ROLE OF MRI IN SCREENING, DIAGNOSIS AND MANAGEMENT OF BREAST CANCER

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Introduction

In the USA, Breast Cancer is:

- The Most Common Non-Skin Cancer
- The Second Leading cause of Cancer-related Deaths in women

Globally, Half a Million Deaths Annually, related Directly or Indirectly to Breast Cancer

Different Diagnostic Techniques have been used, including:

- Ultrasound, Mammography and MRI
At present,

**Mammography**: the only tool to decrease mortality from breast cancer

**Ultrasound**:
- Operator dependent,
- no Standard Technique,
- High false-positive rate
- Inability to show micro-calcifications

- However, Mammography may miss up to 35% of malignant cases (Dense Breasts / Subtle features of Malignancy / Multifocal or Multicentric lesions)
- **MRI**:
  - Noninvasive,
  - Enables a 3D Process,
  - Possess Techniques for **Direct Imaging of Angiogenesis**

- **Functional MRI** to:
  - Correctly Diagnose, DDx and Guide Therapy based on Functional Properties of lesions, such as:
    - Vascularity and Perfusion, which is more apt for the current Multidrug Regimen, with Angiogenic and Cytostatic properties
  - Dynamic Contrast-enhanced (DCE) MRI for the **assessment of Multifocal Malignancy**

- **DCE MRI**:
  - facilitates the evaluation of **Total Extent of the disease**
  - Improves **Diagnostic Accuracy**
Indications and Contraindications of Breast MRI (ACR)

- MRI is an essential tool in:
  - Screening high-risk groups
  - Assessing the extent of disease
  - Follow-up
  - Unknown Primary Tumor
  - Assessing the Response to Chemotherapy
  - Women who have 20-25% or Greater lifetime risk of breast cancer, including:
    - those with a strong family history of Breast or Ovarian Cancer
    - those treated for Hodgkin's disease
MRI as a Screening Technique

- MRI: (not a Routine Test)
  - Highest Sensitivity;
  - Limitation: Low Specificity and High Cost!

  - in Women with (BRCA), Breast Cancer Gene Mutations; (Higher Risk at an earlier age),:
  - MRI is more sensitive than Mammography, US and Clinical Exam alone.

  - BRCA1-associated Breast Cancers: with Round Margins and Rare Calcifications, exhibiting Benign Mammographic Appearance.

- In such cases, MRI has a special Role in Early Detection
- Childhood Cancer Survivors (High Risk, due to Exposure to Cytotoxic Therapy and Radiation)
- In this subset, MR screening is Highly Recommended for patients at a younger age
MRI in the Diagnosis of Breast Cancer

- **MRI**: Better Identifies:
  - Multifocal and Multicentric lesions than Triple Assessment (Clinical Exam, FNA and Mammo)
  - Occult Lesions in Clinical Exam and Mammography
  - MRI-guided Needle Localization Biopsy plays a Role in verifying Suspicious Lesions found in breast MRI
  - To Diagnose Occult breast cancer in patients with axillary lymphadenopathy (regardless of Breast Density)
  - Detecting cancer in Contralateral Breast in women with Newly Diagnosed Breast Cancer
  - Diagnosis of Infiltrating Lobular Carcinoma, which has Unique Difficulties in Diagnosis due to its infiltrative growth pattern:
    - No Cyst formation, Hemorrhage, Necrosis and Calcification
Infiltrating Lobular Carcinoma, incidental finding in CT Scan
MRI in DCIS

- 60% of patients with DCIS may develop Invasive Cancer over a period of 10 years
  - for better Outcomes it is Important to be Diagnosed and Evaluated Properly
- 50% Of all the High-grade DCIS, are:
  - Occult in Mammography,
  - but Detectable by MRI alone
  - MRI Sensitivity: 88% and Mamo: 27%
MRI in Nipple Discharge

- MRI Detects underlying potential Intraductal Malignancy of Nipple Discharge
MRI to access both structural and functional changes during the course of Treatment

MR imaging of DCIS for staging and assessment of response to hormonal treatment
MRI for Staging of Breast Cancer

- Preoperative staging:
  - Precisely Defining the **Extent of Breast Cancer**
    - by MRI 98%, Mammography 55%
  - which is Important for:
    - Local Therapy and Breast Conservation
    - Avoiding unnecessary Repeated Excisions
- Lymph Node Evaluation
Precisely Defining the **Extent of Breast Cancer**
1/2/2006
after 8 month
T1 and T2 without contrast
T1 with contrast
Management of Breast Cancer

- MRI is **Noninvasive** and **Highly Sensitive** and the only Technique which has the **Ability to Capture Biological Information**
- MRI has Superior **Sensitivity** and **Accuracy** to Clinical Exam, Mammo, and US

- So, Potentiality, **It could Change the Management and Therapy** in selected patients
- Treatment changes effectively in **15% of patients** due to the **Findings on MRI**
- Neoadjuvant Chemotherapy is the Primary Treatment Modality in: **locally advanced disease**
- **To plan Surgery and Estimate Prognosis**

  Assessing the Clinical Response and Biological Responsiveness of tumors is essential

  - to Predict Outcome in Clinically and Biologically difficult Breast Cancer
  - Selecting Patients for Breast Conservation
  - Prediction of Patient Expectations from Chemotherapy

- **Clinical Exam**: is **Subjective and Unreliable**
- **MRI** has a **Well-established Role**
Limitations

- Challenges in Interpretation of Enhancement of:
  - Normal Fibro glandular Tissue in the Proliferative Phase of Menstrual Cycle
  - Benign Breast Disease and Post-irradiation and Postsurgical Changes, and local Granulation Tissue

- Although MRI cannot correctly differentiate between Inflammatory Carcinoma and Mastitis, the differences in Enhancement in these conditions are useful for follow-up

- MRI is useful in assessing the response to Neoadjuvant Chemotherapy; however,:
  - it may Underestimate the Residual Tumor due to Decreased Vascularity and Permeability after Chemotherapy

- The Sensitivity and Specificity of:
  - Mammography are 82% and 64%
  - Contrast-enhanced MRI are 92% and 76%
Conclusion

- Despite the fact that MRI is expensive and less specific,
- it is Emerging as an Important Tool in the Detection, Diagnosis and Staging of Breast Cancer.
- It is also Useful in Assessing:
  - The Efficacy of Chemotherapy and Planning Surgical Treatment.
- Most importantly, it Enables the Detection of Carcinomas that are both Clinically and Mammographically Occult.
- Thus, judicious use of MRI leads to Better Outcomes in:
  - the Work-up of Breast Abnormality and
  - Helps the Clinician to Reduce Morbidity associated with Breast Cancer.
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