, MD, Evanston, IL (*Presenter*) Nothing to Disclose
Robert M. Nishikawa, PhD, Pittsburgh, PA (*Presenter*) Royalties, Hologic, Inc; Research Grant, Hologic, Inc; Research Consultant, iCAD, Inc; Research Grant, Koios Medical; Research Grant, General Electric Company
Nisha Sharma, MBChB, Leeds, United Kingdom (*Presenter*) Nothing to Disclose
Mengmeng Jia, Beijing, China (*Presenter*) Research support, General Electric Company

Program Information

This session will provide an overview of current GE ABUS research projects. Participants will have an opportunity to hear from current research principal investigators (PI) who will discuss their study objectives and status of their respective projects including: Implementation of Invenia ABUS (Automated Whole Breast Ultrasound) at NorthShore University HealthSystem, A prospective study evaluating efficacy of ABUS as an adjunctive screening modality for the detection of breast cancerThe Effect of Priors on the Recall Rate in Breast Cancer, The Effect of Priors on the Recall Rate in Breast Cancer Screening with Invenia, Role of ABUS as an alternative to breast MRI in assessing response to neoadjuvant chemotherapy, and Exploration on the possibility of applying Automated Breast Ultrasound System (ABUS) to population-based breast cancer screening. There will also be a discussion concerning the current challenges in breast care that use of ABUS may help solve as well as adoption opportunities. Opportunities for participation in GE Sponsored Research projects will also be reviewed. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

ED001-TH

Breast Thursday Case of the Day

Thursday, Dec. 5 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
Jody C. Hayes, MD, Southlake, TX (*Abstract Co-Author*) Nothing to Disclose
Stephen J. Seiler, MD, Dallas, TX (*Abstract Co-Author*) Consultant, Delphinus Medical Technologies, Inc; Consultant, Seno Medical Instruments, Inc
Natalie G. Stratemeier, MD, Oklahoma City, OK (*Abstract Co-Author*) Nothing to Disclose
Meghan Woughter, MD, Temple, TX (*Abstract Co-Author*) Spouse, Vice President, nThrive, Inc
Oyindamola Akinseye, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Susan O. Holley, MD,PhD, Raleigh, NC (*Abstract Co-Author*) Nothing to Disclose
Ronald J. Dolin, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Dayna Levin, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Shannon Lanzo, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Sean A. Maratto, MD, Philadelphia, PA (*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.

RC615

Tomosynthesis: Case-based Interactive Challenge (Interactive Session)

Thursday, Dec. 5 8:30AM - 10:00AM Room: E350

BR

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

Participants
Liane E. Philpotts, MD, Madison, CT (*Moderator*) Consultant, Hologic, Inc

For information about this presentation, contact:

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zuleyml@upmc.edu

Special Information

This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

LEARNING OBJECTIVES

1) Understand how to deal with the increased information provided in digital breast tomosynthesis exams while optimizing workflow. 2) Appraise DBT artifacts. 3) Recognize potential pitfalls in DBT interpretation.

ABSTRACT

Using interactive cases, various aspects of digital breast tomosynthesis mammography will be presented to highlight tips in interpretation, optimize workflow, and reduce errors by recognizing pitfalls.

Sub-Events

RC615A The '3-D's' of Tomosynthesis: Density, Dots, and Distortions

Participants
Michael N. Linver, MD, Alexandria, VA (*Presenter*) Medical Advisory Board, Three Palm Software; 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) Appreciate the added value of Tomosynthesis in the detection of subtle breast cancers. 2) Assess the advantages and shortcomings of Tomosynthesis in the evaluation of breast calcifications. 3) Discern the value of Tomosynthesis in eliminating unnecessary recalls of areas of dense tissue seen on screening mammograms.

RC615B Understand the Artifacts and Optimize Your Workflow

Participants
Sarah M. Friedewald, MD, Chicago, IL (*Presenter*) Consultant, Hologic, Inc; Research Grant, Hologic, Inc;

RC615C Pitfalls in Interpretation

Participants
Liane E. Philpotts, MD, Madison, CT (*Presenter*) Consultant, Hologic, Inc

For information about this presentation, contact:

liane.philpotts@yale.edu

LEARNING OBJECTIVES

1) Reduce perceptual errors in DBT. 2) Accurately localize lesions on tomosynthesis. 3) Differentiate architectural distortion from pseudo-architectural distortion. 4) Analyze fat-containing lesions.

VW32

AI-based Mammography Reading: Self-guided Reading Session: Presented by Siemens Healthineers

Thursday, Dec. 5 10:15AM - 2:00PM Room: North Building, Booth 8563

Program Information

You will learn about the benefits of the AI-based Transpara™* decision-support tool from ScreenPoint Medical. It has been integrated with the advanced visualization software *syngo*. Breast Care* to support 2D and 3D mammography reading. Together, they provide interactive decision support with an overall exam score to help prioritize reading. **syngo*.Breast Care VB40 and Transpara™ for 3D are currently under development; they are not for sale in the U.S. Their future availability cannot be guaranteed. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP

https://www.fairorg.de/Siemens-Healthineers/portal/workshop.cfm/rsna19/

Printed on: 10/29/20

VW33

50° Wide-angle Tomosynthesis and Contrast-enhanced Mammography Self-guided Reading Sessions: Presented by Siemens Healthineers

Thursday, Dec. 5 10:15AM - 2:00PM Room: North Building, Booth 8563

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 challenging cases with a solution enables you to develop and test your reading skills. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP

https://www.fairorg.de/Siemens-Healthineers/portal/workshop.cfm/rsna19/

Printed on: 10/29/20

AI51

AI Theater: The Economic Impact of AI on Mammography-The MD Anderson Experience: Presented by CureMetrix

Thursday, Dec. 5 10:30AM - 10:50AM Room: AI Showcase, North Building, Level 2, Booth 10724

Participants

Ray C. Mayo III, MD, Houston, TX (*Presenter*) Nothing to Disclose
Alyssa T. Watanabe, MD, Manhattan Beach, CA (*Presenter*) Consultant, CureMetrix, Inc

Program Information

Based on recently published studies by MD Anderson Cancer Center and CureMetrix this presentation will highlight how artificial intelligence (AI) has improved workflow, reduced false-positives and improved cancer detection to make a clinical and economic impact on the mammography practice.

Printed on: 10/29/20

SSQ01

Breast Imaging (Radiomics and Radiogenomics)

Thursday, Dec. 5 10:30AM - 12:00PM Room: S406B

AI BR

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

Participants
Katja Pinker-Domenig, MD, New York, NY (*Moderator*) Speakers Bureau, Siemens AG ; Advisory Board, Merantix Healthcare GmbH
Stamatia V. Destounis, MD, Scottsville, NY (*Moderator*) Advisory Committee, Hologic, Inc; Medical Advisory Board, iCad, Inc

Sub-Events

SSQ01-01 Radiomics Analysis of Textural Kinetics Features and Enhancement Parameters for Prediction of the Malignity in an Ultrafast Breast DCE-MRI Sequence

Thursday, Dec. 5 10:30AM - 10:40AM Room: S406B

Participants
Saskia Vande Perre, Paris, France (*Presenter*) Nothing to Disclose
Loic Duron, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Audrey Milon, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Julie Poujol, PhD, Vandoeuvre-les-Nancy, France (*Abstract Co-Author*) Employee, General Electric Company
Daniel Balvay, DiplPhys, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Laure S. Fournier, MD,PhD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Isabelle Thomassin-Naggara, MD, Paris, France (*Abstract Co-Author*) Researcher, General Electric Company; Research funded, General Electric Company; Researcher, Canon Medical Systems Corporation; Research funded, Canon Medical Systems Corporation; Research funded, Hologic, Inc; Research funded, Siemens AG; Research funded, Guerbet SA

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PURPOSE

To evaluate the performance of radiomic analysis of ultrafast breast MR sequence to distinguish benign from malignant breast lesions.

METHOD AND MATERIALS

117 women (mean age= 54 years old (28-88)) who underwent breast MRI including ULTRAFAST sequence between July 18th 2016 and March 31st 2017 in whom an abnormal enhancing lesion was identified with subsequent pathological analysis (n=174: 68 benign, 7 borderline and 99 malignant lesions) were retrospectively and consecutively included. Two readers classified lesions according to the Breast Imaging Reporting And Data System (BIRADS) on a FAST protocol (T1W, T2W, T1W-fat saturated 2min after injection) and a FULL standard protocol. They independently determined if any lesion was visible on the ultra-fast sequence and what was its time to Enhancement (TTE). Semi-quantitative enhancement parameters were extracted using the Matlab software (n=7) and texture parameters (n=57) and their temporal evolution across each phase of the ULTRAFAST sequence (n=11) (kinetic texture parameters) were calculated using Pyradiomics. Statistical analysis by LASSO-logistic regression and cross validation were performed to build a model.

RESULTS

Regression analysis selected 15 significant variables in a radiomic model named malignant probability score which displayed an AUC=0.876 (Sensitivity (Se) =0.98, Specificity (Spe)= 0.52 Accuracy (Acc) =0.78). An Abbreviated protocol combing FAST analysis, TTE and the malignant probability score increases the diagnostic performance (AUC= 0.882, Se=0.95 , Sp=0.64, Acc=0.82) compared to the BI-RADS from FULL protocol (AUC=0.831, Se=0.98, Sp=0.17 , Acc=0.63) and from FAST protocol (0.800, Se=0.92, Sp=0.28, Acc=0.64).

CONCLUSION

A model based on radiomics parameters including kinetic texture parameters extracted from an ULTRAFAST sequence reach better diagnostic performance than BI-RADS on FAST or FULL standard protocol.

CLINICAL RELEVANCE/APPLICATION

Radiomic analysis on early MR enhancement improves BI-RADS classification on an abbreviated protocol (ULTRAFAST + FAST) and overtakes BI-RADS classification on conventional FULL protocol or FAST protocol..

SSQ01-03 To Develop a Radiomic Nomogram from Multi-Parametric MRI for the Prediction of Breast Cancer

Thursday, Dec. 5 10:50AM - 11:00AM Room: S406B

Participants
Weijing Tao, Nanjing, China (*Presenter*) Nothing to Disclose
Lun Zhao, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

Xiuli Li, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Guangming Lu, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To develop a radiomic nomogram from multi-parametric MRI for the prediction of breast cancer..

METHOD AND MATERIALS

This study involved 200 patients with 211 lesions (145 malignant lesions and 66 benign lesions), who underwent multi-parametric MRI examine including non-enhanced and enhanced T1WI, T2WI, diffusion weighted imaging (DWI) and pharmacokinetic dynamic contrast enhanced magnetic resonance imaging (DCE-MRI) before surgery or puncture. Apparent diffusion coefficient (ADC) map in DWI and quantitative parameter (Ktrans, Kep, Ve, and Vp) maps in pharmacokinetic DCE-MRI were used. Region of interests (ROIs) were sketched in enhanced T1WI map and mapped to other maps in every slice of lesions. A total of 1132 radiomic features were extracted from each MRI parameter map. The radiomic features were further selected and classified by support vector machine (SVM) and logistic regression. Radiomic models were constructed via 10 times 5-folds cross-validation and valuated with the receiver operating characteristic (ROC) curves. The optimal radiomic model was selected by comparing the area under ROC curve (AUC) values of each single and joint parameter. The nomogram based on the optimal radiomics model was built to assess risk of breast cancer in patients.

RESULTS

AUC values of radiomic models of non-enhanced T1WI, enhanced T1WI, T2WI, ADC, Ktrans, Kep, Ve, and Vp maps were 0.79, 0.81, 0.84, 0.83, 0.86, 0.80, 0.78 and 0.82 respectively in diagnosis of breast cancer. The radiomic model of combination of Ktrans, T2WI and ADC maps was considered as the optimal model with an AUC of 0.88. The radiomic nomogram was built from Ktrans, T2WI and ADC to predict malignant risk of breast lesions.

CONCLUSION

Radiomic nomogram based on multi-parametric MRI could be used to predict risk of breast cancer for every patient, and will be beneficial to improve the accuracy of breast cancer diagnosis preoperatively.

CLINICAL RELEVANCE/APPLICATION

The optimal model was constructed by combining radiomic features of Ktrans, T2WI and ADC maps. The nomogram of optimal radiomic model could help to predict malignant risk of breast lesions in clinical.

SSQ01-04 Assessment of Continuous Learning on Radiomic Analysis of Breast Lesions on a Large Clinical DCE-MRI Dataset

Thursday, Dec. 5 11:00AM - 11:10AM Room: S406B

Participants
Hui Li, PHD, Chicago, IL (*Presenter*) 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
Wenjuan Ma, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Peifang Liu, MD, PhD, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Maryellen L. Giger, PhD, Chicago, IL (*Abstract Co-Author*) Advisor, Qlarity Imaging; 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:

huili@uchicago.edu

PURPOSE

To assess the robustness of AI (radiomics with machine learning) analysis methods on MRI examinations in the task of distinguishing malignant from benign breast lesions with continuous learning using augmented training datasets.

METHOD AND MATERIALS

Study included a total of 1979 breast MRI examinations performed within 2015, 2016, and 2017, retrospectively collected under a HIPAA-compliant, IRB approved protocol with1483 malignant and 496 benign lesions based on histopathological testing. The three years of data contained unique patients (no overlap between the years) with average clinical characteristics of 45.8, 46.5, 47.7 years in age, and 1.8, 1.8, 1.7 cm in size. AI radiomic analyses of each lesion included: automatic lesion segmentation, automated extraction of 38 radiomic features, and machine learning classification using support vector machine analysis. Independent training and testing was performed to assess the performance of multiple learning stages on breast lesion classification. Three classification tasks to mimic the clinical setting were performed to evaluate the robustness of continuous AI learning by examining various training:testing dataset arrangements: (1) 2015 cases: 2016 cases, (2) 2015 cases: 2017 cases, and (3) 2015+2016 cases: 2017 cases, respectively, with the latter two serving as an example of a yearly-based continuous learning scenario. Area under the ROC curve (AUC) was used as the figure of merit to assess the classifier performance for all lesions as well as only mass lesions and only non-mass lesions.

RESULTS

AUC values for the three training:testing datasets were 0.88, 0.88, and 0.89, respectively, showing initial high performance and slight improvement with additional training. For masses and non-mass lesions within the three training:testing datasets, AUCs of 0.87, 0.87, and 0.88 and of 0.90, 0.89, 0.90, were obtained, respectively.

CONCLUSION

Statistically improved classification performance was observed with continuous learning using the yearly-augmented datasets. Further study with a larger multi-institutional dataset and smaller learning increments are needed to validate the findings from this study.

CLINICAL RELEVANCE/APPLICATION

The continuous learning of machine learning in radiomic analysis for the classification performance using augmented datasets showed potential to yield improved performance and to be adopted in clinical setting.

SSQ01-05 MRI Background Parenchymal Enhancement (BPE) are Associated with Breast Cancer Recurrence Risk and Metastasis

Thursday, Dec. 5 11:10AM - 11:20AM Room: S406B

Awards
Trainee Research Prize - Fellow

Participants
Dooman Arefan, PhD, Pittsburgh, PA (*Presenter*) Nothing to Disclose
Ruimei Chai, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
Lei Zhang, PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Margarita L. Zuley, MD, Pittsburgh, PA (*Abstract Co-Author*) Investigator, Hologic, Inc
Wendie A. Berg, MD, PhD, Gibsonia, 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

For information about this presentation, contact:

wus3@upmc.edu

PURPOSE

Breast tumor-derived radiomic features in breast DCE-MRI have been shown associated with prognosis. DCE-MRI background parenchymal enhancement (BPE) has been reported as a risk marker for breast cancer mainly studied in screening populations. We investigated roles of BPE quantified in cancer-affected breasts in association with breast cancer distant recurrence risk (via Oncotype DX) and breast cancer axillary lymph node (ALN) metastasis.

METHOD AND MATERIALS

A retrospective IRB-approved study was conducted on two independent cohorts of totally 244 breast cancer patients (all unilateral and confirmed by pathology). Cohort I had 127 ER+ and Node- invasive breast cancer patients who had Oncotype DX scores available, while Cohort II had 117 invasive breast cancer patients who had ALN metastasis status available. Tumors were segmented in 3D space on the affected breasts using an interactive MRI segmentation software by an experienced radiologist, and DCE-MRI-based radiomic features (i.e., morphological, texture and contrast enhancement kinetics) were extracted from the segmented tumors. On the tumor-excluded whole breast region, previously validated automated computer algorithms were applied to quantify the absolute volume of BPE and its relative amount over the whole-breast volume, at three different enhancement ratio cut-offs (i.e., 20%, 30%, and 40%). A linear discriminant analysis model with typical feature selection was used to classify 1) High vs Low+Intermediate Oncotype risk categories on Cohort I and 2) ALN metastasis positive vs negative on Cohort II, on tumor-based radiomics alone, BPE measures alone, and their combination. AUC and accuracy were performance metrics.

RESULTS

Tumor-based radiomic model's AUC was 0.76 and 0.88 for Oncotype DX and ALN classification, respectively, while the corresponding AUC was 0.75 and 0.82 on using BPE alone. When combining radiomics and BPE, the corresponding AUC increased to 0.82 and 0.92, respectively, and accuracy increased to 0.80 from 0.76 (Oncotype) and to 0.92 from 0.83 (ALN).

CONCLUSION

Quantitative BPE is associated with breast cancer distant recurrence risk and ALN metastasis and it can enhance the classification when combined with tumor-derived radiomics.

CLINICAL RELEVANCE/APPLICATION

DCE-MRI BPE measures quantified in cancer-affected breasts may provide additional complementary information over tumor-derived radiomics to enhance breast cancer prognosis assessment.

SSQ01-06 Characterization of Breast Lesions by 4D Radiomics of Dynamic Contrast-Enhanced Breast MRI Data

Thursday, Dec. 5 11:20AM - 11:30AM Room: S406B

Participants
Claudia Sodano, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Matthias Dietzel, MBA,MD, Erlangen, Germany (*Presenter*) Nothing to Disclose
Panagiotis Kapetas, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Thomas H. Helbich, MD, Vienna, Austria (*Abstract Co-Author*) Research Grant, Medicor, Inc ; Research Grant, Siemens AG ; Research Grant, C. R. Bard, Inc; Research Grant, Guerbet SA; Research Grant, Novomed GmbH
Pascal A. Baltzer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate a temporally and spatially-resolved (4D) radiomics approach on dynamic contrast enhanced (DCE) breast MRI images to

distinguish benign from malignant enhancing breast lesions.

METHOD AND MATERIALS

This retrospective study was approved by the local IRB and informed consent was waived. Consecutive patients with mammographic or US suspicious findings underwent 1.5T breast MRI according to international recommendations (EUSOMA, EUSOBI, ACR). Eligible for this study were lesions with a histologically proven diagnosis by image-guided biopsy. Two blinded readers, supervised by an experienced breast radiologist analyzed all DCE using a commercially available software. This software extracts BI-RADS derived and pharmacokinetic enhancement features (Tofts model) in a voxel-wise manner. The raw data were extracted and further analyzed by principal component analysis (PCA) and artificial neural networks (ANN, multilayer perceptron). The diagnostic accuracy of the extracted features was measured by the area under the receiver operating characteristics curve (AUC).

RESULTS

470 (295 malignant, 175 benign) lesions in 329 patients (mean age 55.3 years, range 15-83) were examined. 72 DCE features were extracted based on automated volumetric lesion analysis. Five independent component features were extracted using PCA; the AUC to differentiate benign from malignant lesions ranged between 0.579-0.799. ANN using a split sample approach (70% training and 30% validation sample) combined these features into a predictive model revealing an AUC of 0.836 (95%-CI 0.799-0.868).

CONCLUSION

The investigated automated 4D Radiomics approach revealed a high diagnostic ability to distinguish between benign and malignant lesions without requiring subjective reader interpretation.

CLINICAL RELEVANCE/APPLICATION

The application of computer aided interpretation of breast MRI images may reduce the workload of radiologists, thereby reducing the overhead associated with breast MRI acquisition and interpretation.

SSQ01-07 Quantitative MRI Radiomics in the Task of Predicting Molecular Classification of Invasive Breast Cancers in a Large Clinical Dataset from China

Thursday, Dec. 5 11:30AM - 11:40AM Room: S406B

Participants
Yu Ji, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Hui Li, PHD, Chicago, IL (*Presenter*) 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
Wenjuan Ma, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Peifang Liu, MD, PhD, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Maryellen L. Giger, PhD, Chicago, IL (*Abstract Co-Author*) Advisor, Qlarity Imaging; 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

PURPOSE

To evaluate the potential of quantitative MRI radiomics in the task of predicting molecular classification of invasive breast cancers in a large clinical dataset from China.

METHOD AND MATERIALS

Our research involved a retrospectively acquired clinical DCE-MRI database of 998 invasive breast cancers. Immunohistochemistry molecular classification was performed including estrogen receptor, progesterone receptor, human epidermal growth factor receptor 2, and Ki-67, the molecular subtype (luminal A, luminal B, HER2-enriched, and triple-negative). The average age of the patients were 48.4 years with a standard deviation 9.6 years. Once each tumor was indicated to our radiomics workstation, the machine learning algorithm automatically segmented and extracted radiomic features on the primary tumor, including those from six categories: size, shape, morphology, enhancement texture, kinetics, and enhancement-variance kinetics. Within 5-fold cross validation, feature selection and classification with linear discriminant analyses was conducted. Performance of the classifier model for molecular subtyping was evaluated using receiver operating characteristic analysis.

RESULTS

The resulting radiomic tumor signatures from the radiomics classifier yielded AUC values of 0.75 (se = 0.08), 0.72 (se = 0.05), and 0.76 (se = 0.09) in the tasks of distinguishing between luminal A/luminal B vs. HER2-enriched, luminal A/luminal B vs. triple negative, and HER2-enriched vs. triple negative, respectively. Luminal A/luminal B tumors exhibited smaller sizes as compared to HER2-enriched tumors and higher irregularity compared to triple negative tumors. HER2-enriched tumors showed more irregularity than triple negative tumors.

CONCLUSION

Quantitative MRI radiomics demonstrated promising classification performance in predicting molecular classification of invasive breast cancers in a large clinical dataset from China.

CLINICAL RELEVANCE/APPLICATION

Our computerized radiomic analysis method has potential to yield a quantitative predictive signature for advancing precision medicine.

SSQ01-08 Radiomics of Triple-Negative Breast Cancer: Prediction of Systemic Recurrence

Thursday, Dec. 5 11:40AM - 11:50AM Room: S406B

Participants

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PURPOSE

To predict and validate the systemic recurrence free survival of triple-negative breast cancer (TNBC) with radiomics of preoperative breast MRI

METHOD AND MATERIALS

This IRB-approved retrospective study included 231 TNBCs. Radiomics analysis was performed for TNBCs on the preoperative subtracted constrast-enhanced breast MRI. Rad score was generated from the radiomic features. Patients were assigned as the training set (n=182, GE scanner) and the validation set (n=49, Philips scanner). Uni- and multivariate Cox proportional hazard regression was performed for the features to predict the systemic recurrence. External validation with the validation set was performed with the selected features chosen from the multivariate analysis, and C-index was calculated.

RESULTS

Systemic recurrence was observed in 22 (9.5%) cases (training set, n=19; validation set, n=3); among these, 9 died from the recurrence (training set, n=7; validation set, n=2). The rad score was generated with 32 radiomics features. In the training set, the Rad score was significantly higher in the group with systemic recurrence (median, -8.430; interquartile range (IQR), -8.800 to -8.259) than the group without recurrence (median, -9.873; IQR, -10.226 to -9.468, P<0.001). On univariate analysis, pathologic invasive cancer size, lymphovascular invasion status, surgery type, number of metastatic axillary lymph node, and Rad score were significantly associated with the systemic recurrence. Multivariate analysis was performed with the pathologic invasive cancer size, lymphovascular invasion status, surgery type, number of metastatic axillary lymph node, and Rad score, and lymphovascular invasion (P=0.015) and Rad score (P<0.001) remained statistically significant. The C-index predicting the systemic recurrence of the training set with selected five variables was 0.97. When the model was validated with the validation set, the C-index was 0.848.

CONCLUSION

Radiomics of preoperative breast MRI could be used to predict the systemic recurrence of TNBC and the validation showed the compatible result.

CLINICAL RELEVANCE/APPLICATION

Radiomics of preoperative breast MRI could be used to predict the systemic recurrence of TNBC and the validation showed the compatible result.

SSQ01-09 Radiomics of Breast MRI and 18F-FDG PET/CT as a Prognostic Criteria of Invasive Breast Cancer of No Special Type

Thursday, Dec. 5 11:50AM - 12:00PM Room: S406B

Participants
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PURPOSE

Breast cancer is a heterogeneous group of tumors with a different prognosis. Nottingham Prognostic Index (NPI) and molecular subtypes of primary tumors are used for predicting patient outcomes. The aims of this study were: - to explore the presence of correlation between apparent diffusion coefficient (ADC), perfusion enhancement integral (PEI) and standardized uptake value (SUV) values and pathological prognostic factors such as Ki-67 and molecular type; - to identify the associations between ADC, PEI and SUVmax values and NPI prognostic groups; - to consider the viability of using DWI and 18F-FDG PET/CT for risk stratification.

METHOD AND MATERIALS

64 patients (mean age 54.1) with invasive breast carcinoma (IBC) were recruited into a retrospective study. Breast MRIs including DWI with ADC maps, DCE perfusion PEI maps and 18F-FDG PET/CT were made with an interval between studies not exceeding 2 weeks. Mean and minimal ADC values, mean PEI and SUVmax of breast tumors were measured. All patients were divided into three risk groups according to NPI and four (luminal A, luminal B, HER2+ and triple-negative) molecular types groups. For assessment of possible association between ADC, SUVmax, PEI and Ki-67 Spearman's correlation coefficient was used. Kruskall-Wallis test was applied for comparison ADCmean, ADCmin, PEImean and SUVmax means in molecular types and NPI prognostic groups.

RESULTS

Negative intermediate correlation between ADCmin, ADCmean values and Ki-67 was revealed. There were statistically significant differences between mean SUVmax and PEImean in NPI prognostic groups and mean ADC values in molecular type groups. Mean ADC values for Luminal A tumors were statistically significant higher than for Luminal B (P=0.02) and triple negative (P=0.039) types. Also, there were significant differences between means SUVmax in tumors with different grade and means ADCmin and PEImean for different stages of regional lymph node metastatic disease.

CONCLUSION

SUVmax, PEI and ADC correlated with prognostic factors and may be used for predicting the prognosis of breast cancer. ADC value can be used as in vivo marker of invasive breast cancer molecular type.

CLINICAL RELEVANCE/APPLICATION

Although the use of SUVmax, ADC and PEI as potential in vivo markers of survival cannot yet replace biopsy, the perspective of a

dynamic assessment of changes in the molecular status of a tumor and metastasis during treatment is of interest.

Printed on: 10/29/20

SSQ14

Nuclear Medicine (Breast/General Oncology Nuclear Medicine and PET)

Thursday, Dec. 5 10:30AM - 12:00PM Room: S402AB

BR MR NM OI

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

Participants
Amy M. Fowler, MD,PhD, Madison, WI (*Moderator*) Institutional research support, General Electric Company; Author with royalties, Reed Elsevier
Bital Savir-Baruch, MD, Atlanta, GA (*Moderator*) Research Grant, Blue Earth Diagnostics Ltd; Consultant, Blue Earth Diagnostics Ltd

Sub-Events

SSQ14-01 Can We Replace Sentinel Lymph Node Resection in Breast Cancer Patients by Breast MRI, Axillary MRI, Axillary 18F-FDG PET/MRI or Axillary Sonography?

Thursday, Dec. 5 10:30AM - 10:40AM Room: S402AB

Participants
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Lino Sawicki, MD, Dusseldorf, Germany (*Presenter*) Nothing to Disclose

PURPOSE

To compare the diagnostic performance of Mamma-MRI, axillary MRI, axillary 18F-FDG PET/MRI and axillary sonography in the detection of lymph node metastases in patients suffering from breast cancer.

METHOD AND MATERIALS

56 female patients with breast cancer (mean age 53.5±12.2 years) with newly diagnosed, histopathologically proven breast cancer were prospectively enrolled in this two-center trial. All patients underwent dedicated prone 18F-FDG breast PET/MRI and supine whole-body 18F-FDG PET/MRI as well as axillary sonography. Sentinel lymph node biopsy (SLNB) and/or axillary lymph node dissection were performed in all patients and histopathology served as reference standard. Sensitivity, specificity, PPV, NPV and accuracy regarding axillary lymph node assessment were calculated for dedicated breast MRI, axillary MRI, axillary 18F-FDG PET/MRI and axillary sonography.

RESULTS

According to the reference standard, lymph node metastases were present in 25 patients with a total of 78 metastases. On a patient based analysis, dedicated breast MRI identified 14/25 (56%), axillary MRI 15/25 (60%), axillary PET/MRI 19/25 (76%) and axillary sonography 18/25 (72%) of the patients with a positive nodal status. On a lesion-based analysis, sensitivity, specificity, PPV, NPV and accuracy were 54.5%, 88.9%, 88.9%, 54.5% and 67.6% for breast MRI; 55.1%, 90%, 89.3%, 53.2% and 57,5% for axillary MRI; 71.4%, 92.1%, 65.0%, 89.7% and 78.2% for axillary PET/MRI and 60.0%, 86.2%, 84.0%, 61.1% and 71.9% for axillary sonography.

CONCLUSION

18F-FDG PET/MRI and sonography serve equally acceptable diagnostic accuracy for nodal staging in breast cancer patients and are both superior to dedicated breast MRI or supine whole-body MRI. Although PET/MRI provides important information for staging workup breast cancer patients, neither PET/MRI nor axillary sonography do reliably differentiate N-positive from N-negative breast cancer patients.

CLINICAL RELEVANCE/APPLICATION

Sentinel lymph node biopsy cannot be replaced by imaging procedures alone and is still mandatory for staging breast cancer patients.

SSQ14-02 Simultaneous PET/MRI in the Early Prediction of Response to Neoadjuvant Chemotherapy in Patients with Locally-Advanced Breast Cancer

Thursday, Dec. 5 10:40AM - 10:50AM Room: S402AB

Participants
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PURPOSE

Aim of the study was to assess whether simultaneous PET/MRI could be helpful in the early prediction of the response to neoadjuvant chemotherapy (NAC) in patients with locally advanced breast cancer (LABC).

METHOD AND MATERIALS

Between January 2017 and July 2018, 20 consecutive patients (mean age 45 yrs) with LABC who underwent anthracycline- and taxane-based neoadjuvant chemotherapy (NAC) followed by surgical resection were prospectively enrolled. Simultaneous breast PET/MRI examination was performed twice in each patient, one week before NAC and early after the second anthracycline cycle. PET/MRI images were analyzed to extract quantitative diffusion (ADCmin, ADCmean), perfusion (Ktrans, Kep, Ve, IAUC) and metabolic (SUV2d, SUV3d, MTV) parameters. The variation of each parameter (delta, D) after the second anthracycline cycle was then calculated. The normality of the data was tested using the Shapiro-Wilk test. Differences in terms of pre-treatment and D parameters between patients histologically classified as complete response (CR) and partial response (PR) were compared using of the nonparametric Mann-Whitney U test. Logistic regression analysis was performed to identify imaging parameters predictive of the response.

RESULTS

D-Size, D-Ktrans, Kep, D-Kep, MTV and D-MTV resulted significantly different ($p<0.03$) between patients who showed CR and PR. In detail, pre-treatment Kep and MTV were significantly lower in patients with CR while the variation of each parameter was significantly higher in patients with CR as compared to patients with PR. A cut-off value of 5.09 D-MTV perfectly predicted the response to treatment (Figure 1). MRI parameters significantly associated to the response to treatment were D-Ktrans ($p=0.05$), Kep (0.04), and D-Kep (0.05).

CONCLUSION

Simultaneous breast PET/MRI could be useful to early predict the response to NAC in patients with LABC. Our preliminary observations show that functional (i.e. perfusion and metabolic) rather than morphological parameters may identify patients who will respond completely, particularly using both pre-treatment and the variation of quantitative parameters early after the second cycle of NAC.

CLINICAL RELEVANCE/APPLICATION

Simultaneous breast PET/MRI may be useful for early identification of LABC patients who would benefit from continuing NAC or for whom surgical excision could be optionally considered.

SSQ14-03 Quantitative 18F-FDG Uptake of Invasive Breast Cancer Using Harmonized Prone PET/CT and Simultaneous Breast PET/MRI with 10 Minute PET Acquisition Time

Thursday, Dec. 5 10:50AM - 11:00AM Room: S402AB

Participants
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PURPOSE

To compare tumor 18F-FDG uptake measured with 10 min PET acquisition using breast PET/MRI harmonized with prone PET/CT in patients with newly diagnosed invasive breast cancer.

METHOD AND MATERIALS

This HIPAA-compliant, IRB-approved single-institution, prospective study was performed from 2016 to 2018. Patients with biopsy-proven invasive breast cancer undergoing preoperative breast MRI were included. Patients who were pregnant, lactating, had implants, or underwent neoadjuvant therapy were not eligible. Fasting subjects underwent PET/CT (Discovery 710) of the breasts 60 min after injection of 10 mCi 18F-FDG. Patients were scanned at one bed position for 10 min in the prone position using the breast MRI coil housing with metal components removed. A low dose CT scan was obtained for attenuation correction. Subjects then underwent simultaneous breast PET/MRI (Signa 3.0T PET/MR) using an 8-channel breast coil 85 min after 18F-FDG injection. Standard clinical breast MRI sequences and Dixon-based sequences for attenuation correction were obtained simultaneously with the PET acquisition for 30 min. PET reconstruction was harmonized between scanners based on phantom scans. For analysis, the first 10 min of PET/MRI acquisition was compared to PET/CT. Standardized uptake value (SUV) measurements were performed for the tumor and contralateral normal (nl) fibroglandular tissue. Bland-Altman analysis was performed to determine measurement bias and 95% limits of agreement.

RESULTS

23 women (mean 49.6 yrs; 33-70) with 24 biopsy-proven sites of invasive breast carcinoma participated. Mean lesion size was 3.8 cm (1.1-8.8 cm) on MRI. Mean±SEM for tumor SUVmax, tumor SUVmean, and nl breast SUVmean for PET/MRI vs PET/CT, respectively, were 8.6±1.3 vs 7.3±1.1, 4.9±0.76 vs 3.7±0.57, and 1.4±0.083 vs 1.3±0.090. Measurement bias for PET/MRI vs PET/CT was 15.6% [-15.1,46.2] for tumor SUVmax, 28.7% [-7.21,64.6] for tumor SUVmean, 3.74% [-29.3,36.7] for tumor SUVmax/nl breast SUVmean, and 17.1% [-18.2,52.5] for tumor SUVmean/nl breast SUVmean.

CONCLUSION

Quantitative assessment of 18F-FDG uptake of invasive breast cancer is feasible using simultaneous breast PET/MRI with acceptable agreement between PET/MRI and PET/CT.

CLINICAL RELEVANCE/APPLICATION

Establishing the agreement between PET/CT and simultaneous breast PET/MRI for tumor 18F-FDG uptake is important for potential clinical applications such as neoadjuvant therapy response assessment.

SSQ14-04 Comparison of Whole-Body 18F-FDG-PET/MRI and PET/CT in Terms of Lesion Detection in Asymptomatic Subjects: A Retrospective Study

Thursday, Dec. 5 11:00AM - 11:10AM Room: S402AB

Participants
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Holger Schmidt, Erlangen, Germany (*Abstract Co-Author*) Employee, Siemens AG

PURPOSE

To compare fluorine fluorodeoxyglucose (18F-FDG) combined positron emission tomography and magnetic resonance imaging (PET/MRI) with 18F-FDG combined positron emission tomography and computed tomography (PET/CT) in terms of organ-specific lesion detection in asymptomatic subjects for cancer screening.

METHOD AND MATERIALS

2794 individuals undergoing PET/MRI (Biograph mMR, Siemens Healthcare, Erlangen, Germany) and 4283 individuals undergoing PET/CT examinations (Biograph mCT, Siemens Healthcare, Knoxville, USA), from January 2016 to December 2017 in our center, were enrolled for this retrospective study. The local ethics committee approved this study. Written, informed consent was obtained from all subjects. Besides PET/MRI and PET/CT examinations, the screening methods included ultrasound, CT (for PET/MRI), MRI (for PET/CT) and tumor marker tests of CEA, CA19-9, PSA (for male) and CA125 (for female), dependent on the cancer type. Subjects who had no positive findings in the following 12 months were considered as 'cancer negative'.

RESULTS

In the 2794 subjects, PET/MRI detected 66 suspicious lesions, 54 of them were diagnosed as malignant tumors (true positive) and 12 of them were benign (false positive). 12 malignant tumors were missed but detected by other modalities (false negative). The detection rate, sensitivity, specificity, PPV and NPV of PET/MRI screening were 1.93% (54/2794), 81.8% (54/66), 99.5% (2715/2728), 81.8% (54/66) and 99.5% (2715/2728) respectively. In the 4283 subjects, PET/CT detected 55 suspicious lesions and 48 of them were malignant tumors (true positive) and 7 of them were benign (false positive). 7 malignant tumors were missed but detected by other modalities (false negative). The detection rate, sensitivity, specificity, PPV and NPV of PET/CT screening were 1.12% (48/4283), 87.3% (48/55), 99.8% (4228/4283), 87.3% (48/55) and 99.8% (4228/4283) respectively. The detailed distribution of cancer types is shown in Figure.

CONCLUSION

To our best knowledge, this is the first work to compare the diagnostic values of PET/MRI and PET/CT for cancer screening in asymptomatic subjects. Both methods can detect a wide variety of cancer at early stage.

CLINICAL RELEVANCE/APPLICATION

Compared to PET/CT, PET/MRI has a higher detection rate and a higher sensitivity in solid organs except lung. Considering also the reduced radiation dose, PET/MRI is recommended as part of a cancer screening program for asymptomatic subjects.

SSQ14-05 Whole-Body MRI and 18F-FDG PET/MRI for N and M Staging in Primary Breast Cancer: A Multicenter Trial

Thursday, Dec. 5 11:10AM - 11:20AM Room: S402AB

Participants
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PURPOSE

To evaluate and compare the diagnostic potential of whole-body MRI and 18F-FDG PET/MRI for N and M staging in newly diagnosed, histopathological proven breast cancer.

METHOD AND MATERIALS

A total of 77 patients with newly diagnosed, histopathological proven breast cancer were enrolled in this study prospectively. All patient underwent a whole-body 18F-FDG PET/MRI in supine position. The MRI protocol included a transverse T2-weighted, a T1-weighted and a DWI sequence of the whole body from head to the thigh. The N and M staging was assessed according to the eighth edition of the American Joint Committee on Cancer staging manual in MRI datasets alone and in 18F-FDG PET/MRI datasets, respectively. Histopathology or follow up examination as reference standard were available in all 77 patients for N and M staging. A McNemar chi2 test was performed to investigate whether differences in the evaluation of the correct N and M stage between 18F-FDG PET/MRI and MRI were statistically significant.

RESULTS

MRI and PET/MRI were concordant for N and M staging in 74 of 77 (96.1%) patients. Compared to the reference standard, PET/MRI as well as MRI determined a correct N and M stage in 57/77 (74%) of the patients, respectively. A positive nodal status was present in 33/77 patients (43%). PET/MRI determined the N stage correctly in 62 of 77 (80.5%) patients with a sensitivity of 78.8% and a specificity of 93.2%. MRI determined the N stage correctly in 61 of 77 (79%) with a sensitivity of 75.8% and a specificity of 93.2%. Distant metastases were present in 4/77 patients (5%). PET/MRI detected all of the histopathological proven metastases (100% identification), while one metastasis was missed in MRI (75% identification). Additionally, PET/MRI leads to false-positive findings in 6 patients (8%) and MRI in 5 patients (7%). No statistically significant differences between the modalities were seen.

CONCLUSION

18F-FDG PET/MRI was shown to be slightly superior to MRI in the N and M staging in primary breast cancer patients. However, both modalities bear the risk to overestimate the M-stage.

CLINICAL RELEVANCE/APPLICATION

A whole-body 18F-FDG PET/MRI and MRI are highly accurate for evaluating the M stage in breast cancer patients and therefore could be considered in combination with a dedicated breast 18F-FDG PET/MRI as staging method of choice at time of diagnosis.

SSQ14-06 Correlation of 18F-FDG PET/MRI Imaging Information with Relevant Immunohistochemical Markers in Breast Cancer Patients: Could PET/MRI Identify High-Risk Patients?

Thursday, Dec. 5 11:20AM - 11:30AM Room: S402AB

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PURPOSE

To correlate prognostically relevant immunohistochemical parameters of breast cancer with simultaneously acquired standardized uptake values (SUV) and apparent diffusion coefficient (ADC) derived from hybrid PET/MRI.

METHOD AND MATERIALS

56 female patients with therapy naive, histologically proven breast cancer (mean age 54.1±12.0 years) underwent dedicated prone 18F-FDG breast PET/MRI and supine whole-body 18F-FDG PET/MRI. As part of the diagnostic imaging protocol, diffusion-weighted imaging (DWI, b values: 0, 500, 1000 s/mm²) was performed simultaneously with PET acquisition. A region of interest (ROI) encompassing the entire primary tumor was drawn into each patient's breast and prone PET/MR images to determine the glucose metabolism represented by maximum and mean SUV and into ADC maps to assess tumor cellularity represented by mean and minimum ADC values. Histopathological tumor grading as well as additional prognostically relevant immunohistochemical markers, i.e. Ki-67, progesterone, estrogen receptor, and human epidermal growth factor receptor 2 (HER2/neu) were determined.

RESULTS

We found a significant inverse correlation between both SUV- and ADC-values derived from breast PET/MRI ($r=-0.49$ for SUVmean vs. ADCmean and $r=-0.43$ for SUVmax vs. ADCmin, both $p<0.001$). Tumor grading as well as Ki67 showed a significant positive correlation with SUVmean from both whole-body PET/MRI ($r=0.42$ and $r=0.37$, $p<0.001$) and breast PET/MRI ($r=0.37$ and $r=0.32$, $p<0.01$). For immunohistochemical markers, HER2/neu significantly correlates inverse with ADC-values from breast PET/MRI ($r=-0.35$, $p<0.01$). In addition, estrogen receptor expression showed significant inverse correlation with SUV-values from whole-body PET/MRI ($r=-0.47$, $p<0.001$) and breast PET/MRI ($r=-0.45$, $p<0.001$).

CONCLUSION

The present data show a correlation between increased glucose-metabolism, cellularity, degree of differentiation as well as Ki67 and HER2/neu expression of breast cancer primaries. 18F-FDG-PET and DWI from hybrid PET/MRI may offer complementary information for evaluation of breast cancer aggressiveness in initial staging and treatment response.

CLINICAL RELEVANCE/APPLICATION

Easily applicable information from PET/MRI leads to complementary knowledge in breast cancer staging workup. This could help to identify high-risk patients efficiently.

SSQ14-07 Impact of 18FDG PET/MRI on Therapeutic Management in Breast Cancer Patients - A Prospective Multicenter Comparison Trial to the Guideline Staging Algorithm

Thursday, Dec. 5 11:30AM - 11:40AM Room: S402AB

Participants
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PURPOSE

To investigate whether the differences between the traditional staging imaging algorithm and 18F-FDG PET/MR lead to different therapeutic decisions in patients with breast carcinoma

METHOD AND MATERIALS

A total of 57 female patients with newly diagnosed breast cancer and elevated pre-test probability for distant metastases (initial tumor stage, immunohistochemical receptor expression) from two centers were prospectively included in this study. The traditional staging imaging algorithm was performed in clinical routine at the home institution of the patient. Additionally, each patient underwent a PET/MRI including dedicated diagnostic breast imaging and a whole-body MRI. Tumor stage was determined according to AJCC Staging Manual separately for both, 18F-FDG PET/MR and traditional staging algorithm. To determine the different treatment strategies each patient was discussed two times in separate DMT sessions. In one, the determination of the treatment strategy was based exclusively on the results of the traditional algorithm and in the other on the PET/MR. The primary endpoint was the incidence of differences between the therapy recommendations. The secondary endpoint was the comparison of diagnostic accuracy between the traditional staging algorithm and PET/MR for the TNM classification.

RESULTS

PET/MR and the traditional staging algorithm agreed on TNM-stages in 45 of 57 (78.9%) patients. All deviations between were due to a higher stage in PET/MR. Compared with the reference standard, PET/MR determined correct stage in 53/57 (93.0%) and the traditional staging algorithm in 43/57 (75.4%), respectively and resulting in a significant higher diagnostic accuracy in PET/MR. Different therapeutic decisions between PET/MR and the traditional staging algorithm occurred in 7/57 (12.3%) of the patients.

CONCLUSION

For breast cancer patients with elevated pre-test probability for distant metastases a change of the therapy regime occurs in 12.3% compared to the traditional staging algorithm when staged by 18F-FDG PET/MR. Furthermore the study revealed the diagnostic superiority for determining the exact TNM stage of 18F-FDG PET/MR over the traditional staging algorithm

CLINICAL RELEVANCE/APPLICATION

Current guidelines should consider systemic staging with 18F-FDG-PET/MRI in breast cancer patients with elevated pre-test probability for distant metastases at the time of initial diagnosis.

SSQ14-08 CT-Less Direct Correction of Attenuation and Scatter in Image Space Using Deep Learning for Total-Body PET: A Feasibility Study

Thursday, Dec. 5 11:40AM - 11:50AM Room: S402AB

Participants
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PURPOSE

A total-body PET scanner like EXPLORER provides a substantial sensitivity gain of a factor of approximately 40 over current clinical PET scanners. The 40-fold increase in the effective sensitivity can reduce total radiation dose by 1/40th; however, the extra radiation dose of CT for PET attenuation and scatter correction (ASC) will mitigate the merit of the ultralow-dose PET. Therefore, we propose CT-less direct ASC without any intermediate step using deep learning (DL) potentially for total-body PET.

METHOD AND MATERIALS

In an IRB-approved study, we obtained images from 59 whole-body 18F-FDG PET/CT studies that were acquired from March 2016 through August 2017. A deep convolutional neural network (DCNN) was implemented with the 59 pairs of uncorrected PET (without ASC; PETUC) and corrected PET (with ASC; PETASC) as inputs to predict attenuation-scatter corrected PET (PETDCNN) directly from uncorrected PET (50/9 split for training and test data). Quality of the predicted images (PETDCNN) was evaluated using standardized uptake values (SUV) by the normalized root mean square error (NRMSE), peak signal to noise ratio (PSNR), and structural similarity index (SSIM). Statistical analyses were performed using joint and error histograms.

RESULTS

The overall performance of PETDCNN is quantitatively comparable to CT-based ASC (PETASC). Across the test set of 9 subjects, the NRMSE was 0.26 ± 0.05; the average PSNR was 14.75 ± 3.22; the average SSIM was 0.94 ± 0.03, demonstrating high image similarity between PETDCNN and reference PETASC. The joint histogram shows the voxel-wise similarity between PETDCNN and

reference PETASC with the slope of 1.05 and R2 of 0.90 which was consistent with the result of the error histogram where most of errors (~ 90%) stay within ±0.5 SUV differences.

CONCLUSION

We demonstrated the feasibility of CT-less direct ASC using deep learning potentially for total-body PET. The clinical translation of our approach will remove the need of CT scans for PET ASC, which results in significant reduction of radiation dose particularly for pediatric patients or treatment follow-ups.

CLINICAL RELEVANCE/APPLICATION

Our proposed DL method can remove the need of CT for PET ASC, which reduces the radiation dose from a whole-body CT scan, preserving the merit of ultra-low dose imaging in total-body PET.

SSQ14-09 Quantitative Standardized Uptake Value Evaluation of 4x Faster PET Scans Enhanced Using Deep Learning

Thursday, Dec. 5 11:50AM - 12:00PM Room: S402AB

Participants
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PURPOSE

The goal of this study was to evaluate the accuracy of quantitative standardized uptake values (SUV) for noisy PET scans acquired 4x faster and subsequently enhanced using deep learning.

METHOD AND MATERIALS

15 subjects (7 male, 8 female; mean age: 67 years, range: 45;85 yrs, average BMI: 30, range: 19-48) referred for clinical whole-body PET/CT exams underwent two separate PET scans - one with the standard acquisition duration followed by one acquired 4 times faster, following IRB approval and informed consent. The 4x faster PET images were enhanced using a deep learning (DL) software (SubtlePET, Subtle Medical, Menlo Park, CA). One nuclear medicine physician reviewed the standard acquisition PET images, identified possible lesions and some normal regions, and drew regions of interest (ROIs) in OsiriX. The same lesions were reviewed on the DL-enhanced 4x faster scan images and the ROIs from the standard acquisition were propagated to the DL-enhanced 4x faster scan. Quantitative mean and maximum SUV values per ROI between the standard and DL-enhanced 4x faster acquisitions were visualized using Bland-Altman tests and compared using concordance correlation coefficients (CCC), linear regressions, and Mann-Whitney U-Tests.

RESULTS

A total of 63 ROIs were identified in the standard acquisition PET images. The Bland-Altman plot in Fig.1a-b (dotted line indicating mean, and dashed line indicating 95% limits of agreement) showed minimal differences between SUVs obtained from the two sets of scans, with almost all values contained within the 95% limits of agreement interval. CCC and linear Pearson coefficient values of 0.99 for both SUV-max and SUV-mean indicated very strong agreement between the SUV values from standard acquisition and DL-enhanced scan (Fig.1c-d, where the dotted line indicates the unity line). This was further indicated by the lack of statistical significance of p=0.68 for SUV-max and p=0.77 for SUV-mean values using the Mann-Whitney U-Test. Sample images can also be seen in Fig.1.

CONCLUSION

Deep learning can enhance 4x faster PET acquisitions without compromising quantitative SUV values compared a standard duration acquisition.

CLINICAL RELEVANCE/APPLICATION

Deep learning can enhance image quality of noisy 4x faster PET acquisitions thereby enabling higher comfort for patients, higher throughput of PET scans for hospitals, or reduced radiotracer dosages.

VW60

AI-based Decision Support for Diagnostic Breast Ultrasound: Presented by GE Healthcare

Thursday, Dec. 5 10:30AM - 11:00AM Room: South Building, Booth 5135

Participants

Michael Washburn, MS, Wauwatosa, WI (*Presenter*) Nothing to Disclose

Program Information

Clinicians can interpret up to one in three cases differently. How can they reduce variability in BI-RADS categorization to achieve greater consistency and confidence in the decision-making process? This new proprietary algorithm automatically classifies user-selected region(s) of interest (ROIs) containing a breast lesion into four BI-RADS-aligned categories (Benign, Probably Benign, Suspicious, Probably Malignant), and displays a continuous graphical confidence level indicator of where the lesion falls across all categories. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

VW61

Advancing Personalized Breast Care: Setting up the UK BRAID Trial: Presented by GE Healthcare

Thursday, Dec. 5 11:30AM - 12:00PM Room: South Building, Booth 5135

Participants

Fiona J. Gilbert, MD, Cambridge, United Kingdom (*Presenter*) Research Grant, Hologic, Inc; Research Grant, General Electric Company ; Research Consultant, Alphabet Inc; Research support, Bayer AG; Research collaboration, Volpara Health Technologies Limited

Program Information

Women with dense breasts have lower sensitivity compared to those women with fatty breasts and they also have an increased risk of developing breast cancer. Supplemental screening is recommended in some parts of Europe and the US. However, while it is clear that different techniques will pick up additional cancers, there has not been a comparison of which of these modalities is more appropriate. The BRAID trial is a randomized controlled trial to compare supplemental whole breast ultrasound with Contrast Enhanced Mammography and Abbreviated MRI. The outcome measures are cancer detection rate, size and types of cancers and recall rates of supplemental modality. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

BRS-THA

Breast Thursday Poster Discussions

Thursday, Dec. 5 12:15PM - 12:45PM Room: BR Community, Learning Center

BR RO OI

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Despina Kontos, PhD, Philadelphia, PA (*Moderator*) Research Grant, Hologic, Inc

Sub-Events

BR245-SD-THA1 The Crowd-Within Effect in Expert Radiologists: Independent Ratings of the Same Case Lead to Better Performance in Mammography Diagnosis

Station #1

Participants
Hayden Schill, La Jolla, CA (*Presenter*) Nothing to Disclose
Jeremy M. Wolfe, PhD, Cambridge, MA (*Abstract Co-Author*) Research collaboration, Koninklijke Philips NV; Pending research, General Electric Company
Timothy Brady, PhD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

If you ask a person the same question twice and average the results, performance can be significantly better than any single response alone ("crowd-within" effect, Vul & Pashler, 2008). Is this true for assessments of mammograms by expert radiologists? We measured the crowd-within effect in the context of a study of radiologists' memory for images. If this is true, averaging a given person's rating of abnormality across multiple exposures to the same mammograms should result in better accuracy than looking at either rating alone.

METHOD AND MATERIALS

Stimuli were single-breast mammograms: 80 abnormal and 40 normal (non-cancerous) cases. Images were presented for three seconds each, followed by two questions. (1) Was the image normal or abnormal? (2) Have you seen this image before? Confidence was rated on a six-point scale. Each image was either new or a repeat of an image seen 3 or 30 items previously. Comparing combined responses to pairs of images to responses to individual images allows us to measure the crowd-within effect.

RESULTS

Radiologists (N=32) are better at remembering abnormal than normal at 30-back ($t(31) = 2.2$, $p < 0.05$), but not 3-back. Under these viewing conditions, experts could detect abnormality with $d' = 0.94$ (AUC=0.716). When information was combined over pairs of repeated images, performance increased ($d' = 0.97$; AUC=0.745, $p<0.001$).

CONCLUSION

Radiologists had better memory for abnormal compared to normal medical images at long delays. Furthermore, when presented with the same case twice, performance improved when averaged across those responses compared to either response alone. This suggests that there is some independent "noise" in each judgement. These noise effects can be reduced by averaging more than one response. It remains to be seen whether this benefit would occur if radiologists were offered unlimited time to process each image.

CLINICAL RELEVANCE/APPLICATION

There may be situations in which having a second look at an image or a case will prove to be valuable and future studies will determine the potential integration of this strategy to the clinic.

BR246-SD-THA2 Low-Dose Imaging Technique (LITE) MRI: Introduction of a Reduced-Dosage Dynamic Contrast-Enhanced MRI Technique in Breast Imaging

Station #2

Participants
Deepa Sheth, MD, Chicago, IL (*Presenter*) Research Grant, Guerbet SA
Federico Pineda, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Abe, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Gregory S. Karczmar, PhD, Crete, IL (*Abstract Co-Author*) Nothing to Disclose

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dsheth@radiology.bsd.uchicago.edu

PURPOSE

To evaluate the diagnostic equivalency of a reduced-dosage dynamic contrast enhanced (DCE) breast MRI technique to standard-dosage utilizing a novel dual-dose injection protocol.

METHOD AND MATERIALS

Between October 2017 and April 2018, six patients (age range: 18-60) with a total of eight lesions (lesion size range: 0.5-2.0 cm as measured on ultrasound) with imaging features suggestive of a fibroadenoma were imaged. All lesions were ultimately either biopsy-proven or clinically-confirmed to be benign. Each patient underwent an IRB-approved dynamic contrast-enhanced MRI scan utilizing a novel dual-dose injection protocol. Pre-contrast scans including T2-weighted scans and high temporal resolutions scans were obtained. Next, 15% of the contrast was administered with post-contrast imaging including: standard T1 weighted scans and high temporal resolution scans. Approximately 10 minutes later, 85% of the contrast was administered with repeat post-contrast imaging similar to prior. Two radiologists reviewed the low-dose MR images and high-dose MR images to evaluate for: lesion conspicuity, imaging characteristics and enhancement kinetics.

RESULTS

In all 8 out of 8 lesions, there was concordance between the low-dose MR images and high-dose MR images in terms of lesion conspicuity and imaging characteristics. While the ratio of the contrast doses administered was roughly 0.18, this was not reflected in the ratios of kinetic parameters. The uptake rate ratio (low-to-high dose) was 1.30 ± 0.39, upper limit of enhancement had a 0.31 ± 0.06 ratio, and 0.35 ± 0.06 for initial area under the uptake curve. Rates of initial uptake measured with low-dose MRI were uniformly and significantly greater than rates measured by the high-dose MRI. Lesion time-to-enhancement was similar for both doses, with a ratio of 0.91 ± 0.06. Lesion conspicuity was measured as the ratio of the signal increase in the lesion to the signal increase in the surrounding parenchyma. The average lesion conspicuity over the first minute of enhancement had a low-to-high dose ratio of 1.87 ± 0.99.

CONCLUSION

This preliminary study demonstrates that LITE MRI has the potential to be diagnostically equivalent to standard DCE MRI in breast imaging.

CLINICAL RELEVANCE/APPLICATION

Low-dose imaging technique (LITE) MRI can be a promising alternative to standard-dose breast MRI, particularly with recent concerns related to gadolinium deposition.

BR247-SD-THA3 A Machine Learning Approach to Radiogenomics of Breast Cancer to Predict Prognostic Biomarkers Using Low-Dose Perfusion Breast CT

Station #3

Participants
Eun Kyung Park, MD,PhD, 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;
Kwang-sig Lee, Seoul , Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Chang Sub Ko, Ansan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kyu Ran Cho, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ok Hee Woo, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sung Eun Song, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To investigate the diagnostic value of a machine learning approach to radiogenomics using low-dose perfusion breast computed tomography (CT) for predicting the prognostic biomarkers of invasive breast cancer.

METHOD AND MATERIALS

This prospective study enrolled a total of 771 cases in 257 patients with invasive breast cancer. Low-dose perfusion CT was performed in the prone position using a spectral CT (iQon, Philips Heathcare) after contrast injection (Xenetix350, Guerbet). The 18 CT perfusion parameters of cancers analyzed using six machine learning models to predict lymph nodes status, tumor grade, tumor size, estrogen receptor (ER), progesterone receptor (PR), HER2, Ki67, and molecular subtype of cancer. Accuracy and the AUC (area under the ROC curve) were calculated for the machine learning models, and importance of CT parameters were evaluated in prediction of biomarkers.

RESULTS

The random forest is the best model for predicting prognostic biomarkers in terms of accuracy and the AUC. The accuracy of the random forest was higher than that of logistic regression by 11% on average: 78% vs. 65% for lymph node status, 81% vs. 66% for tumor grade, 80% vs. 71% for tumor size, 83% vs. 76% for ER status, 81% vs. 70% for PR status, 83% vs. 78% for HER2 status, 72% vs. 63% for Ki67, and 67% vs. 48% for the molecular subtype of breast cancer. The better performance of the random forest over logistic regression was more apparent in AUC with a 0.16 margin on average: 0.84 vs. 0.66 for lymph node status, 0.90 vs. 0.72 for tumor grade, 0.86 vs. 0.74 for tumor size, 0.89 vs. 0.77 for ER status, 0.87 vs. 0.71 for PR status, 0.89 vs. 0.68 for HER2 status, 0.80 vs. 0.67 for Ki67, and 0.83 vs. 0.69 for the molecular subtype of breast cancer. According to CT variable importance from the random forest, perfusion (mL/min/100/g), permeability (mL/min/100/g), blood volume permeability (mL/100/g), peak enhancement intensity (HU), time to peak (sec) were important predictors.

CONCLUSION

A machine learning approach to radiogenomics using low-dose perfusion breast CT is a useful noninvasive tool for predicting the prognostic biomarkers of invasive breast cancer.

CLINICAL RELEVANCE/APPLICATION

A machine learning approach to radiogenomics using low-dose perfusion breast CT is a noninvasive recommendation tool for predicting the prognostic biomarkers of invasive breast cancer.

BR261-SD-THA4 Trends in Use of Percutaneous versus Open Surgical Breast Biopsy: An Update

Station #4

Participants
Ida Teberian, MD, Cherry Hill, NJ (*Presenter*) Nothing to Disclose
Theresa J. Kaufman, DO, Villanova, PA (*Abstract Co-Author*) Nothing to Disclose
Laurence Parker, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Vijay M. Rao, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Lydia Liao, MD, PhD, Philadelphia , PA (*Abstract Co-Author*) Nothing to Disclose
David C. Levin, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, HealthHelp, LLC Board Member, Outpatient Imaging Affiliates, LLC

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PURPOSE

To compare trends in the use of percutaneous and open surgical breast biopsies and to determine the relative roles of radiologists and surgeons in performing them.

METHOD AND MATERIALS

The nationwide Medicare Part B Physician/Supplier Procedure Summary Master Files for 2004 to 2016 were reviewed. CPT codes pertaining to breast biopsies were selected and analyzed. Trends were studied in total volume of breast biopsies performed in the Medicare fee-for-service population, as well as in the volumes of imaging-guided percutaneous biopsies (IGPBs) and open surgical biopsies. Using Medicare's physician specialty codes we determined the number of procedures performed by radiologists, surgeons, OB/GYNs, and all other physicians as a group. Because the Medicare Part B databases are complete population counts, sample statistics are not required.

RESULTS

Between 2004 and 2016, the total volume of breast biopsies steadily increased in the Medicare fee-for-service population from 144,697 in 2004 to 193,736 in 2016 (+34%). Utilization of IGPBs increased from 124,423 to 187,914 (+51%). The use of open surgical breast biopsies declined from to 6605 to 2373 (-64%). IGPBs performed by radiologists increased from 89,493 to 160,485 (+79%). IGPBs by surgeons declined from 30,264 to 24,703 (-18%). By 2016, 97% of all breast biopsies were performed using imaging-guided percutaneous techniques. Radiologists performed 85% of these IGPB procedures, while surgeons performed 13%, OB/GYNs performed 0.1%, and other physicians performed 1%.

CONCLUSION

There is a steady upward trend in the utilization of breast biopsies, largely due to increased use of imaging-guided percutaneous techniques. By 2016, the overwhelming majority of breast biopsies (97%) used this approach and radiologists strongly predominate. In contrast, the use of open surgical biopsies has steadily declined, as has performance of any type of breast biopsies by surgeons and other nonradiologist physicians.

CLINICAL RELEVANCE/APPLICATION

Imaging-guided percutaneous needle breast biopsies are replacing open surgical breast biopsies, and a large majority of these procedures are done by radiologists.

BR262-SD-THA5 A Radiomics Approach to Classification of Fibroepithelial Lesions on Breast Ultrasonography

Station #5

Participants
Yongsik Sim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sieun Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Sungwon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun-Kyung Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To develop and evaluate a radiomics-based classifier to distinguish between phyllodes tumors and fibroadenomas on breast ultrasonography.

METHOD AND MATERIALS

A total of 190 patients with fibroepithelial lesions diagnosed by core needle biopsy between August 2003 and December 2017 were included. These lesions were finally confirmed as fibroadenomas (n=82) or phyllodes tumors (n=108) by surgical resection within 3 months. The tumors were semi-automatically segmented using publicly available software MIPAV (Medical Image Processing, Analysis, and Visualization). Pixel spacing and grayscale histograms of the ultrasound images were normalized using open-source library Simple ITK. A total of 737 radiomic features were extracted from the preprocessed images. By comparing the radiomic profiles of 40 tumor masks drawn by two radiologists, radiomic features with an intraclass correlation coefficient of less than 0.75 were excluded. The high-throughput radiomic features were selected by a least absolute shrinkage selection operator (LASSO) through 5-fold cross validation using a training set (133 of 190 images, 70%). An area under the receiver operating characteristic curve and accuracy of the radiomic classifier were estimated using a validation set (57 of 190 images, 30%).

RESULTS

The radiomic signatures based on the 10 selected features were higher in phyllodes tumors than in fibroadenomas when applied to

the validation set (0.29 [95% CI: 0.27, 0.31] vs. 0.21 [95% CI: 0.18, 0.25], p=.001). The radiomic classifier achieved an area under the receiver operating characteristic curve of 0.745 (p=.002, 95% CI: 0.613, 0.877) with an accuracy of 0.719 (sensitivity 0.781, specificity 0.640) when the threshold value was optimized to 0.247.

CONCLUSION

Our radiomics-based classifier to differentiate phyllodes tumor from fibroadenoma on ultrasonography yielded an area under the receiver operating characteristic curve of 0.745 and an accuracy of 0.719.

CLINICAL RELEVANCE/APPLICATION

An optimized classifier with radiomics approach may help prevent unnecessary excision of fibroadenomas and undertreatment of phyllodes tumors.

BR215-ED-THA6 Abbreviated and Ultrafast Breast Magnetic Resonance Imaging (MRI) in Clinical Practice: What the Radiologist Needs to Know

Station #6

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Yiming Gao, MD, New York, NY (*Presenter*) Nothing to Disclose
Samantha L. Heller, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Abbreviated and Ultrafast MRI are emerging techniques that reflect increasing understanding of breast cancer as a heterogenous group of diseases. These approaches aim to target more biologically aggressive cancers, while maximizing diagnostic accuracy. As these techniques enter clinical practice, it is essential that radiologists understand how and why interpretation in this setting may differ from conventional MRI. In this exhibit, we will describe current techniques; assess pros and cons of abbreviated approaches; discuss clinical applications and evolving guidelines; and explore diagnostic implications via a case-based review.

TABLE OF CONTENTS/OUTLINE

1. Define Abbreviated and Ultrafast MRI a. What are the differences? b. Pros and Cons 2. Understand important parameters a. Spatial vs. Temporal resolution 3. AB-MR a. Typical algorithms vs. conventional full protocol b. ? specificity, ? sensitivity c. No kinetics d. Review outcomes and literature 4. Ultrafast MRI a. Techniques and rationale b. ? specificity, maintain sensitivity and scan time c. Kinetic information d. Complements ABMR e. Review outcomes and literature 5. Clinical implementation a. ACR compliance b. Workflow, Reimbursement 6. Clinical implications/Case-illustration a. Lesion vs BPE b. Benign vs. Malignant (Utility of T2?) c. High risk screening - TP/FP/PPV

BR216-ED-THA7 Breast MR Imaging Response to Neoadjuvant Chemotherapy: Learning through Pathology Correlation

Station #7

Participants
Christopher Kyriakakos, MD, Manhasset, NY (*Presenter*) Nothing to Disclose
Sujata Sajjan, MD, Lake Success, NY (*Abstract Co-Author*) Nothing to Disclose
Yelena Kozirovsky, MD, Lake Success, NY (*Abstract Co-Author*) Nothing to Disclose
Suzanne McElligott, MD, Manhasset, NY (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Neoadjuvant chemotherapy (NAC) is a vital tool in the treatment of locally advanced and increasingly, early stage breast cancer. NAC goals include downstaging disease and acheiving pathologic complete response (pCR). Downstaging enables lumpectomy in lieu of mastectomy, and acheiving pCR is associated with improved disease tree and overall survival. Future develpments surrounding NAC may enable avoidance of surgical intervention altogether. Breast MR more accuartely predicts residual tumor than mammography, US, and clinical exam. Assessing response to NAC on breast MR is challenging due to different subtypes, histologic grades, and tumor morphologies. It is paramount that interpreting radiologists be familiar with MR patterns of response to common subtypes, residual disease assessment, and imaging diagnosis of pCR. Using a series of cases from our institution, we will illustrate pre and post NAC breast MR findings and provide surgical pathology correlation.

TABLE OF CONTENTS/OUTLINE

Role of NAC. Factors affecting response to NAC: tumor subtype, ductal vs. lobular, ER/PR+/HER2-, HER2+, triple negative, histologic grade, treatment regimen, morphology on imaging. Case based review of reporting guidelines for pre and post NAC MR findings. Assessing pCR - invasive vs. in situ components and over and under estimation of disease with rad-path correlation.

BR217-ED-THA8 Collecting Pearls: An Interactive Review of Breast Cancer Staging

Station #8

Awards
Magna Cum Laude

Participants
Brian G. Jiang, MD, Boston, MA (*Presenter*) Nothing to Disclose
Rashmi Mehta, MBA, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Vandana M. Dialani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Evguenia J. Karimova, MD, Memphis, TN (*Abstract Co-Author*) Research Consultant, Intrinsic Imaging LLC
Valerie J. Fein-Zachary, 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
Jordana Phillips, MD, Newton Center, MA (*Abstract Co-Author*) Research Grant, General Electric Company Consultant, General Electric Company

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TEACHING POINTS

To use an interactive, learner-driven, case-based approach to: 1. Demonstrate impact of prognostic biomarkers on breast cancer staging according to American Joint Committee on Cancer (AJCC)'s 8th edition staging guideline 2. Review finer anatomic details pertinent to TNM staging

TABLE OF CONTENTS/OUTLINE

1. Overview of changes to new AJCC Breast Cancer Staging system 2. Case-based review of 8 main teaching points including: a) Intramammary = Axillary: intramammary lymph nodes and why they matter. b) Be positive: upstaging of disease based on ER/PR/HER2 profile. c) May I have your number: downstaging of disease based on Oncotype DX Breast Recurrence Score. d) Nicer than it looks: classification change for lobular carcinoma in situ. e) Not in the chest: pectoral muscles involvement does not count for T staging. f) Judging the cover: satellite skin changes and T staging. g) Counting stars: multifocal vs. multicentric disease. h) One, two, three: classification of axillary lymph nodes.

Printed on: 10/29/20

VW62

Automating Breast Ultrasound: A Live Experience: Presented by GE Healthcare

Thursday, Dec. 5 12:30PM - 1:00PM Room: South Building, Booth 5135

Participants

Kristina L. Jong, MD, Santa Barbara, CA (*Presenter*) Nothing to Disclose

Program Information

This 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. *RSVP is required; adding this session to your agenda does not secure your seat in this session. Click the link below to RSVP.*

RSVP Link

http://ge.cvent.com/events/ge-breast-health-advantage-workshop-rsna-2019-/event-summary-d271e6d32bb947418ff2cd821db4757e.aspx

Printed on: 10/29/20

BRS-THB

Breast Thursday Poster Discussions

Thursday, Dec. 5 12:45PM - 1:15PM Room: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Despina Kontos, PhD, Philadelphia, PA (*Moderator*) Research Grant, Hologic, Inc

Sub-Events

BR249-SD-THB2 Staging Nodal Ultrasound in Breast Cancer: Can Metastases Skip Contiguous Nodal Basins or Do They Always Follow Expected Pathways?

Station #2

Participants
Hannah L. Chung, MD, Houston, TX (*Presenter*) Nothing to Disclose
Jessica W. Leung, MD, Houston, TX (*Abstract Co-Author*) Scientific Advisory Board, Subtle Medical
Jia Sun, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To identify the patterns of nodal disease in newly diagnosed invasive breast cancers and to determine the frequency of skipped metastases and associated tumor characteristics.

METHOD AND MATERIALS

This is a HIPPA compliant and IRB-approved retrospective cohort study, consisting of 1100 ultrasound (US) exams performed for nodal staging of newly diagnosed invasive breast cancers in a 15-month period at a single institution. The US nodal staging protocol consists of imaging the axillary levels I, II, III and internal mammary chain (IMC) ipsilateral to the cancer, with additional imaging of the supraclavicular (SC) space if any of the axillary levels or IMC is positive. Electronic medical records were reviewed. We recorded and analyzed the following: patient age, tumor size, location, histology, grade, ER/HER2 status, US findings, and nodal biopsy results.

RESULTS

US and biopsy excluded nodal involvement in 705 cancers. 395 cases had any positive nodal disease (N+). The highest level of nodal involvement: 223 (56%) level I, 43 (11%) level II, 48 (12%) level III and 77 (20%) SC. 4 (1%) cases had isolated IMC disease without axillary involvement. Among the 395 N+ cases, US detected an additional 172 N+ cases beyond level I. Excluding level II disease, there were 129 cases involving the higher nodal basins. US beyond axillary level I thus changed the N staging in 33% (129/395) of all new breast cancers. Skipped metastases (SM) were defined as non-contiguous spread from axillary level I to II to III to SC. In total, there were 16 SM (Figure), yielding a 4.0% (16/395) incidence (95% exact binomial CI .023, .065). By Fisher's exact test, lower grade and lobular histology were significantly associated with SM. No association was found with patient age, tumor size, location, or ER/HER2 status.

CONCLUSION

Nodal metastases may not be contiguous and unpredictable patterns of nodal spread occur. SM may occur at any level but most commonly skipped to the SC region with an observed 4% incidence.

CLINICAL RELEVANCE/APPLICATION

Comprehensive nodal basin US identifies unsuspected disease. If axillary level I is positive, then the remainder of regional nodal chains should be imaged. Accurate US staging has important effects on treatment planning and prognosis.

BR250-SD-THB3 Machine Learning Model Generalizes Across Manufacturers and Clinical Sites

Station #3

Participants
Bryan Haslam, Cambridge, MA (*Presenter*) Employee, DeepHealth, Inc
William Lotter, PhD, Cambridge, MA (*Abstract Co-Author*) Officer, DeepHealth Inc
Abdul Rahman Diab, Cambridge, MA (*Abstract Co-Author*) Employee, DeepHealth, Inc
Mack K. Bandler, MD, Medford, OR (*Abstract Co-Author*) Nothing to Disclose
A. Gregory Sorensen, MD, Belmont, MA (*Abstract Co-Author*) 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

Generalization is critical for the successful clinical application of machine learning and cannot be assumed; recent studies have shown that indeed many machine learning algorithms (or models) do not transfer across populations or even across different imaging equipment manufacturers. Applying machine learning to screening mammography has shown promise in classifying the presence of cancer, but many of the results presented so far have been tested on data taken from the same distribution from which the algorithms were trained, including the same manufacturer and the same clinic. Therefore, we sought to develop and test a model that could translate from one manufacturer to another and from one site to another.

METHOD AND MATERIALS

We compiled two separate testing data sets consisting of de-identified images and linked reports, collected from two mammography centers (Site A and Site B) following an IRB-approved protocol. Data originated from GE equipment and included presentation FFDM studies from both sites. We developed a novel convolutional neural network (CNN) architecture and trained this model using entirely Hologic data, including the Digital Mammography DREAM Challenge training data set. The model was tested on the DREAM challenge test set and additionally on the two different data sets described: Site A: 1880 studies and 41 biopsy-confirmed malignancies, and Site B: 1792 studies and 83 biopsy-confirmed malignancies. The receiver operating characteristic (ROC) curves and the corresponding area-under-the-curve (AUC) were calculated for each of the two data sets. The AUC was obtained from the DREAM test set but due to the data being protected, the ROC curve was not reported to us.

RESULTS

AUC values for performance on the test datasets were: DREAM: 0.90, Site A: 0.91, and Site B: 0.89.

CONCLUSION

The developed machine learning model demonstrated successful transfer across different manufacturers and different clinical sites.

CLINICAL RELEVANCE/APPLICATION

Machine learning can be developed so that testing at new sites and with new manufacturers does not result in significant loss of performance; such robustness is critical for deploying machine learning to the clinic.

BR263-SD-THB4 Preoperative Prediction of Regional Lymph Node Metastasis of Breast Cancer by Radiomics of DCE-MRI with an Ensemble of Deep Learning Models

Station #4

Participants
Pengfei Deng, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Xin Chen, MD, Xi'an, China (*Presenter*) Nothing to Disclose
Jixin Chen, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Fengjun Zhao, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Xiaowei He, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Quan Xin Yang, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Weibo Gao, Xi'an , China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Accurate staging of regional lymph nodes (RLN) provides important prediction and prognostic information in the management of breast cancers. Therefore, we tried to preoperatively predict regional lymph node (RLN) metastasis of breast cancer by radiomics analysis of dynamic contrast-enhanced MRI (DCE-MRI) with an ensemble of deep learning models.

METHOD AND MATERIALS

The DCE-MRI images of 108 breast cancer patients in this retrospective study included five phases (from first phase to fifth phase) of contrasted images, which were partitioned to training set (n=76) and testing set (n=32). Centered on the geometrical center of each breast mass, we cropped the original image into squared region of interest (ROI) with 80×80 pixel. Then, five phases of contrasted images were used to train five deep learning (DL) models, respectively. Each DL model was modified from inception V3 by adding a fully connected layer with 128 nodes before reaching the prediction output. During validation, the prediction for each slice of a patient derived from the ensemble of five predictions made by the five DL models. Finally, the metastasis characteristic of a patient was determined by summarizing the predictions on all of the slices with majority voting.

RESULTS

On the training set, the area under the curve (AUC) values of each one of the five DL models and the ensemble model were approximated to 1.00. On the testing set, the AUCs for the five models were 0.82, 0.92, 0.87, 0.91, and 0.91, respectively. However, the AUC for the ensemble of five models achieved a high value of 0.94.

CONCLUSION

The DL model has reached a high prediction accuracy on each contrasted MRI image, however the AUC values were not consistent among different phases. Especially, the AUC of the first phase of contrasted image was below 0.85. By using the ensemble strategy, this study achieved the highest AUC value, beyond the prediction accuracy on any DL model.

CLINICAL RELEVANCE/APPLICATION

Our proposed method can accurately predict RLN metastasis of breast cancers, which has great potential to be a powerful tool of clinical management of breast cancers.

BR264-SD-THB5 Usefulness of Imaging Findings in Predicting Tumor Infiltrating Lymphocytes in Patients with Invasive Breast Cancer

Station #5

Participants
Filiz Celebi, MD, Istanbul, Turkey (*Presenter*) Nothing to Disclose
Filiz Agacayak, Istanbul , Turkey (*Abstract Co-Author*) Nothing to Disclose
Alper Ozturk, Istanbul , Turkey (*Abstract Co-Author*) Nothing to Disclose
Serkan Ilgun, Istanbul , Turkey (*Abstract Co-Author*) Nothing to Disclose
Fatma Aktepe, Istanbul , Turkey (*Abstract Co-Author*) Nothing to Disclose
Vahit Ozmen, Istanbul , Turkey (*Abstract Co-Author*) Nothing to Disclose
Muhammed Ucuncu, Istanbul , Turkey (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

elbuken.filiz@gmail.com

PURPOSE

Tumor-infiltrating lymphocytes (TILs) have been determined as a new prognostic biomarker and the indicator of immunotherapy response in breast cancer. The aim of this study is to investigate the effectiveness of imaging features in predicting TILs levels in invasive breast cancer patients.

METHOD AND MATERIALS

From November 2015 through January 2019, a total of 158 patients with histopathologically confirmed invasive breast cancer included in our study. All lesions were evaluated based on BIRADS lexicon. Ultrasoun (US) was performed for all patients and 89 of these patients underwent magnetic resonance imaging (MRI) for preoperative assesment. The histologic stromal TIL (sTIL) levels were assessed based on the guidelines of the International Immuno-Oncology Biomarker Working Group on Breast Cancer. Associations between TILs and imaging features were evaluated. Comparison of variables were performed by Mann-Whithey U and Kruskal-Wallis test and based on the significant variables acquired from univariate analysis, logistic regression was performed. Finally, ROC analysis was applied to test the diagnostic power of a logistic regression analysis model.

RESULTS

Tumors with high TIL levels had a more circumscribed margin, a round shape , heterogen echogenity and larger size by ultrasonography ($p< 0.005$). There was a statistically significant positive correlation between TILs level and appearent diffusion coefficient (ADC) value ($p<0.001$). Tumors with high sTIL levels had more homogeneous enhancement than tumors with low TIL levels and statistically significant difference was found between them ($p= 0.001$). Logistic regression analysis showed that ADC was the most statistically significant parameter in predicting TILs level (The odds ratio was 90.952; $p=0.002$). The optimal cutoff value for ADC in predicting low and high TILs level was found 0,87x10-3 mm2 s-1 (AUC= 0.726).

CONCLUSION

Imaging findings, especially ADC may play an important role in predicting sTIL levels as a noninvasive method and improve the accuracy of biopsy results in uncertain situations and also give an opportunity for optimal treatment management and prognosis estimation.

CLINICAL RELEVANCE/APPLICATION

The prediction of sTIL levels using imaging findings may give an opportunity for optimal treatment management and prognosis estimation.

BR218-ED-THB6 Developing Asymmetries without Sonographic Correlates: Our Experience, Teaching Points, and Review of Literature

Station #6

Participants
Shawdi Manouchehr-Pour, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Youn Kyung Lee, MD, Arcadia, CA (*Abstract Co-Author*) Nothing to Disclose
Linda Hovanessian-Larsen, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Sandy C. Lee, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

shawdimpour@gmail.com

TEACHING POINTS

- Review definition, prevalence, and significance of developing asymmetry - Present how we approach developing asymmetries using illustrative case examples, with emphasis on cases without sonographic correlate - Review current literature and recommendations including utility of MRI and tomosynthesis

TABLE OF CONTENTS/OUTLINE

I. Introduction - Definition - Significance: risk of underlying malignancy - Differential diagnosis II. Assessment of developing asymmetry - Additional mammographic views to confirm and help localize finding - Targeted ultrasound to look for sonographic correlate - Percutaneous biopsy under sonographic or stereotactic guidance unless definite benign US correlate (e.g. simple cyst) - Radiologic-pathologic correlation - Role of digital breast tomosynthesis - MRI as a problem solving tool: (1) inconclusive or equivocal mammographic and sonographic work up, (2) no sonographic correlate and unable to perform stereotactic biopsy, or (3) radiologic-pathologic discordance - Pitfalls (e.g. skin lesions) III. Pictorial case examples of developing asymmetries without sonographic correlates presented with benign and malignant histopathology, clinical pearls, and relevant literature review

BR219-ED-THB7 Papillary Lesions of the Breast Diagnosed at Percutaneous Biopsy: Is Surgery Mandatory?

Station #7

Participants
Maria P. Swiecicki, MD, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose
Karina Pesce, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Maria Jose Chico, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Carolina Hadad, Capital Federal, Argentina (*Abstract Co-Author*) Nothing to Disclose
Diana Herbas Galindo, Capital Federal, Argentina (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

paz.swiecicki@gmail.com

TEACHING POINTS

To identify imaging criteria that may assist in the diagnosis of papillary lesions and eventually in their management.To discuss the role of percutaneous biopsy (ultrasound guided core biopsies and vacuum-assisted biopsies with stereotactic guide) in the diagnosis of papillary lesions.To consider factors related to upgrade rates at surgical biopsy and their correlate at imaging.To describe the current controversies in the management of these lesions and the role of imaging and interventional radiology in this subject-matter.

TABLE OF CONTENTS/OUTLINE

Introduction and review of current literature.Evaluation of papillary lesions at imaging, the role of percutaneous biopsies at diagnosis and the risk of upgrade after surgical excision.Illustration with cases from our institution.Discussion of benefits and pitfalls of percutaneous biopsies regarding the management of papillary lesions.Conclusions.

BR220-ED-THB8 Make RHEUM for Breast Disease

Station #8

Awards
Certificate of Merit

Participants
Charmi Vijapura, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose
Ralla A. Shrit, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Rifat A. Wahab, DO, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Mary C. Mahoney, MD, Cincinnati, OH (*Abstract Co-Author*) Researcher, General Electric Company

TEACHING POINTS

To characterize the clinical and pathological presentation of breast disease in patients with a concurrent rheumatologic disease or connective tissue disorders. To discuss when radiologists should include rheumatologic patterns of disease in their differential considerations. To summarize the imaging findings associated with rheumatologic and connective tissue manifestations in the breast. To utilize sample cases to better equip the radiologist in differentiating mimics of breast malignancy from other entities, such as lupus, sarcoid, and vasculitis.

TABLE OF CONTENTS/OUTLINE

Common breast manifestations of Sarcoid, Lupus, vasculitis and other granulomatous and connective tissue diseases. Incidence/prevalence of breast cancer in patients with a rheumatologic disease. Rheumatologic and connective tissue disease mimickers. Common breast imaging findings and complications seen with rheumatologic diseases. Sample cases including: Systemic Lupus Erythematosus Rheumatoid Arthritis Sjogren's Syndrome Vasculitis Cogan's Syndrome Dermatomyositis Scleroderma Polymyalgia Rheumatica Sarcoidosis

MSCB51

Case-based Review of the Breast (Interactive Session)

Thursday, Dec. 5 1:30PM - 3:00PM Room: N230B

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, Scarsdale, NY (*Director*) Nothing to Disclose

For information about this presentation, contact:

Jiyon.Lee@nyumc.org

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. Special presentations by PBG and DBK provide historical perspective to enable appreciation for our breast imaging subspecialty.

ABSTRACT

ABSTRACT Title: Managing expectations in breast imaging around the world. 'Best' versus sufficient? Abstract: Our case-based review course will 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. Cases help demonstrate breast imaging now and evolving. Special historical perspectives by PBG and DBK (session 1) impress with how far we have come as a subspecialty and where we are headed for the people we serve. Please join us for smart fun!

Sub-Events

MSCB51A Ultrasound from the Beginning to Now in All Its Humble Glory

Participants
Paula B. Gordon, MD, Vancouver, BC (*Presenter*) Stockholder, OncoGenex Pharmaceuticals, Inc ; Stockholder, Volpara Health Technologies Limited; Scientific Advisory Board, Real Imaging Ltd; Scientific Advisory Board, DenseBreast-info, Inc; Scientific Advisor, Dense Breasts Canada

LEARNING OBJECTIVES

1) Understand the evolution of breast ultrasound and be introduced to the pioneers in the subspecialty; Illustrative cases will be shown, with audience electronic responses.

MSCB51B Our 3D Modalities: Expanding Utility, Increasing Efficiency and Improving Specificity: A US-German Perspective

Participants
Ingolf Karst, MD, Chicago, IL (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

ingolf.karst@nm.org

LEARNING OBJECTIVES

1) Compare distinguished breast imaging strategies in the US and Germany to help increase specificity in breast cancer detection.
2) List ways to increase efficiency in breast imaging by using modern breast imaging modalities and optimize the use of resources.
3) Assess current breast imaging technologies to reach desired goals in the daily practice to improve cancer detection.

ABSTRACT

This case rich review will highlight adoption of modern 3D modalities in breast imaging to enhance the daily routine with an emphasis on what to learn from different strategy approaches in the US and German healthcare environment.

Active Handout:Ingolf Karst

http://abstract.rsna.org/uploads/2019/19000806/RSNA_2019_3D_Case_Review_Handout.pdf

MSCB51C Breast Imaging in Western Australia: How We Do It in the Land Down Under

Participants
Vanessa Atienza-Hipolito, MD,FRANZCR, Cottesloe, Australia (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

VanessaA@wbi.net.au

LEARNING OBJECTIVES

1) To learn the imaging features of interesting breast cases encountered in public and private centres. 2) To understand the imaging tests performed and further management of these breast cases. 3) To learn the standard practice of breast cases in screening (public) versus diagnostic (private) imaging setting in Western Australia.

ABSTRACT

Australia has a national breast screening program which provides FREE screening mammogram to women 40 years and over with no breast symptoms. The target age group is 50-74 years whereby these women receives a reminder letter every 2 years. Women who are recalled for further investigation are invited to attend in different Breast Assessment Centres across Australia.

Active Handout:Vanessa Atienza-Hipolito

http://abstract.rsna.org/uploads/2019/19000808/RSNA 2019 CB RC 05december2019 handout.pdf

MSCB51D Major Advances in Women's Health Over the Last 50 Years

Participants
Daniel B. Kopans, MD, Waban, MA (*Presenter*) Royalties, Cook Group Incorporated; Research Consultant, Deep Health; Scientific Advisory Board, Dart, Inc

LEARNING OBJECTIVES

1) Understand the history of Breast Imaging in the U.S.. 2) Understand the evolution of breast evaluation in the U.S.. 3) Understand the major milestones in imaging the breast dating back to the 1960's.

ABSTRACT

Randomized, controlled trials proved that early detection reduces deaths from breast cancer for women ages 40-74. This has been confirmed by numerous observational studies as well as a large 'failure analysis' performed in the Harvard teaching hospitals that showed that more than 70% of the women who died from breast cancer, despite having access to modern therapy, were among the 20% of women who were not participating in screening. A very large study in Sweden showed that the incidence of death from breast cancer was 60% lower at 10 years and 47% lower at 20 years for women who particiatped in screening than those who did not, again despite all having access to modern theapy. Despite an almost continuous effort required to address over 40 years of misinformation denigrating breast cancer screening, imaging the breast has undergone a steady evolution in our effort to improve our ability to detect more cancers at a time when cure is possible. This progression will be presented.

SPSH51

Hot Topic Session: Management of the Axilla-Biopsy and Staging

Thursday, Dec. 5 3:00PM - 4:00PM Room: E353C

BR

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

Participants
Fiona J. Gilbert, MD, Cambridge, United Kingdom (*Moderator*) Research Grant, Hologic, Inc; Research Grant, General Electric Company ; Research Consultant, Alphabet Inc; Research support, Bayer AG; Research collaboration, Volpara Health Technologies Limited

Sub-Events

SPSH51A Imaging of the Axilla

Participants
Fleur Kilburn-Toppin, MBBChir, MA, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose
Nisha Sharma, MBChB, Leeds, United Kingdom (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

nisha.sharma2@nhs.net

LEARNING OBJECTIVES

1) To understand the clinical role of axillary staging. 2) To appreciate the importance of discriminating minimal versus advanced nodal disease. 3) To assess the role of axillary imaging in patients undergoing neoadjuvant chemotherapy. 4) To learn novel techniques for accurate axillary lymph node marking.

ABSTRACT

Axillary grey scale ultrasound is considered the gold standard for staging the axilla in the context of breast cancer. This talk will discuss the current limitations with axillary grey ultrasound and the importance standardising axillary reporting of the axilla. New innovations regarding axillary ultrasound will also be explored and how this may impact on current practice. The role of imaging in the context of neoadjuvant chemotherapy will also be touched upon.

SPSH51B Image Guided Biopsy of the Axilla

Participants
Alexandra Athanasiou, MD, MSc, Athens, Greece (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

aathanasiou@mitera.gr

LEARNING OBJECTIVES

1) To assess clinical importance of Image Guided Biopsy of the Axilla. 2) To describe various techniques of performing Image Guided Biopsy of the Axilla. 3) To explain tips and tricks of how to proceed in technically challenging cases of Image Guided Biopsy of the Axilla. 4) To list current methods of lymph node marking in patients undergoing neoadjuvant treatment. 5) To explain rationale behind lymph node marking in the neoadjuvant setting.

ABSTRACT

Image-Guided Biopsy of the Axilla is an important step of completing pre-operative local staging and diagnosis, thus ensuring an optimal personalized treatment for patients presenting with a suspicious breast lesion. Thorough knowledge of axillary anatomy is mandatory Familiarity with available techniques and biopsy devices ensures a technically accurate and safe procedure. As for any image-guided biopsy procedure, radiologic-pathologic correlation is mandatory in order to ensure the lowest possible rate of false negative results

SPSH51C Surgical Management of the Axilla

Participants
Richard J. Bleicher, MD, Philadelphia, PA (*Presenter*) Speaker, Genomic Health, Inc

LEARNING OBJECTIVES

1) To understand current methods and standards for surgical assessment and management of the axilla vis-à-vis imaging assessment. 2) To understand controversies in surgical axillary management in the adjuvant setting. 3) To understand controversies in surgical axillary management in the neoadjuvant setting.

ABSTRACT

Axillary management is a critical component of breast cancer evaluation and treatment. Surgical evaluation of the axilla and lymph nodes have long been standard, but the paradigms for assessment of the axilla have been changing. These changes have been

rapid due to clinical trial results, advances in imaging assessment and localization, and paradigm shifts in management of some breast phenotypes using neoadjuvant chemotherapy. Practice patterns also vary within the US and around the world. This session will review standard surgical management as well as where controversies exist both in the surgical management of the axilla as well as in the changing dynamics between surgical and imaging assessment of the axilla in the adjuvant and neoadjuvant settings.

Printed on: 10/29/20

SPSH54

Hot Topic Session: Imaging of Traumatic Brain Injury-Present and Future

Thursday, Dec. 5 3:00PM - 4:00PM Room: E451A

ER MI NR

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

Participants
Donna J. Cross, PhD, Salt Lake City, UT (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe new and universal approaches for the visual examination of acute brain injury. 2) Examine novel approaches for the assessment of traumatic brain injury. 3) Describe methods under development to assess traumatic brain injury-related neurodegenerative disorders.

ABSTRACT

This session will highlight molecular imaging of traumatic brain injuries from current clinical work up of acute injury to tracer development for the assessment of chronic brain injury such as Chronic Traumatic Encephalopathy. Topics will include new PET tracers, MRI methodologies and quantitative analyses currently used in research.

Sub-Events

SPSH54A Imaging of Acute TBI

Participants
Yoshimi Anzai, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

yoshimi.anzai@hsc.utah.edu

SPSH54B PET Tracers to Assess TBI and CTE

Participants
Gerard N. Bischof, PhD, Cologne, Germany (*Presenter*) Nothing to Disclose

SPSH54C Advanced MRI Techniques for TBI Research

Participants
Pratik Mukherjee, MD, PhD, San Francisco, CA (*Presenter*) Research Grant, General Electric Company; Medical Adivisory Board, General Electric Company; Patent Pending USPTO No. 62/269,778

MSCB52

Case-based Review of the Breast (Interactive Session)

Thursday, Dec. 5 3:30PM - 5:00PM Room: N230B

BR

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

Participants
Jiyon Lee, MD, Scarsdale, NY (*Director*) Nothing to Disclose

For information about this presentation, contact:

Jiyon.Lee@nyumc.org

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. Special presentations by PBG and DBK provide historical perspective to enable appreciation for our breast imaging subspecialty.

ABSTRACT

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Sub-Events

MSCB52A France: The Usual and the Bizarre of our Breast Imaging and Vacuum-assisted Breast Biopsy Findings

Participants
Foucauld Chammings, MD,PhD, Bordeaux, France (*Presenter*) Speakers Bureau, Hologic, Inc; Speakers Bureau, Devicor Medical Products, Inc;

LEARNING OBJECTIVES

1) Identify the situations where core needle biopsy might no yield reliable pathology results. 2) List the diagnostic and therapeutic indications of VABB. 3) Specify in which cases VABB can be recommended for the removal of lesions with uncertain malignant potential (B3). 4) Define the adequate technique of guidance ((ultrasound, tomosynthesis, MRI)) of vacuum-assisted breast biopsy according to imaging features.

ABSTRACT

Vacuum-assisted breast biopsy (VABB), which provides bigger specimen than core needle biopsy, is more and more used In France. Thanks to a better sampling, VABB reduces the likehood of underestimation and can provide more reliable diagnosis for some type of breast lesions This presentation shows various clinical breast cases, usual or unusual, illustrating the place and interest of VABB in breast imaging. The current diagnostic and therapeutic indications of VABB in France are reviewed and different techniques of guidance, ultrasound, tomosynthesis and MRI, are presented.

Active Handout:Foucauld Chammings

http://abstract.rsna.org/uploads/2019/19000816/Active MSCB52A.pdf

MSCB52B Croatia: Breast Imaging in a Small European Country

Participants
Boris Brkljacic, MD,PhD, Zagreb, Croatia (*Presenter*) Advisory Board Member, contextflow GmbH

For information about this presentation, contact:

boris@brkljacic.com

LEARNING OBJECTIVES

1) To present the health care system and organization of breast imaging in Croatia. 2) To present the national mammographic

screening programme running in Croatia. 3) To present several breast imaging cases from the clinical practice.

ABSTRACT

Croatia is a small central and south east European country with population of 4.2 million and with the national health care system with many similarities to the UK and other EU member states. Some 2.700 breast cancers are diagnosed annually, and 800-850 women die because of the breast cancer. National mammographic screening program is running since October 2006, with attendance rate of 60-63%. Utilization of breast ultrasound in Croatia differs compared to North America, since radiologists perform ultrasound examination themselves, and sonographers do not exist. Ultrasound is used extensivelly in addition to mammography, and all patients with mammographic breast density ACR C and D are referred to aditional sonographic examinations. Several breast imaging cases will be presented, related to mammography, ultrasound and MRI findings of different breast cancers, and different benign lesions, including unusual cases, cases of minimally invasive treatment of small breast cancers with radiofrequency ablation.

Active Handout:Boris Brkljacic

http://abstract.rsna.org/uploads/2019/19000817/Active MSCB52B.pdf

MSCB52C India: Navigating Cultural and Socio-economic Challenges in Pursuit of Global Breast Health

Participants
Shilpa V. Lad, MD, Ottawa, ON (*Presenter*) Faculty, C. R. Bard, Inc; Faculty, FUJIFILM Holdings Corporation

For information about this presentation, contact:

lad_shilpa@hotmail.com

LEARNING OBJECTIVES

1) To address the factors that are responsible for higher incidence of locally advanced breast cancer and higher mortality associated with breast cancer in India as compared to North America. 2) Does breast cancer awareness and screening for breast cancer indeed make a difference? 3) Other factors that contribute to the higher incidence of locally advanced breast cancer and higher mortality such as cultural taboos, uninsured population with economic limitations and lack of a robust public healthcare system. 4) To understand the outcomes of no screening in a world where screening for breast cancer is constantly debated.

ABSTRACT

Breast cancer in India is more serious than one can imagine. Although the incidence of breast cancer in India (1 in 22) is lower than that in North America (1 in 8) , the mortality associated with breast cancer is much higher in India (50%). One of the primary reasons for the high mortality is locally advanced breast cancer at diagnosis. The reason for this is multifactorial. Lack of breast cancer awareness, lack of a standardised breast screening program, cultural taboos and financial constraints. In other words awareness & screening are key factors for timely diagnosis. The success story in North America is due to early diagnosis which is a result of awareness and screeing.

Active Handout:Shilpa Vidyadhar Lad

http://abstract.rsna.org/uploads/2019/19000818/Active MSCB52C.pdf

MSCB52D Breast Imaging Challenges in the World's Most Populous Country: China

Participants
Dengbin Wang, MD, Shanghai, China (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To get knowledge from the Chinese cases in which there may be some dense breast management issues, big mass, and novel technology applications as well. 2) The multimodality technologies are supposed to be implemented for the cases in the lecture. 3) Some rare cases will be delivered and it should be good to know them.

ABSTRACT

The lecture will present a couple of cases really from Chinese domestic Hospital (Xinhua Hospital, Shanghai Jiao Tong University School of Medicine). The full field digital mammography, DBT, ultrasound, and MRI will be introduced for the clinical applications in the breast cases including benign and maligant tumors. Some cases will be involved in the management of dense breasts in China. Some may have a big palpable mass which should be rare in the Western countries. As usual, some handout materials will be provided for the background in China.

Active Handout:Dengbin Wang

http://abstract.rsna.org/uploads/2019/19000819/Active MSCB52D.pdf

Handout:Dengbin Wang

http://abstract.rsna.org/uploads/2019/19000819/Active MSCB52D.pdf

RC715

New Science: A Bridge to Breast Cancer Screening

Thursday, Dec. 5 4:30PM - 6:00PM Room: S102CD

BR

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

Participants
Elizabeth S. Burnside, MD,MPH, Madison, WI (*Moderator*) Research Grant, Hologic, Inc

For information about this presentation, contact:

zuleyml@upmc.edu

LEARNING OBJECTIVES

1) Understand that new evidence dispels persistent myths and reasserts the effectiveness of mammography screening. 2) Appreciate that we can address current challenges for breast cancer screening acceptance by decreasing harms and advancing novel solutions. 3) Recognize that using social determinants to drive efficient delivery and decrease disparities has the potential to improve breast cancer screening, save lives, and elevate program effectiveness.

Sub-Events

RC715A New Science

Participants
Robert A. Smith, PhD, Atlanta, GA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

robert.smith@cancer.org

RC715B Screening Perspective: Current and Future Issues

Participants
Mark A. Helvie, MD, Ann Arbor, MI (*Presenter*) Institutional Grant, General Electric Company; Institutional Grant, IBM Corporation

LEARNING OBJECTIVES

1) Review current challenges for breast cancer screening acceptance. 2) Describe methods to decrease screening adverse risks (harms). 3) To consider future directions for screening.

RC715C Healthcare Delivery, Social Determinant, and Disparities

Participants
Elizabeth S. Burnside, MD,MPH, Madison, WI (*Presenter*) Research Grant, Hologic, Inc

LEARNING OBJECTIVES

1) Understand why the delivery of breast cancer screening services is generally more important than technology available. 2) Appreciate that disparities in breast cancer screening not only miss opportunities to save lives but also cast doubt on technical and program effectiveness. 3) Recognize that risk factors and social determinants have the potential to improve delivery, save lives, and elevate program effectiveness.

RC750

MR Imaging-guided Breast Biopsy (Hands-on)

Thursday, Dec. 5 4:30PM - 6:00PM Room: E260

BR MR

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

Participants
Roberta M. Strigel, MD, Madison, WI (*Presenter*) Research support, General Electric Company
Rosalind P. Candelaria, MD, Houston, TX (*Presenter*) Nothing to Disclose
Brian Johnston, MD, Queen Creek, AZ (*Presenter*) Nothing to Disclose
Jennifer R. Kohr, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Diana L. Lam, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Santo Maimone IV, MD, Jacksonville Beach, FL (*Presenter*) Research Consultant, GRAIL Inc
Cecilia L. Mercado, MD, New York, NY (*Presenter*) Nothing to Disclose
Jessica H. Porembka, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Gaiane M. Rauch, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose
Jeffrey S. Reiner, MD, New York , NY (*Presenter*) Nothing to Disclose
Raman Verma, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
Ryan W. Woods, MD, MPH, Madison, WI (*Presenter*) Nothing to Disclose
Bethany L. Niell, MD,PhD, Tampa, FL (*Presenter*) Nothing to Disclose
Beatriu Reig, MD, New York, NY (*Presenter*) Nothing to Disclose
Anand K. Narayan, MD,PhD, Boston, MA (*Presenter*) Nothing to Disclose
Eren D. Yeh, MD, Belmont, MA (*Presenter*) Consultant, Statlife SAS
Debbie L. Bennett, MD, Saint Louis, MO (*Presenter*) Advisory Board, Devicor Medical Products, Inc; Speaker, Hologic, Inc
Dana Ataya, MD, Tampa, FL (*Presenter*) Nothing to Disclose
Richard S. Ha, MD, New York, NY (*Presenter*) Nothing to Disclose
Erin I. Neuschler, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Denise M. Thigpen, MD, Washington, DC (*Presenter*) Nothing to Disclose

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 on 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.

RC752

Breast Elastography (Hands-on)

Thursday, Dec. 5 4:30PM - 6:00PM Room: E264

BR US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 0

FDA Discussions may include off-label uses.

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.

RC815

The Neoadjuvant Patient

Friday, Dec. 6 8:30AM - 10:00AM Room: E352

BR MR

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

Participants
Eric L. Rosen, MD, Seattle, WA (*Moderator*) Nothing to Disclose

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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

RC815A State-of-the-Art: An Evidence-based Approach

Participants
Eric L. Rosen, MD, Seattle, WA (*Presenter*) Nothing to Disclose

RC815B Ongoing Trials and Future Directions

Participants
Jessica W. Leung, MD, Houston, TX (*Presenter*) Scientific Advisory Board, Subtle Medical

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. 3) To understand the role that imaging plays in these trials.

RC815C Ultrasound Evaluation of the Axilla in the Neoadjuvant Patient

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 in the setting of Invasive Breast Cancer. 3) Describe the role of axillary US in the surgical management of the axilla after neoadjuvant treatment.

SST01

Breast Imaging (Interventional and Pathological Correlation)

Friday, Dec. 6 10:30AM - 12:00PM Room: E450A

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
Hiroyuki Abe, MD, Chicago, IL (*Moderator*) Nothing to Disclose

Sub-Events

SST01-01 Accuracy of MRI Biopsy in Diagnosing a Breast Cancer Pathologic Complete Response Following Neoadjuvant Chemotherapy

Friday, Dec. 6 10:30AM - 10:40AM Room: E450A

Participants
Elizabeth J. Sutton, MD, New York, NY (*Presenter*) Nothing to Disclose
Mahmoud A. El-Tamer, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Lior Braunstein, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Edi Brogi, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Virgilio Sacchini, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Neoadjuvant chemotherapy (NAC) has changed the management of breast cancer. The best outcome post-NAC is a pathologic complete response (pCR). There remains no minimally-invasive approach with sufficient accuracy to diagnose a pCR so surgery remains the standard of care. The purpose of this proof-of-concept clinical trial is to evaluate the accuracy of MRI-biopsy in diagnosing a pCR post NAC compared to reference-standard breast surgery specimen.

METHOD AND MATERIALS

Between 2017-2019, our IRB approved this pilot study that accrued 15 women with biopsy-proven operable invasive breast cancer who met the following inclusion criteria: (a) standard-of-care NAC, (b) pre- and post-NAC MRI, (c) imaging complete response defined as no residual enhancement on post-NAC MRI and (d) planned definitive surgery at our institution. A post-NAC standard of care MRI-guided biopsy was performed of the 15 treated tumor beds without intravenous contrast. The primary endpoint is to estimate the negative predictive value (NPV) of MRI biopsy to reference-standard breast surgery specimen. In this context, NPV is defined as the number of true pCR (biopsy negative, i.e. no disease found on the percutaneous biopsy and pCR at surgery) divided by the number of all biopsy negatives. The positive predicitve value (PPV), sensitivity, and specificity of the biopsy were also calculated.

RESULTS

15 patients with an MR imaging complete response post-NAC underwent MRI biopsy. Reference standard surgical pathology demonstrated a pCR in 10/15 (67%) and no-pCR in 5/15 (33%). The accuracy of MRI biopsy was 14/15 (93%). MRI biopsy was false in 1/15 (7%). In this false negative case surgical pathology identified 0.2mm of invasive disease, a true positive (no-pCR). All no-pCR tumor beds demonstrated very small volume residual disease with the largest invasive cancer measuring 3mm. The statistical measurements of MRI-guided biopsy in diagnosing a pCR compared with the reference standard surgical pathology are: NPV 91%, PPV 100%, Sensitivity 80% and Specificity 100%.

CONCLUSION

The accuracy of MRI-guided biopsy in diagnosing a pCR post-NAC in this pilot study is very high when compared to reference standard surgical pathology, which supports the need for a larger study.

CLINICAL RELEVANCE/APPLICATION

MRI-guided biopsy is a promising minimally-invasive approach with accuracy in diagnosing a pCR post-NAC to potentially obviate surgery in this subset of patients.

SST01-02 Compliance and Utility of 6 Month Follow-Up MRI After a Benign Concordant MR Breast Biopsy

Friday, Dec. 6 10:40AM - 10:50AM Room: E450A

Participants
Shruthi Ram, MD, Providence, RI (*Presenter*) Nothing to Disclose
Helaina Regen-Tuero, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Grayson L. Baird, PhD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Ana P. Lourenco, MD, Foxboro, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the utility and compliance of 6 month follow up MRI following benign concordant MRI guided breast biopsy and investigate potential causes for noncompliance.

METHOD AND MATERIALS

IRB approved retrospective review of all benign concordant MRI biopsies from 1/1/2013 to 1/1/2018. Biopsy results with high risk lesions or malignancy were excluded. For each benign concordant MRI biopsy, the following was collected from the electronic medical record: patient age, pathology from MRI biopsy, any recommendation for 6 month follow up MRI, any documented communication to thereferring physician, available follow up imaging, repeat biopsies, subsequent malignancies, insurance type, and referring physician's institution and specialty.

RESULTS

There were 139 benign concordant MRI biopsies in 127 patients during the study period. Mean patient age was 47.6 years (range 25 to 73). Follow-up MRI was performed at 6 months in 31.5% (40/127) and at 12 months in 18.1% (23/127) (Table 1). A 6 month follow up MRI was recommended in 63/127 (49.6%). Of these, 33/63 (52.4%) had a 6 month follow up MRI. Communication of the 6 month follow up recommendation was documented in only 6/63 (9.5%). Most patients without subsequent MRI in our system (n=50) had follow-up benign mammography at a mean of 0.9 years following MRI biopsy (range 0.2 to 2.2 years). There were no repeat biopsies or subsequent malignancies at the site of benign MRI biopsy. No correlation was observed between likelihood of 6 month follow up MRI and patient insurance type, ordering provider specialty or institution.

CONCLUSION

When 6 month follow-up MRI was recommended following a benign concordant biopsy, compliance was 52.4%. Lack of communication of the recommendation between the radiologist and referring physician may at least partially explain the low compliance. There were no false negative biopsies identified in this study, raising questions about the utility and cost-effectiveness of routine 6 month follow-up MRI following benign concordant MRI biopsy.

CLINICAL RELEVANCE/APPLICATION

Careful assessment of each benign concordant MRI biopsy may be more appropriate than routine 6 month follow-up MRI recommendation.

SST01-03 The Feasibility of Breast Conservation Therapy in Multifocal/Multicentric Breast Cancer Using Multiple Radioactive Seeds: A Paradigm Shift

Friday, Dec. 6 10:50AM - 11:00AM Room: E450A

Participants
Mary S. Guirguis, MD, Houston, TX (*Presenter*) Nothing to Disclose
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PURPOSE

Our study aims to validate breast conservation therapy in multifocal/multicentric (MF/MC) breast cancer (BC) using multiple radioactive seeds for localization.

METHOD AND MATERIALS

We retrospectively reviewed all radioactive-seed-localized segmentectomies at our institution between January 1, 2014 and April 26, 2017, where two or more radioactive seeds were used in the same breast. Patients with benign breast disease, unifocal BC and noncontinguous multicentric BC were excluded. Patient's age, demographics, pathology, and imaging were reviewed. Pre-operative diagrams were provided denoting the number and location of radioactive seeds, which were then examined intraoperatively using handheld gamma probes prior to segmentectomy. Intraoperative margin assessment was performed for all cases, including whole specimen radiography and gross-sectioning. Positive or close margins were re-excised intraoperatively and examined by permanent pathology,

RESULTS

Ninety-two patients underwent breast conservation therapy for MF/MC BC, using two or more radioactive seeds for preoperative localization without technical problems. Mean patient age was 56.8 years (range 33-80), and 55% of patients received neoadjuvant chemotherapy. Forty-six percent of patients had invasive ductal carcinoma and ductal carcinoma in situ (DCIS), 30% invasive ductal carcinoma, 10% invasive lobular carcinoma, 9% DCIS, and 5% invasive mammary carcinoma. Forty-nine percent of patients underwent localization using three seeds, 45% with 2 seeds, and 6% with 4 or more seeds. The mean distance between seeds was 4.8 cm (range 1-10). Seventy-five percent (69/92) had negative final margins, 15% (14/92) close or 2 mm margins, and 10%

(9/92) positive margins. Of those with positive margins, 3 underwent margin re-excision, and 6 completion mastectomy. One patient with close margins underwent re-excision, while the remaining patients with close margins did not require repeat surgery and were treated with adjuvant radiation therapy.

CONCLUSION

Preoperative localization of MF/MC BC with multiple radioactive seeds can successfully achieve clear surgical margins in 75% of cases.

CLINICAL RELEVANCE/APPLICATION

Patients with MF/MC BC can achieve breast conserving surgery, instead of mastectomy, if meticulous preoperative localization is performed using multiple radioactive seeds.

SST01-05 Tomosynthesis-Guided Breast Biopsy versus Stereotactic Biopsy: What's So Different?

Friday, Dec. 6 11:10AM - 11:20AM Room: E450A

Participants
Cleo Rochat, Providence, RI (*Presenter*) Nothing to Disclose
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Ana P. Lourenco, MD, Foxboro, MA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To compare biopsy outcomes from two years preceding and following implementation of digital breast tomosynthesis (DBT)-guided biopsy.

METHOD AND MATERIALS

IRB-approved, HIPAA compliant retrospective review of all vacuum-assisted core breast biopsy procedures using 2D stereotactic guidance from 2013-2015 and DBT-guided biopsy from 2015-2017. All screening and diagnostic mammography was performed with DBT during the study period. Patient demographics, biopsy target type, pathology from 9G vacuum assisted core biopsy, surgical excision pathology when available, breast density, and imaging follow-up results were recorded. Biopsy targets and radiology-pathology discordance rate were compared between the two groups. Generalized mixed modeling was used to examine pre/post DBT biopsy results using SAS 9.4.

RESULTS

There were 1405 breast biopsy procedures in 1313 patients; 643 using 2D stereotactic guidance (2013-2015) (median age 56) and 762 using 3D DBT guidance (2015-2017) (median age 58). Of the 2D group, 55.6% had dense breast tissue as compared with 57.5% in the DBT group. Calcifications were the most common biopsy target for both groups constituting 89.9% (578/643) of 2D biopsies and 71.1% (542/762) of DBT biopsies (p<.0001). For 2D biopsies, architectural distortion (AD) was the least common biopsy target at 2.0% (13/643) but increased to 17.7% (135/762) for the DBT group (p<.0001). Overall radial scars identified increased from 1.7% [1.0, 3.1] to 8.3% [6.5, 10.5] (p<.0001). The discordance rate increased from 1.4% [1.0, 2.7] to 4.5% [3.2, 6.2] following the implementation of DBT-guided biopsy (p=.0021). Of the 34 discordant DBT-guided biopsies, 30 of the biopsy targets were architectural distortions.

CONCLUSION

With the transition from 2D stereotactic biopsy to DBT biopsy, there was a significant increase in the number of architectural distortions targeted for biopsy, the number of radial scars identified, and the radiology-pathology discordance rate.

CLINICAL RELEVANCE/APPLICATION

While DBT biopsy has enabled the targeting of very subtle lesions such as architectural distortion, radiologists should be cognizant of the potential for radiology-pathology discordance.

SST01-06 Radial Scars in the Era of Digital Breast Tomosynthesis: What is the Rate of Upgrade to Malignancy?

Friday, Dec. 6 11:20AM - 11:30AM Room: E450A

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PURPOSE

To determine the rate of upgrade for radial scars (RS) diagnosed at core needle biopsy and to assess how the radiologist's recommendation for excision based on imaging features compares with excisional biopsy results.

METHOD AND MATERIALS

IRB approved, HIPAA compliant retrospective review of radiology and pathology databases at a tertiary breast center to identify all "radial scar" and "complex sclerosing lesions" between March 2012 and December 2017. During the study period, all mammography was performed with digital breast tomosynthesis. Patient demographics, initial imaging, needle and excisional biopsies, and follow-up

imaging data were collected. Upgrade to malignancy was defined as discovery of DCIS or invasive carcinoma at the same site as the RS upon surgical excision. Initial imaging leading to the discovery of the radial scar was reviewed by a fellowship trained breast radiologist. Based on the imaging findings, this radiologist recommended excisional biopsy or imaging follow-up for each case.

RESULTS

There were 146 biopsy-proven radial scars in 142 patients. Median patient age was 57 (range 26-87). Presenting imaging findings on mammography were mass 49 (34%), architectural distortion 40 (27%), calcifications 37 (25%), asymmetry 4 (3%); 5 (3%) mass on ultrasound; on MRI 7 (5%) mass and 4 (3%) non-mass enhancement. 117 (80%) demonstrated radial scar as the most ominous histological finding at that biopsy site (no atypia or cancer). The remaining 29 cases had associated atypia (n=15) or cancer (n=14) and were excluded. Of the 117 RS without associated atypia, 1 (0.8%) was upgraded to invasive ductal carcinoma at excision. Of these 117 RS without atypia, 72 were excised, 19 underwent benign imaging follow-up for a median of 3 years (range 1 to 5.5 years) and 16 were lost to follow-up. Based on initial imaging review, the radiologist recommended excision in 87%. No malignancy would have been missed if the remaining cases had not been excised.

CONCLUSION

Radial scars without atypia had an upgrade rate of 0.8% in this study. Radiologist assessment of imaging findings and recommendation for excision vs imaging follow-up would not have missed the one malignancy in this study.

CLINICAL RELEVANCE/APPLICATION

The very low upgrade rate of RS without atypia supports imaging follow-up rather than excision, which could reduce the number of benign surgeries patients undergo.

SST01-07 Evaluation of Pathological Results of Tomosynthesis Guided Vacuum Assisted Breast Biopsy

Friday, Dec. 6 11:30AM - 11:40AM Room: E450A

Participants
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PURPOSE

Digital breast tomosynthesis (DBT) guided vacuum assisted breast biopsy (TVAB) can target not only the calcified lesions detected on 2D mammogram but also non-calcified lesions only visualized on DBT. It is unknown if TVAB will result in more malignant or invasive cancer. In this study, we aimed to evaluate the pathological results of tomosynthesis guided vacuum assisted breast biopsy (TVAB) and compare to those of conventional stereotactic vacuum assisted biopsy (SVAB).

METHOD AND MATERIALS

All women who underwent TVAB (from May 2013 to April 2015) or SVAB (from June 2015 to May 2017) procedure were included in this retrospective study. Patients' demographics, lesion mammographic appearance, and biopsy pathologic results were compared between these two groups. The significance level was accepted as $p<0.05$.

RESULTS

389 patients with 410 lesions underwent SVAB and 540 patients with 579 lesions underwent TVAB. The mean ages in SVAB and TVAB groups are 55.9±10.3 and 57.9±10.5, respectively. TVAB is found to have a higher biopsy rate of non-calcified lesions than SVAB (26% vs 16%, $P < 0.05$). No statistically significant differences were found between the two groups with respect to histological results of lesions such as breast tissue, benign changes, high risk lesions, or malignant lesions ($p=0.161$). Similar high-risk lesion upgraded rate was also observed. Among the malignant lesions, the rate of ductal carcinoma in situ (DCIS) is high in both SVAB group (88.6%) and TVAB group (77.9%), but no difference in the rate between these two groups is identified either ($p=0.26$).

CONCLUSION

TVAB group can biopsy more non-calcified lesions compared to conventional SVAB because it can target not only the calcified lesions detected on 2D mammogram but also non-calcified lesions only visualized on DBT. However, no significant histological differences (malignant vs benign or DCIS vs invasive cancer) in the biopsied lesions were found in these two groups.

CLINICAL RELEVANCE/APPLICATION

With increasing utilization of digital breast tomosynthesis and DBT guided vacuum-assisted biopsy (TVAB) in clinical practice, understanding this new technology and predicting biopsy results are important for the radiologist.

SST01-08 Digital Breast Tomosynthesis (DBT)-Guided Vacuum-Assisted Biopsy (VAB) with Integrated Real-Time Radiography System (IRRS): Initial Single-Center Experience

Friday, Dec. 6 11:40AM - 11:50AM Room: E450A

Participants
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PURPOSE

We reviewed our experience with a DBT-guided VAB with IRRS to evaluate technical success, time for completing the procedure and added value of real-time specimen radiographs.

METHOD AND MATERIALS

The institutional review board approved this retrospective study and informed consent was waived. From January 2018 to October 2018 consecutive patients with suspicious mammographic calcifications (BI-RADS >=4) were referred to DBT-guided VAB with an IRRS (Brevera®, Hologic, Bedford, Mass). A 9-gauge VAB device was used and 12 specimens were always acquired in a clockwise manner; real time specimen radiography was measured for all biopsied lesions. 95% confidence interval (CI) and chi-squared statistics were used.

RESULTS

A total of 74 patients with median age of 51 years (range 38-82) with 74 suspicious lesions underwent DBT-guided VAB. Technical success was achieved in 74 of 74 lesions (100%, 95% CI 95%, 100%). The time to complete the procedure was 15.54 ± 8.47 min (mean ± standard deviation) including identification, targeting, sampling, and real-time specimen radiography. No major complications were observed. Pathology of specimens resulted into: 45 B2, 5 B3 and 24 B5 lesions. Only one B2 lesion was upgraded to high-grade DCIS at final pathology. While of 471 specimens with calcifications, 105 (22%) were found with cancer and 361 (78%) were cancer-free, of 417 specimens without calcifications 56 (13%) were found with cancer and 361 (87%) were cancer-free ($P < 0.001$).

CONCLUSION

DBT-guided VAB with IRRS using a 9-gauge needle allowed for a safe, rapid, and adequate sampling of lesions with mammographic suspicious calcifications. Even though a significant difference in cancer prevalence was observed between specimens with (22%) or without calcifications (13%), a strategy for reducing the number of samples based the IRRS result (presence or absence of calcifications) is not feasible due to the too overall high probability of non-cancer specimens (727/888, 82%, 95% CI 79%, 84%).

CLINICAL RELEVANCE/APPLICATION

The IRRS makes the operator more confident that the sample is adequate and may allow for sparing subsequent control mammogram after the procedure, with a better patient compliance. Nevertheless, an earlier completion of the procedure, reducing the number of samples, does not seem to be feasible.

SST01-09 Results of a Phase I, Prospective, Non-Randomized Study Evaluating a Magnetic Occult Lesion Localization Instrument (MOLLI) for Excision of Non-Palpable Breast Lesions

Friday, Dec. 6 11:50AM - 12:00PM Room: E450A

Participants
Ananth Ravi, PhD, Toronto, ON (*Presenter*) Research Consultant, MOLLI Surgical Inc
Frances Wright, MD, MEd, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Mia Skarpathiotakis, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Mark Semple, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Alexandru Nicolae, Torotno, ON (*Abstract Co-Author*) Nothing to Disclose
Nicole Look Hong, MD,MSc, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this first-in-human study was to evaluate the clinical feasibility of using a Magnetic Occult Lesion Localization Instrument (MOLLI) for localizing non-palpable breast lesions.

METHOD AND MATERIALS

A pilot study of 20 women with non-palpable lesions visualized under ultrasound received a lumpectomy using the MOLLI guidance system at a single institution. Patients were co-localized with magnetic and radioactive markers up to 3 days before excision under ultrasound guidance by a dedicated breast radiologist . Both markers were localized intraoperatively using dedicated hand-held probes. The primary outcome was successful excision of the magnetic maker, confirmed both radiographically and pathologically. Demographic data, margin positivity, and re-excision rates are reported. Surgical oncologists, radiologists and pathology staff were surveyed for user satisfaction using 5-point Likert scale questionnaires.

RESULTS

Demographic data can be found in Table 1. *Post-Radiological Analysis*: Post-implant mammograms verified that 17/20 markers were placed directly in the lesion center and 20/20 had minimal to no migration. Radiologists reported that all marker implantations procedures were 'easy' or 'very easy' following a single training session. *Post-Surgical Analysis*: All MOLLI markers were removed with the specimen during surgical excision; no cases required final verification using the radioactive marker. Measurement of the distance of the MOLLI marker from anterior, posterior, superior, inferior, medial and lateral aspects of the excised tissue specimen agreed with radiological imaging estimates to within 2 mm. In all cases, surgeons ranked the MOLLI guidance system as 'very easy' for lesion localization. *Pathologic Analysis*: All patients had negative margins and did not require re-excision. All Anatomic Pathology staff ranked the MOLLI system as 'very easy' to use and localize markers.

CONCLUSION

The MOLLI guidance system is a reliable, accurate, and non-radioactive method for localization and excision of non-palpable breast lesions. Further clinical evaluation of the MOLLI system in comparative studies against current standards of care are required to demonstrate efficacy and patient-reported outcomes.

CLINICAL RELEVANCE/APPLICATION

MOLLI guided lumpectomy results in similar re-excision and margin positivity rates are radioactive-seed localization.

Printed on: 10/29/20