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Review Article

The Role of Radiologist in Conservative Management of Breast Cancer

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Abstract

Breast conserving therapy (BCT) means breast conserving surgery (BCS), followed by a suitable-dose of radiotherapy to eliminate any microscopic residual neoplastic breast disease. BCS is currently considered the most suitable protocol for management of early stage of invasive cancer, that combines both adequate surgical margins and an acceptable cosmetic result. The role of mammography and breast ultrasonography for many years was concerning the diagnosis of breast tumors and local recurrence after treatment. The advent of the Breast Imaging Reporting and Data System (BIRADS) by the American College of Radiology, helps to maximize Radiologist's role through any factors: standardized the description and recommended management of breast lesions. BIRADS has increased the radiopathological correlation of radiologists' reports, improving the reports' reliability and has also established a common language for all of the physicians involved in multidisciplinary breast disease management team, favoring agreement on decisions, and Furthermore, advances in breast magnetic resonance imaging; functional MRI and image-guided interventional procedures have increased our responsibility in the therapeutic decision-making process. The role of Radiologist in BCT: I- Accurate and early diagnosis of breast cancer and staging. II- Interventional role of Radiologist in BCT including imaging-guided biopsy of breast masses, stereotactic biopsy of nonpalpable lesions and or microcalcifications guided by mammography or MRI. Post-biopsy-clips insertion, and pre-neoadjuvant chemotherapy localization of malignant lesion by US-guided insertion of a hydromark (clips). Pre-operative localization of non-palpable breast mass or microcalcifications by US-guided insertion of wire. III- Evaluation of response to neoadjuvant therapy using RECIST (Response Evaluation Criteria in Solid Tumors).

Keywords: Breast Conserving Therapy (BCT); Breast Conserving Surgery (BCS); Breast Imaging Reporting and Data System (BIRADS)

Role of radiologist in BCT:

A successful BCS requires Accurate and early diagnosis of breast cancer and staging Through screening and diagnostic mammography (digitalized or full-digital) and high-resolution US

Imaging features: Malignant mass and Microcalcifications with DCIS architecture distortion and Associated nipple and skin changes and enlarged axillary LN.

MRI: Dynamic MRI and MRS and MR-Diffusion (for high risky women, small lesions, multifocal and multicentric lesions).

Other imaging diagnostic workup (abdominal and pelvic US and chest x-ray +/- isotope bone scan) for staging of breast cancer.

Small invasive breast cancer (Mammography and US and CEMRI and dynamic curve).

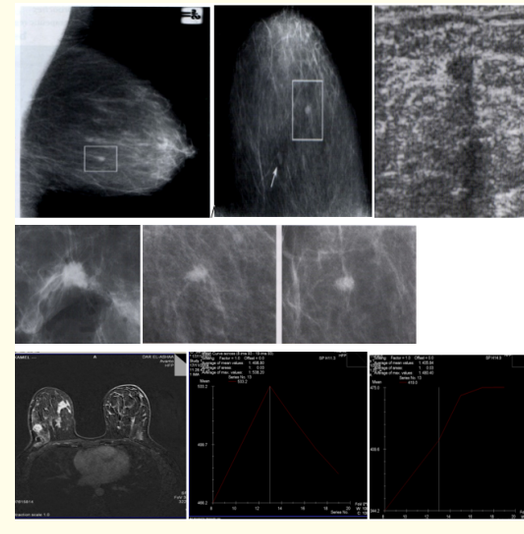

Figure 1

Interventional role of radiologist in BCT

1. Ultrasound-guided biopsy of masses, or mammography-guided (stereotactic biopsy) of occult breast lesions or suspicious microcalcifications:
   - MRI-guided stereotactic biopsy of lesions (enhanced mass or non-mass enhancement) seen only by MRI.
   - FNAC and cell block and or True-cut needle biopsy (for tissue diagnosis and tumor markers ER, PR, HER2/neu).
2. Post-biopsy-clips insertion, and pre-neoadjuvant chemotherapy localization of malignant lesion by US-guided insertion of hydromark (clips).
3. Preoperative localization of non-palpable breast mass by US-guided insertion of wire.

US-guided true-cut biopsy: Using a true-cut needle 14 gauge

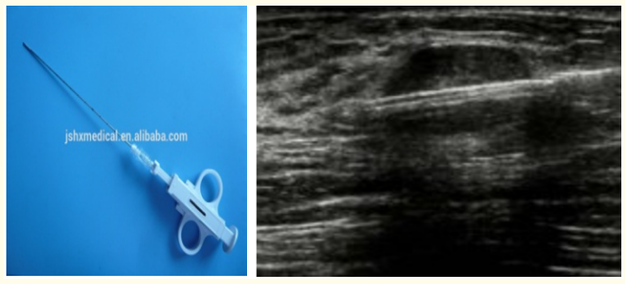

Figure 2

Hydromark (clips) for marking site of the breast mass and site of biopsy

48 years old lady with locally advanced invasive ductal carcinoma at upper-outer quadrant of the right breast. MLO mammograms before and after neoadjuvant chemotherapy show a partial response to the treatment. Two metallic markers were introduced into the lesion before neoadjuvant chemotherapy.

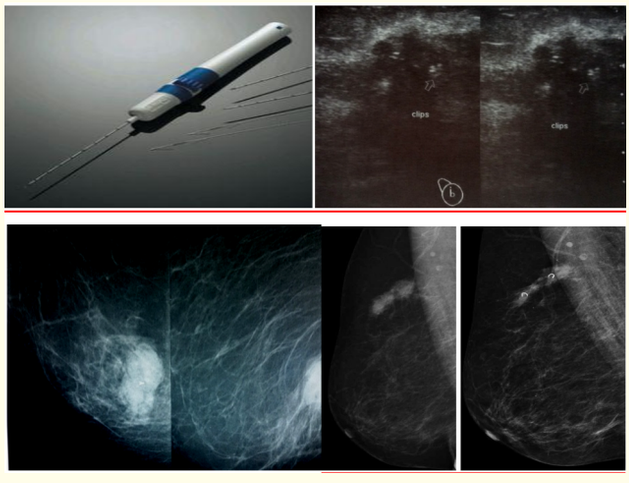

Figure 3

Non palpable breast lesions

Non-palpable breast lesions are lesions detected only by imaging modalities on screening either mammography or ultrasonography.

Only about 30% of non-palpable breast lesions are malignant.

The role of radiologist in the management of non-palpable breast lesions:

1. To ensure the presence of mass lesions by imaging using compression technique in mammography or the use of magnification technique.
2. Complementary ultrasonography for confirmation of mammographic findings.
3. The use of wire needle technique for localisation of non-palpable breast lesions guided by ultrasonography or by mammography for lesions not seen by US.
4. Specimen mammography is performed for excision specimen to ensure an adequate surgical margin.
5. The mammographic findings may only a cluster of microcalcifications that needs pre-operative wire localization.

Wire localization

1. Wire-guided technique is a relatively simple, cost-effective method for localization of nonpalpable breast lesions or microcalcifications.
2. Dislodgment of wire is a rare complication that could affect an accurate intraoperative finding of the lesion by the surgeon.
3. This technique requires a cooperation of the patient, to keep the wire intact prior to and during surgery.

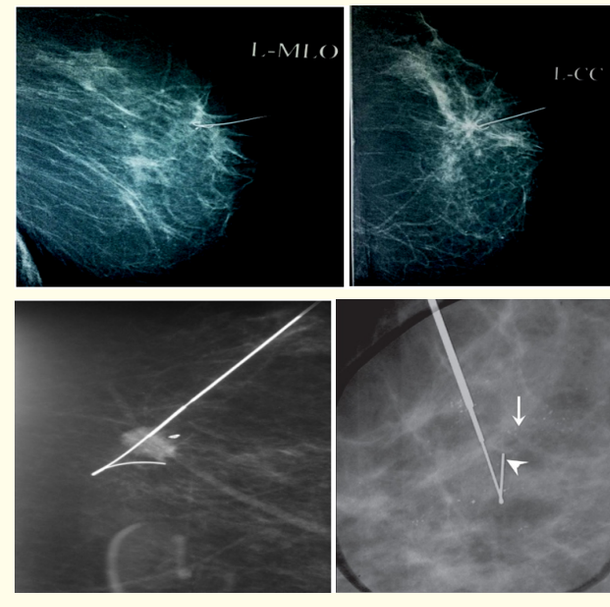

Figure 4 and 5

Evaluation of response to neoadjuvant chemotherapy

Evaluation of the tumor changes during cancer chemotherapy

RECIST (Response Evaluation Criteria in Solid Tumours)

It was published by WHO in 2000, used by many investigators, in assessment of treatment outcome. Revised RECIST in 2009, Major changes are:

1. Reduction of Number of lesions required to assess tumor burden from a maximum of 10 to a maximum of 5.
2. Assessment of pathological LN is incorporation of nodes with short axis > 15 mm considered measurable and as target lesions and When nodes reduced to < 10 mm considered normal.

RECIST, four groups are categorized

Response criteria used on Evaluation of target lesions

1. Complete Responder (CR): Disappearance of all target lesions: The complete disappearance of the tumor. When pathological LN detected (whether target or non-target) must have diameter < 10 mm.
2. Partial Response (PR): 30% or more decrease in the diameters of malignant lesions considering pre-treatment sum diameters. and/or non-measurable residual disease.
3. Progressive Disease (PD): A: 20% or more increase in the sum of diameters of target lesions. In addition to an absolute increase of diameter of the lesion at least 5 mm. B: The appearance of new lesions (one or more) is considered a progressive disease.
4. Stable Disease (SD): Neither enough shrinkage to qualify for PR (partial response) nor significant increase to justify a progressive disease.

The evaluation of the degree of response to neoadjuvant therapy is not an easy task.

MRI is the best technique to detect morphological changes of treated tumor, however still there is a possibility of underestimation resulting from the effect of neoadjuvant therapy on tumor vascularity.

Neoadjuvant therapy affects cellular vitality and degree of enhancement at post-contrast study, so it will be non-sensitive modality to detect residual. Few weeks after the first cycle of chemotherapy contrast uptake decreases or disappears that affect the dynamic curve.

MRI can miss residual neoplasm in up to 30% of patients (false negative results), so surgery is must be performed after neoadjuvant chemotherapy.

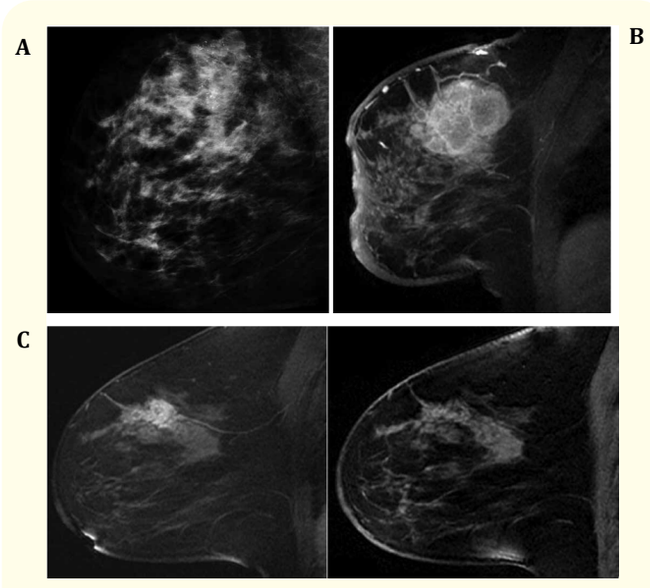

Figure 6: A- RT. MLO mammogram shows a lobulated mass in UOQ with microcalcifications. suspicious axillary LN observed on US. B- FS contrast-enhanced sag. T1-WI before neoadjuvant chemotherapy 6 cm long-axis lobulated mass with intense enhancement observed. C- After four cycles with one cycle every 3 weeks the mass shrunk to 2.5 cm, and only one LN on US was observed. D- After treatment with four cycles (one cycle every 3 weeks) axillary LN and the lesion of the breast were not observed. According to RECIST, the tumor was categorized as a complete responder.

Diffusion-weighted images (DWI) proved to equally diagnose residual tumor as contrast-enhanced MRI, so DWI represents a solution for women with bad renal function.

After the first cycle of neoadjuvant chemotherapy, morphological tumor changes are difficult to be detected, so functional changes in perfusion, diffusion and metabolism of malignant cells are the only available changes to be detected at this phase by more advanced techniques as MR-spectroscopy and positron emission tomography (PET).

MRS can differentiate between responder tumor from non-responder tumor early within 24 hours of the first cycle by a decreased choline spectrum peak.

In invasive breast cancer, restriction of water diffusion induces high signal intensity on diffusion-weighted images which is not pathognomonic, while changes in Apparent Diffusion Coefficient (ADC) is specific for cancer.

A low ADC value < 1.2 indicates malignant tumor; and its persistence low after 24 hours of 1st cycle of neoadjuvant therapy, the

persistence of a low ADC value would indicates a low cytotoxicity, and viable tumor tissue [1-9].

Conclusion

The Radiologist plays an essential role in the multidisciplinary team in conservative management of breast cancer in all steps: diagnosis, before neoadjuvant therapy, pre-operative as well as in the post-operative follow-up.

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