

Spectrum of Mammography and Ultrasonography Findings in Imaging of Post-Surgical Breast: Many Facets!

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ABSTRACT

Introduction: Postoperative breast surgery findings include skin thickening, increased focal breast tissue density, architectural distortion, seroma or fluid/ air collection in the early few months, which decrease over a period of time. Follow up imaging findings include parenchymal scarring, skin thickening / deformity, areas of dystrophic calcification/ fat necrosis and recurrent mass lesions at the post surgical site. The purpose of the study was to evaluate Mammographic and ultrasonographic (USG) findings in the patients who have undergone breast surgery.

Material and methods: A total of 50 patients with history of breast carcinoma surgery were evaluated in the Integrated breast care centre (IBCC) at All India Institute of Medical Sciences, Rishikesh, Uttarakhand (U.K.), India. Mammographic and ultrasonographic evaluation of breast and axilla were done.

Results: Ultrasonography and mammography findings in post surgery patients were illustrated and described. Timing of the appearance of imaging findings were categorized according to the time of presentation.

Conclusion: Post surgical changes should be thoroughly evaluated. Ultrasonography and mammography are the mainstay in the follow up of patients along with clinical examination. Comparison with prior imaging place an important role in reaching to a radiological diagnosis.

Keywords: Post-Operative, Ultrasonography, Mammography

INTRODUCTION

Normal post operative findings on mammography include skin thickening, architectural distortion, and increased density in more than 50% of patients in the initial few months of surgery. Only anecdotal examples of postoperative changes have been reported.^{1,2} The findings reduce in intensity over time and get stable on follow up mammograms in approximately 3 to 5 years time. On ultrasound, the immediate post operative site shows fluid collections-seromas or hematomas, skin thickening and edematous changes. Seromas can be completely anechoic or may contain low level internal echoes, internal septas or dependent debris within. Surgical clips are seen at the site of post surgical site. In some of the cases, recurrent mass lesions can be seen at the site of previous surgeries.

The purpose of the study was to evaluate Mammographic and ultrasonographic (USG) findings in the patients who have undergone breast surgery for carcinoma, either breast conserving or modified radical mastectomy and to provide a pictorial review of post surgical breast based on mammographic and USG findings.

MATERIAL AND METHODS

From the period of January 2019 to June 2019, a total of 50 patients (all females) with history of breast carcinoma surgery (6 months to 5 years interval) who presented for clinical evaluation in the Integrated Breast Care Centre (IBCC), tertiary centre at All India Institute of Medical Sciences, Rishikesh, Uttarakhand (U.K.), India were recruited for dedicated mammographic and ultrasonographic evaluation of breast and axilla. Post operative findings in breast were correlated with clinical features and histopathology findings where applicable.

Inclusion Criteria: All patients who had undergone some form of breast surgery including tumour excisional biopsy (done outside), simple lumpectomy, breast conserving surgery, quadrantectomy, modified radical mastectomy, total mastectomy, radical mastectomy, extended radical mastectomy, axillary dissection; in 0-5 years interval were included in our study. Study also included breast implant case. Mammograms including Full-field digital mammogram (FFDM) and tomosynthesis were done on Hologic Selenia G-XR-62728 including – Craniocaudal (CC) and

Mediolateral oblique (MLO) views. Additional mediolateral (ML) or exaggerated views were taken whenever indicated. USG were done using Mindray Z-6 machine using high frequency transducer (5-10Mhz).

RESULTS

Out of the 50 patients, 35 (70%) patients had skin thickening at the post operative site (Table 1, fig-1). Out of these 35 patients, 32 (64%) patients have seroma underlying the post-operative site. 18 (36%) patients out of 50 had post operative architectural distortion and increased breast tissue density at the post operative site. 10 (20%) patients presented with recurrent mass lesion at the same site. 10 (20%) out of 50 patients had skin-fold. 9 (18%) patients had presented with fat necrosis and dystrophic calcification. 4(8%) patients presented with oil cysts. Only 1 (2%) patient was post breast reconstruction surgery with fat grafting and 1 (2%) patient

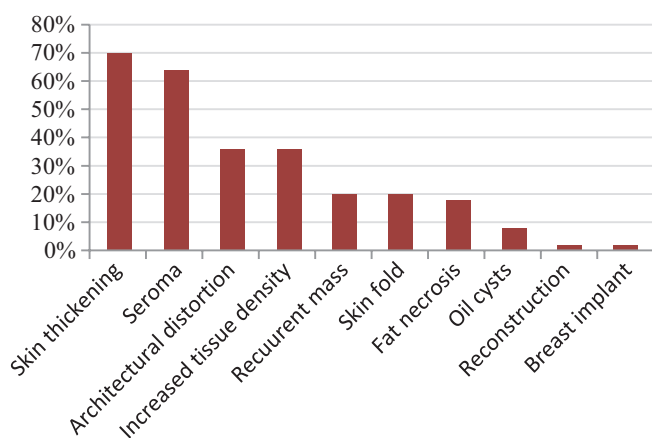


Figure-1: Percentage of Post operative findings

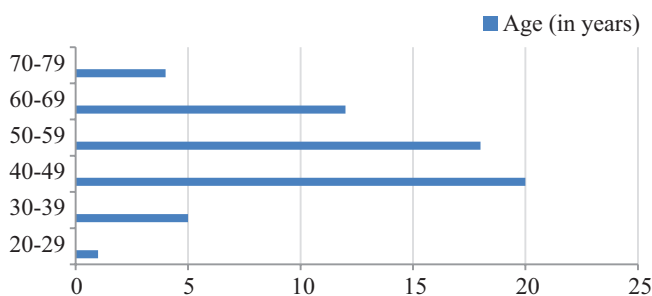


Figure-2: Distribution of patients according to age (in years)

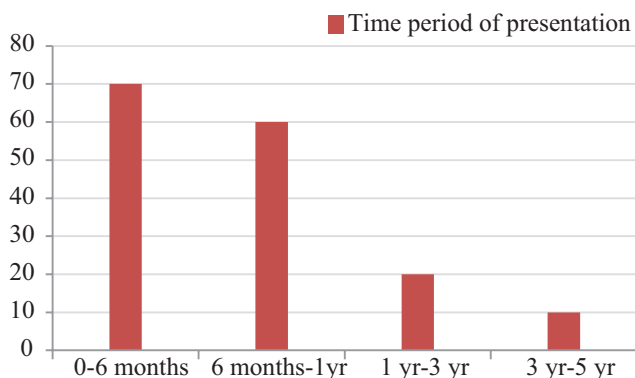


Figure-3: Distribution of patients according to time of presentation

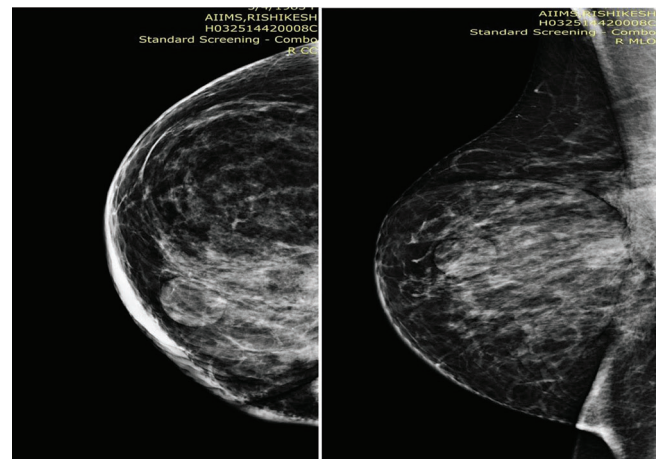


Figure-4a and 4b: Mammogram of a 35 year female with post lumpectomy status showing a curvilinear scar running from 11 – 5 o'clock positions with overlying skin thickening.

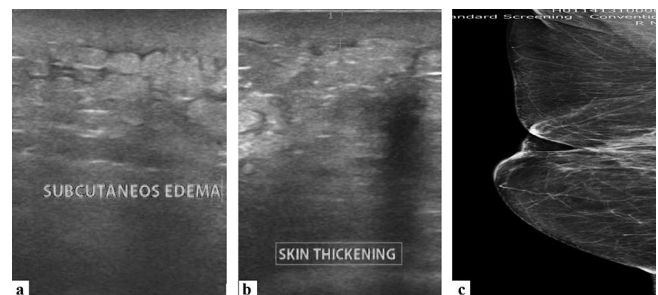


Figure-5: Ultrasonography (a and b) showing skin thickening along with subcutaneous edema seen within the fat lobules. Mammogram (c) of a 64 years female with history of quadrant lumpectomy for ductal carcinoma in situ, post chemotherapy and radiotherapy status done 4 years ago- showing focal skin fold and skin thickening at the scar site.

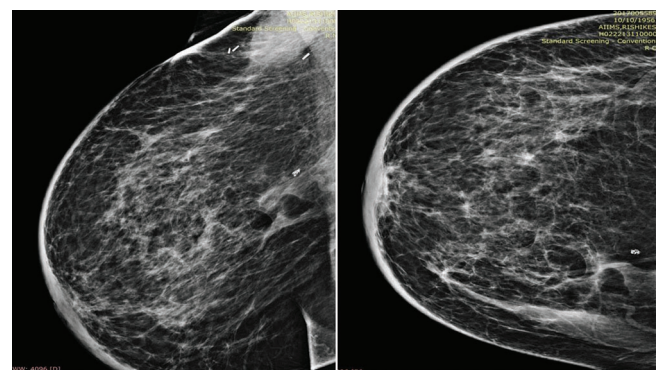


Figure-6 and 6b: Mammogram of a 61 year old female who underwent breast conservation surgery 2 years ago for right breast intraductal carcinoma, post chemotherapy/ and radiotherapy status showing few well defined lobulated low density lesions seen in upper inner quadrant showing a foci of macrocalcification posteriorly. Another ill-defined area of high density in upper inner quadrant, posteriorly in retro-mammary region-suggestive of seromas (which was confirmed on aspiration and cytology). Diffuse skin and trabecular thickening seen. Right axilla and upper outer quadrant shows multiple linear high density areas- surgical clips

Imaging feature	Number of patients	% of patients	Time of presentation
Skin thickening	35 out of 50 patients	70%	0-6 months
Seroma	32 out of 50 patients	64%	0-6 months
Architectural distortion	18 out of 50 patients	36%	0-6 months
Increased tissue density	18 out of 50 patients	36%	0-6 months
Recurrent mass	10 out of 50 patients	20%	6 months-1 year
Skin fold	10 out of 50 patients	20%	6 months- 1 year
Fat necrosis, dystrophic calcification	9 out of 50 patients	18%	1 -3 year
Oil cysts	4 out of 50 patients	8%	1-3 year
Reconstruction	1 out of 50 patients	2%	6 months- 1 year
Breast implant	1 out of 50 patients	2%	1 -7 year

Table-1: Percentage of Post operative findings and most common observed time of presentation

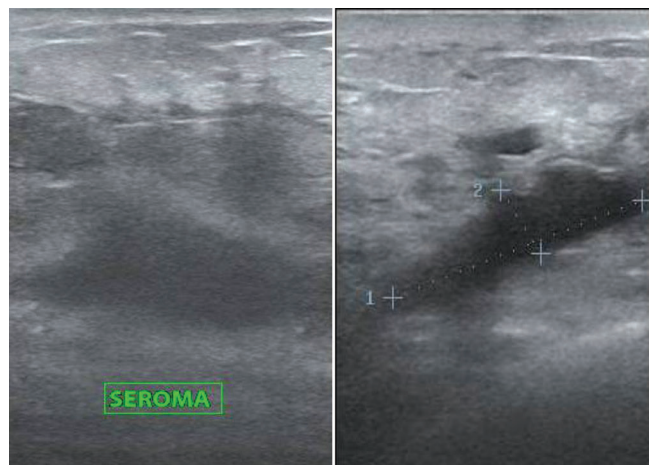


Figure-7a and 7b: Ultrasonography showing an ill defined hypoechoic collection beneath the scar site with surrounding increased echogenicity and inflamed fat.

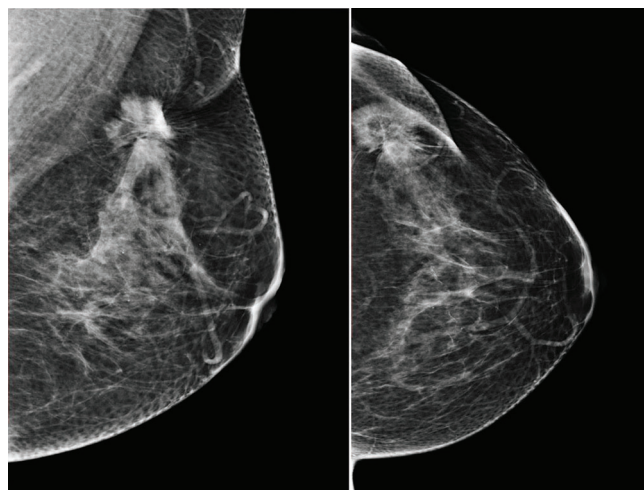


Figure-9a and 9b: Mammogram of a 44 year female who underwent breast conservation surgery 8 months ago for invasive ductal carcinoma left breast shows architectural distortion with central lucency in lateral and upper quadrant at lumpectomy site.

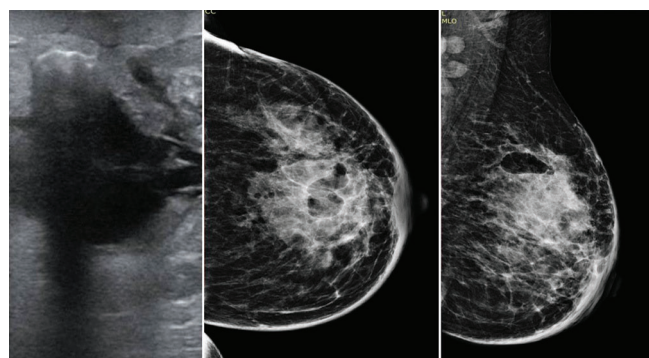


Figure-8a, 8b and 8c: Ultrasonography of a 35 year old female with undocumented lumpectomy done outside in a private centre showing a loculated heterogeneously hypoechoic collection with posterior acoustic enhancement and multiple septa, internal echoes and echogenic areas casting dirty shadow due to air within seroma and increased echogenicity of surrounding breast parenchyma. Mammogram of the same patient (craniocaudal and mediolateral oblique view) showing an irregular high density area in upper central and inner quadrant showing multiple lucent areas-likely air. Findings are suggestive of Seroma with air-post operative changes. The patient underwent biopsy and was proven malignancy on histopathology.

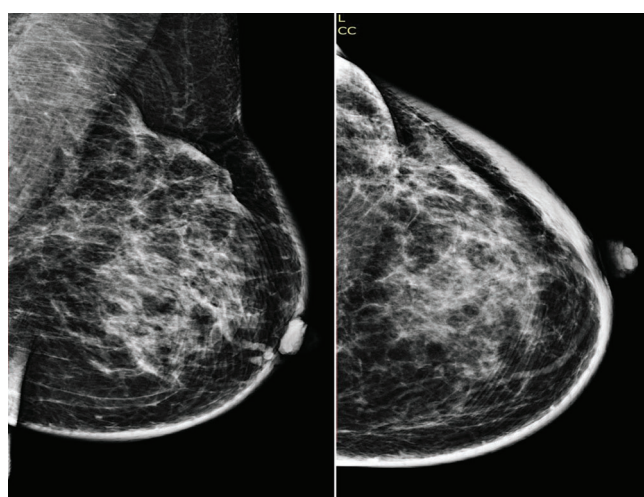


Figure-10a and 10b: Mammogram of a 35 year old female who underwent left breast conservation surgery for carcinoma left breast 1.2 years back – showing architectural distortion with diffuse skin thickening in the left upper outer quadrant at the operative site with few areas of lucency suggestive of fat necrosis.

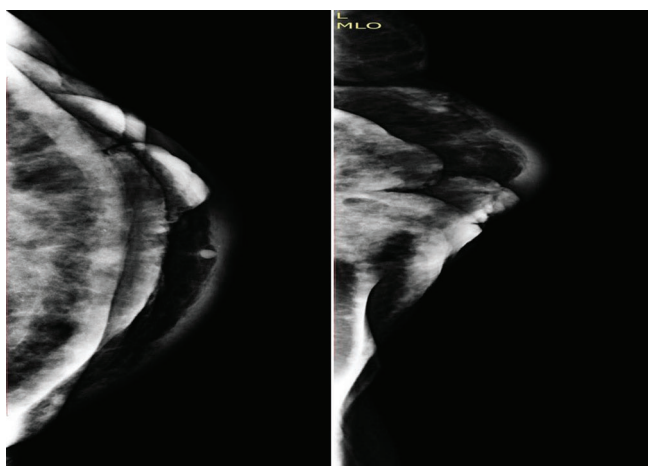


Figure-11a and 11b: Mammogram Craniocaudal (a) and mediolateral oblique (b) view in a 25 year old with quadrant lumpectomy done 2 years back showing – markedly reduced breast tissue with rest of the breast tissue showing architectural distortion with irregularity and clustered fine pleomorphic calcification with overlying skin thickening and retraction- recurrent lesion at the same site.

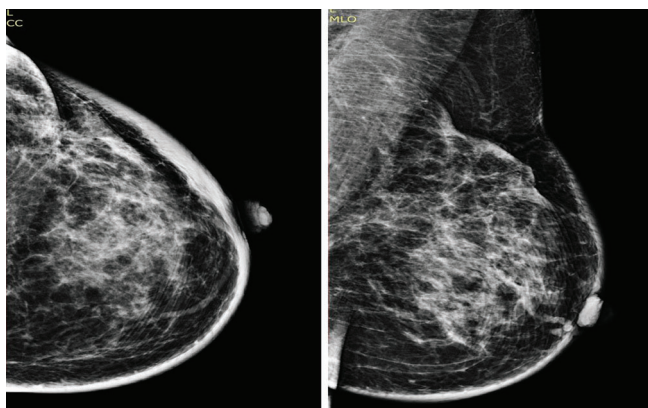


Figure-12a and 12b: Mammogram craniocaudal (a) and mediolateral view (b) of a 36 year old female in post breast conservation surgery done 1 year back showing a well defined iso to high density area with surrounding peripheral lucency seen in upper outer quadrant. Similar few low density areas seen scattered in inner quadrant - fat necrosis.

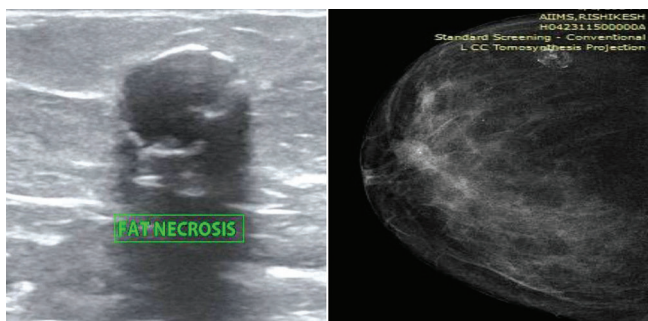


Figure-13a and 13b: Ultrasonography of the breast reveals a well-defined oval hypoechoic lesion showing peripheral hyperechoic rim and eccentric hyperechoic component casting posterior acoustic shadowing in subcutaneous plane. Mammogram of the same patient reveals a lucent lesion with discontinuous rim calcification and coarse macrocalcifications in upper inner quadrant - suggestive fat necrosis.

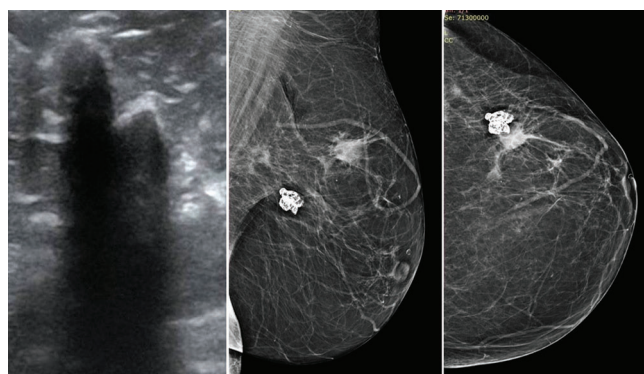


Figure-14a, 14b and 14c: Ultrasonography of a 57 years old female with post lumpectomy status left breast showing an ill-defined area showing multiple foci of coarse macrocalcification in upper outer quadrant beneath the scar site. Mammogram mediolateral oblique and cranio-caudal view of the same patient showing a coarse ill-defined area of macro-calcification - suggestive of dystrophic calcification.

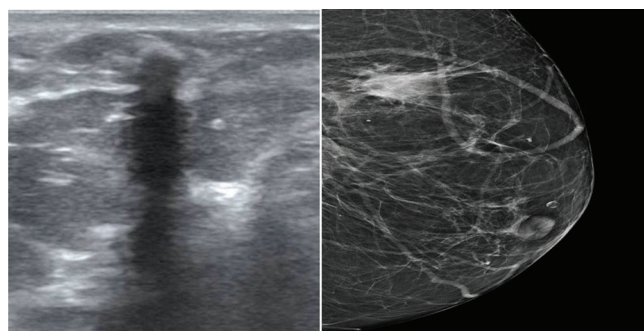


Figure-15a and 15b: Ultrasonography of a 57 year old female with post lumpectomy status showing a small well defined hyperechoic lesion with strong posterior acoustic enhancement. Mammogram craniocaudal view of the same patient showing a well defined lucent lesion with rim calcification in retroareolar region of breast - suggestive of oil cyst.

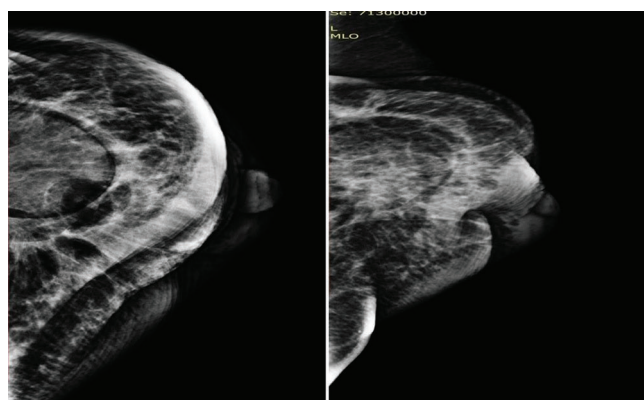


Figure-16a and 16b: Mammogram craniocaudal view of a 47 year old female with Post operative status of left skin and nipple sparing mastectomy with fat grafting showing architectural distortion in entirety with multiple folds of retracted skin with skin thickening. A well-defined iso to high density area with surrounding peripheral lucency seen in upper outer quadrant. Similar few low density areas seen scattered in inner quadrant - post operative changes with fat necrosis.

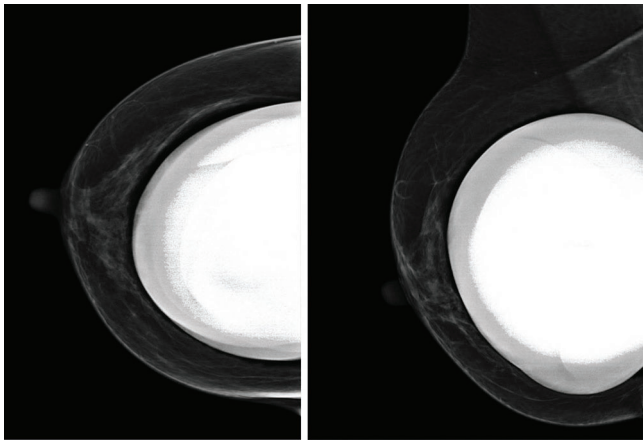


Figure-17a and 17b: Mammogram craniocaudal and mediolateral view of right breast a 60 year old female with bilateral subglandular breast implants, 7 years back, presented with complains of left breast pain since 4 months. Normal silicone implant with maintained outline. No evidence of any implant rupture seen.

Note: Subsequent MRI (not shown) was done for implant integrity which showed intracapsular folds.

was post breast implant surgery. Mean age group of the patients was ranging between 40-60 years which constituted 76% of the total patients (fig 2). Out of the total 50 patients, 15(30%) patients had simple lumpectomy, 20(40%) had undergone breast conservation surgery, 2(4%) had undergone tumour excisional biopsy, 8(16%) had modified radical mastectomy and 5(10%) were post total mastectomy patients. 4(8%) patients had undergone biopsy and 7(14%) had undergone Fine needle aspiration cytology (FNAC) in our study group for evaluation. 35(70%) patients were evaluated in 0-6 months after surgery, 30 (60%) patients in 6 months-1 year, 10(20%) patients in a period of 1-3 years and 5(10%) patients presented 3-5 years after surgery (fig 3). Patients were called for every 6 monthly follow up and then annually.

DISCUSSION

Skin thickening, skin fold and Surgical scar

Normal post operative findings include architectural distortion, increased density and parenchymal scarring in at least 50% patients. These findings decrease in severity over time. These findings get stable in 3-5 years on subsequent mammograms. Scar appears as an area of chronic architectural distortion or a spiculated mass more evident on one projection than the other. Normal skin thickness is less than 2 mm, however in post breast conservation surgery patients, thickness can be 10 mm or more. Any recent change in edema or skin thickening should raise the suspicion of recurrence and should be closely evaluated. By 2 to 3 years after breast conservation therapy, the skin has returned to near-normal thickness, although mild thickening persists in approximately 30% of the patients.³ Nearly all patients who have had axillary dissection or radiation therapy have breast edema.^{4,5} Skin and trabecular thickening can also be seen secondary to radiation therapy⁶ (figure-4,5).

Seroma

Asymmetric soft-tissue densities are expected at

postoperative sites.⁷ They have been described as being more common in older and obese patients.¹¹ MRM is more frequently associated with seroma formation than lumpectomy.⁸⁻¹² Postsurgical seroma after MRM occurs in 20-50% of patients compared with 9-20% of patients after lumpectomy.⁸⁻¹³ In rare cases, when a mammogram is taken within few days of surgery, a round or oval mass in the post operative site is seen representing a seroma or hematoma. Air can be present or absent within it. This mass represents the biopsy-cavity which is filled with fluid that should resolve over time. The adjacent breast tissue shows thickening of trabeculae and increased density in subcutaneous fat caused by local edema and hemorrhage. Over the subsequent weeks, the post-operative site resorbs the air and fluid collection and the collection is replaced by fibrosis, scarring and residual focal skin thickening. On ultrasonography, these are seen as anechoic fluid collections. Later on, thickened nodular margins may develop with internal echoes within. A hematoma is a less common postsurgical complication, with a reported incidence of 2-10% of breast cancer surgery cases.⁹ Hematomas are slightly more dense than seromas on mammograms due to hemosiderin (fig-6,7,8).

Architectural distortion

Distortion of breast parenchyma is commonly seen in post operative patients after breast conservation surgery. On mammogram, this is seen as areas of increased trabecular thickening, increased density, area of focal skin retraction, spiculations seen radiating into the breast parenchyma. Architectural distortion is often a mimic of recurrence in breast carcinoma. Non association with mass, variable appearances on different projections and presence of interspersed areas of fat goes in favour of architectural distortion. Comparison with prior imaging is invaluable in excluding malignancy. On ultrasonography, architectural distortion is seen as area of altered echogenicity with distortion of adjacent cooper's ligaments (fig-9,10).

Recurrence

Recurrent breast cancer is the development of malignancy within the same breast either at the same site or close to the previously operated site in a period of more than two years following surgical excision. The rate of local recurrence may be as high as 19% in 10 years. Maximum cases in recurrence in breast occurs 4-6 years post treatment (fig 11). Tumor recurrence varies from 6% to 10%, at rates reported as 1% to 2% or more per year after treatment.^{14,15,16,17,18}

Fat necrosis

Fat necrosis is a benign (non-cancerous) breast condition that happens when an area of the fatty breast tissue is damaged, usually as a result of injury to the breast. It can also happen after breast surgery or radiation treatment. It can take months to years to develop. Sometimes, inflammation may lead to fibrotic response and can produce appearance similar to desmoplastic reaction in breast along with calcium deposition which can mimic appearance of cancer. Lipolysis, inflammatory cell infiltration, and hemorrhage occur acutely followed by the formation of fibrous scar or a calcified cystic mass as the lesion evolves¹⁹, resulting in a variable imaging appearance. On ultrasonography, seen as hypoechoic mass

with well defined margins and mural nodules within. On Mammography, fat necrosis is seen as an encapsulated fat containing lesion or large calcifications in the surgical bed. Initially it can be seen as ill-defined, irregular area with spiculations (fig -12,13).

Dystrophic calcification

Morphologically these calcifications are large (> 5 mm) and irregular in outline with central lucencies, with no associated mass/density and always occur at the site of surgery.²⁰ These are manifestation of fat necrosis. A dystrophic calcification have smooth margins, unlike the irregular margins seen in microcalcification suggestive of malignancy. They are common after surgery and radiotherapy.²¹ On mamography, the presence of radiolucent area within is indicative of existence of fat (fig 14).

Post operative oil cyst

Oil cyst is a form of fat necrosis. The damaged body tissue is repaired and is replaced by firm scar tissue. The classic appearance of fat necrosis in the breast is a radiolucency that is visible due to its thin capsule. These have a variable appearance on ultrasound but may be hypoechoic. They are well-circumscribed hypoechoic lesions with variable through-transmission of sound. On mammography, these are seen as radiolucent rounded lesions with fat density in the centre. Peripheral calcification if present is seen as eggshell calcification (fig 15).

Reconstruction

Mammographic findings in the patients undergoing breast reconstruction includes changes in the parenchymal architecture, cranial or caudal displacement of the nipple, development of patchy densities due to tissue removal and scarring and also fat necrosis. A new baseline mammogram should be obtained 6 months after surgery. After a mastectomy, breast reconstruction can be done by means of autogenous tissue transfer or implants. The most common autogenous tissue transfer site is from the panniculus or from a free myocutaneous flap. The most frequent location of the donor tissue is from a flap harvested from the latissimus dorsi muscle or the transverse rectus abdominis muscle (TRAM) flap. Ultrasonographic and mammographic findings are related to the development of dystrophic changes within the donor tissue, such as oil cyst, fat necrosis and dystrophic calcification. Sometimes tissue scarring also is a common mimic of cancer, which can lead to warrant of biopsy in those cases (fig 16).

Breast Implant

An increasing number of patients have breast implants for cosmetic augmentation of the breast, reconstruction after mastectomy or correction of congenital malformations.²² Breast implants may be placed in a subglandular (anterior to the pectoralis major muscle) or subpectoral (posterior to the pectoralis major muscle) location. The technique used for mammography in breast implant is Eklund technique. Only 1 patient of implant was included in our study. Extrasilicone ruptures can be easily indentified while intrasilicone ruptures are hard to identify on mammogram. On mammography, implants appear as oval masses with a dense silicone envelope

in outer aspect and a less radio-opaque center. Normal membrane foldings and glandular tissue can be seen through the implant depending on the penetration used. Ultrasound is helpful in the assessment of contour, content and morphology of implant. The normal undulations are seen as wavy echogenic lines with or without intervening fluid. Both the silicone and saline implants appear anechoic surrounded by linear echogenic envelope (fig 17).

CONCLUSION

The post surgical changes in breast need clinical correlation and proper evaluation with the clinical history. Skin thickening, edema, increased breast density and increased trabecular thickening are the findings commonly seen in post operative patients. Any new appearance of architectural distortion or mass lesion or newer microcalcifications should raise suspicion for development of a new cancerous mass lesion and should be thoroughly evaluated. Stability is defined as no interval change on two successive mammographic studies²³ and is generally observed at around 2-3 years after the completion of radiation therapy. Fat necrosis is often a mimic of breast cancer in post operative patients. Such patients should be kept in close follow-up and fully evaluated if clinically appears to be suspicious. Inconclusive diagnosis on ultrasonography and mammography can lead to biopsy in such patients. Thorough knowledge of the imaging features in post operative breast is essential in decision making and follow up.

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