The Dilemmas' in Investigating Breast Cancer Following Breast Augmentation

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ABSTRACT

Introduction: There is still controversy in the literature as regards the role of mammography in diagnosing carcinoma of the breast in women with breast prosthesis, the primary aim of this study was to assess the efficacy of mammography in the management of breast cancer following augmentation of the breast by implants.

Methods: Review of our database and case records from October 2009 till October 2015, along with a detailed analysis of the current medical literature

Results: 15 patients were identified, all developed breast cancer following breast implant insertion. Mammography failed to show any abnormality in 10 patients (66.7%), mammograms detected incidental benign looking microcalcifications (M2) in 2 patients (13.33%), in 2 patients' mammography showed indeterminate findings (M3) (13.33%), only one patient (6.67%) had suspicious mammographic findings (M4). In contrast, Ultrasound Scan (USS) demonstrated lesions in all of 15 patients, the Magnetic Resonance Imaging (MRI) scans, confirmed the lesions denoted in the USS on all of the 6 patients who underwent MRI mammography (100%).

Conclusion: Mammography is a poor modality for the diagnosis of early breast cancer in women following breast augmentation surgery. Authors would advise the consideration of MRI mammography and focused Ultrasound scan in the radiological assessment of these women.

To cite this article
[Metry, M., Shaaban, M., Thomas, R., Amonkar, S., Bristow, G., … Mclean, N. (2017). The Dilemmas' in Investigating Breast Cancer Following Breast Augmentation. *The Journal of Middle East and North Africa Sciences*, 3(6), 17-22]. (P-ISSN 2412- 9763) - (e-ISSN 2412-8937). www.jomenas.org**. 5**

Keywords: Breast cancer, augmentation, implants, mammography, artifacts, MRI, USS

1. Introduction:

Cosmetic Breast augmentation is now the most commonly performed aesthetic surgical procedure with an 800 % increase in the last 20 years (Love & Lindsey, 2000; The American Society for Aesthetic Plastic Surgery, 2012). There is still controversy in the literature as regards the role of mammography in diagnosing carcinoma of the breast in women with breast prosthesis, strong concerns remain that implants could impair the ability to identify breast cancers using mammography, with a potential subsequent increase in the mortality rate (Silverstein et al., 1990;1991).

The current national health services breast cancer screening program is using mammography for screening women with bilateral breast implants; however, women are informed of the possibility that mammography can be less effective in women who have breast implants (National Health Service, 2010).

Contrast-enhanced MRI of the breast is probably the most sensitive method to detect breast pathology. It is best used to improve the sensitivity of mammography and sonography in selected patient groups, where conventional methods are known to be less sensitive (Friedrich, 1998). The primary aim of this study was to assess the efficacy of mammography in the management of breast cancers following augmentation of the breast by implants.

2. Case Report and Analysis of the Cohort:

A 48-year-old female patient presented with a 10-mm mass on the lateral aspect of her left breast, 10 years after she had had bilateral sub glandular breast augmentation, the triple assessment was performed. Neither there was a family history of breast cancer nor was there a family history of ovarian cancer. She had no comorbidities. On examination, she had a smooth small clinically benign 10 mm mass on the lateral aspect of the

left breast (P2). The mammogram showed no abnormality, apart from the presence of the implants (M2) (Fig1), USS showed a 6.5 mm indeterminate lesion (U3) at the site of the clinical mass (Fig 2). Core biopsy revealed invasive ductal carcinoma (no special type), and Axillary lymph nodes fine needle aspiration cytology showed only lymphoid cells. An MRI (Fig 3). the scan showed that the tumor measured 8 mm (MRI 6), and a further incidental MRI 3 abnormality on the contralateral breast, this area was normal breast tissue on second look USS.

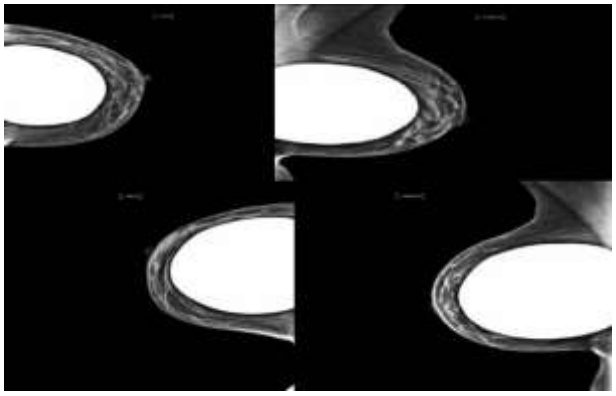

Figure 1. The mammogram images of the case report's patient; no abnormality detected M2.

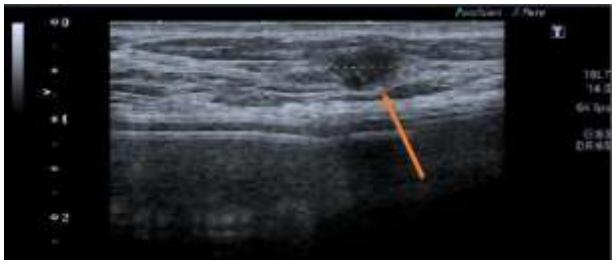

Figure 2. The ultrasound scan of the case report's patient; indeterminate lesion U3.

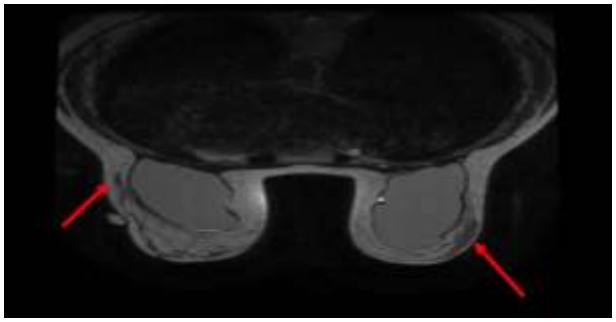

Figure 3. The MRI of the case presentation: showing the malignant lesion on the left (MRI 6), and the area with increased enhancement on the contralateral breast (MRI 3).

The patient underwent a left wide local excision with Sentinel Lymph Node Biopsy and Touch Imprint Cytology. A temporary expander was placed after removal of the original implant; a new implant was inserted after completion of the radiotherapy treatment. Histological examination revealed that the tumor was invasive ductal carcinoma (Grade 1), no associated DCIS. ER +ve (8/10), PR +ve (8/10), HER2 –ve and the Sentinel nodes were free of malignancy. In addition, the patient required anti-hormone therapy in the form of Tamoxifen and underwent a postoperative course of adjuvant Radiotherapy. She was disease free for 33 months following her cancer surgery.

3. Methods:

Following the treatment of this patient, authors have carried out a review of our database and case records from October 2009 till October 2015, along with a detailed analysis of the current medical literature. Authors have identified a further similar 14 patients, a total of 15 women were located from the database in our trust, all have been diagnosed and treated for breast cancer following bilateral breast augmentation with implants in this period.

4. Results:

15 patients were included in this study, the median age at presentation was 48.5 years (31-52ys), the median time from implant insertion and of the cancer detection was 8.75 years (2-17ys). 10 implants were sub glandular and 5 were sub pectoral, only one out of the 15 patients had PIP implants, 11 patients presented with a palpable breast mass, while 4 patients, were found to have changes/ thickening of breast tissue superficial to the implant (table 1). Standard Mammography of the 15 patients failed to show any abnormality in 10 patients (66.7%), mammograms detected incidental benign looking microcalcifications (M2) in 2 patients (13.33%), in 2 patients' mammography showed indeterminate findings (M3) (13.33%), while only one patient out of the 15 patients (6.67%) showed suspicious mammographic findings; in the form of increased density with associated microcalcifications M4.

In contrast, Ultrasound demonstrated the lesions in 15 out of the 15 patients, 3 patients (20%) were staged U5, 4 patients were staged U4(26.67%), 7 patients (46.67%) were staged U3, and one patient was staged as U2 (6.67%). MRI scan was done for 6 patients only out of the 15, the MRI scans confirmed the lesions denoted in the USS on all of the 6 patients (100%). In these 6 patients, the MRI scans showed other lesions which were considered incidental findings, all of these incidental abnormalities underwent further assessment and biopsy when indicated, all of them turned out to be benign, or normal breast tissue. Unfortunately, MRI scans were not done for the remaining 9 patients.

Ultrasound scan guided core biopsy was performed on all of the 15 patients, 14 patients had invasive ductal carcinoma (93.3%) (With variable degrees of differentiations) while one patient had invasive lobular carcinoma (6.7%). See Table 2.

Table 1: *Clinical Presentation of the 15 patients.*

No.	Age of the patient at presentation	Clinical presentation	Type of Implant	Interval from implant insertion to cancer diagnosis
1	52	Thickening E2/3	sub-glandular silicone	17
2	31	Thickening E3	sub-glandular silicone	2
3	44	Mass E2/3	sub glandular silicone	8
4	48	Mass E2	sub glandular silicone	10
5	42	Mass E3	Sub glandular silicone	9
6	49	Mass E3	Sub glandular silicone (Unilateral)	10
7	53	Mass E3/4	Submuscular silicone	11
8	49	Mass E3	Sub glandular silicone	4
9	43	Mass E3/4	Sub glandular silicone	7
10	43	Mass E3	Submuscular (PIP) silicone implants	8
11	51	Mass E3	Submuscular silicone	4
12	36	Thickening E2/3	Sub glandular silicone	3
13	61	Thickening E3	Sub glandular silicone	27
14	44	Mass E3	Submuscular silicone	20
15	54	Mass E3	Submuscular silicone	20

With regards to the oncological management of the 15 patients in this cohort, 4 patients (26.67%) had simple mastectomy, with the implants being explanted. 4 other patients (26.67%) had a Skin Sparing Mastectomy with insertion of tissue expander in replacement of the implant, 3 patients (20%) had a Wide Local Excision (WLE), and insertion of expander instead of the implant, and 4 patients 26.67% had WLE, SLN biopsy with preservation of the implants, all these procedures were joined with Sentinel Lymph Node Biopsy (SLNB) and intra-operative touch Imprint Cytology (TIC). Histopathological examination confirmed that 14 patients (93.33%) had an invasive ductal carcinoma while 1 patient (6.7%) had an invasive lobular carcinoma.

Following assessment and review at the multidisciplinary team meetings, 6 patients (40%) required irradiation and anti-hormone therapy, 2 patients (13.33%) had Chemotherapy and anti-hormone therapy, 4 patients (26.66%) had irradiation, chemotherapy and anti-hormone therapy, 2 (13.33%) needed chemotherapy alone, and 1 patient (6.67%) needed no further treatment.

Table 2: *Triple Assessment Outcome.*

No.	Clinical presentation	USS	Mammogram	MRI	Histology
1	Thickening E2/3	mass U4	no abnormality M2	Not done	invasive ductal carcinoma, G2, ER +ve, her2-ve
2	Thickening E3	mass U3	no abnormality M2	Single mass 13mm	invasive ductal carcinoma, G1, ER+ve, Her2-ve
3	Mass E2/3	Masses x3 U2	M2 benign micro calcifications	not done	invasive ductal cancer ER and PR+ve her2 -ve and DCIS
4	Mass E2	mass U3	no abnormality M2	Mass +incidental finding (normal breast tissue on second look USS	invasive ductal cancer G1 PR and PR+ve, her2-ve
5	Mass E3	mass +calcifications U3	no abnormality M2	not done	invasive ductal cancer G2 PR and PR+ve, her2-ve
6	Mass E3	2 masses U3	not done	Single mass	invasive ductal carcinoma G2, PR, and ER+ve, Her2-ve
7	Mass E3/4	mass U5	indeterminate 10mm area M3	Not done	invasive ductal carcinoma G2, PR and ER+ve, Her2-ve
8	Mass E3	mass	M4 micro calcifications	Not done	invasive lobular ca G3 ER +ve, Her 2 -ve
9	Mass E3/4	carcinoma of the breast U5	M3 microcalcifications	Not done	invasive ductal carcinoma G1, PR, and ER+ve, Her2-ve
10	Mass E3	several cysts + solid lump U3	no abnormalityM2	Single mass 13mm	invasive ductal carcinoma G2, PR and ER+ve, Her2-ve
11	Mass E3	speculated mass U4	intermediate M3	Not done	Invasive ductal carcinoma, G2, ER +ve, Her 2 -ve

5. Discussion:

Although many epidemiological studies failed to demonstrate an increased incidence of breast cancer in a woman who has undergone prior prosthetic augmentation mammoplasty, it has been reported that when breast cancer does rise in this group, it presents as a palpable abnormality and at a more advanced stage (Cahan et al., 1995). Some papers have found that women with breast implants had a 26% increased risk of being diagnosed at a later stage of breast cancer (Lavigne et al., 2013), there being several potential explanations, firstly, that both silicone and saline implants can create radio-opaque shadows on mammography, which may impair visualization of the breast tissue (Tang & Gui, 2011). Secondly, the amount of parenchymal breast tissue obscured at mammography by the implant is known to be between 22% and 83% (Smalley, 2003), thus making the diagnosis potentially much more difficult. Thirdly Insufficient compression of the breast reduces visualization of the parenchyma, especially if there is capsular contracture, capsule contracture may develop in about 15-20% of women with implants which have been shown to reduce mammographic sensitivity by 30-50% (Tang & Gui, 2011). Finally, the occurrences of implant related mammography film artifacts can also make interpretation of mammographic examinations difficult in women with augmented breast (Handel et al., 1992; Fajardo et al., 1995).

Furthermore, specific characteristics of breast implants position might affect detection of a breast cancer (Sarwer et al., 2007). Particularly implants placed in the sub glandular position due to their proximity to the breast tissue are suspected of obstructing mammographic visualization of the breast more than those positioned sub-muscularly (Silverstein et al., 1990;1991).

Eklund's technique, is a mammography modified positioning technique, which has been described in 1988, (Silverstein et al., 1990; Eklund et al., 1980) in this technique the implant is displaced posteriorly against the chest wall and at the same time pulling breast tissue over and in front of the implant, marked improvement in compression and visualization of substantially more breast tissue is achieved by this technique. However, one-third of the patients still not adequately visualized by this technique (Eklund et al., 1980).

Recent reports suggest that MRI imaging may be a helpful tool in these patients as it allows for examination of all of the breast tissue surrounding the implant (Uematsu, 2008; Juanpere et al., 2011). Hence has greater sensitivity than mammography (Orel & Schnall, 2001). Although MRI imaging has demonstrated variable specificity, its reported sensitivity for the demonstration of invasive breast cancer has approached 100% in several studies (Orel & Schnall, 2001).

As regards the role of the Ultrasound Scan (USS) in finding breast masses after augmentation mammoplasty, it offers improved visualization of the breast tissue-prosthesis interface, and it is extremely helpful in distinguishing breast parenchymal lesions from palpable irregularities of the implants, as implant rippling (Shestak et al., 1993).

Regarding the radiological investigations as part of the triple assessment of symptomatic women with prior breast implants, it should be in the form of focused ultrasound scan and breast MRI mammography. instead of standard mammography in women with a breast implant (Heinig et al., 1997; Friedrich, 1998)

Long term breast implant placement has been hypothesized as causing atrophy, thinning, and compression of the breast parenchyma, which may facilitate the detection of palpable breast tumors on physical examination (Skinner, et al., 2001; Jakub et al., 2004; Handel & Silverstein, 2006; Handel, 2007). This suggests that tumors with equal size could be easily palpated with implants especially these in the sub glandular position (Smalley, 2003).

Furthermore, the fact that woman with implants presents more frequently with palpable lesions could be because of their smaller native breast volumes (Clark et al., 1993a).

Further challenges exist as regards the treatment options of these patients, with the presence of breast implants they have an increased risk of developing capsular fibrosis and contracture after breast radiation (Clark et al., 1993b). These changes can develop over time and are not immediately evident (Clark et al., 1993b).

Treatment options include: Given that the aesthetic results of breast conservation treatment with whole breast irradiation are less optimal in the setting of breast implant augmentation. One option for patients with the early-stage disease would be skin-sparing mastectomy with immediate reconstruction (Clark et al., 1993b). In experienced hands, this approach can achieve excellent cosmetic results and can also avoid the need for post-operative irradiation. A disadvantage of this approach is that the patient might lose the nipple-areola complex and associated sensitivity (Clark et al., 1993b). They might also require further surgery at a later date.

For patients who wish to avoid mastectomy, the options are whether to remove the implant or treat cancer with the implant in situ. Removal of the implant only may be considered if, at a later point of time, a cosmetic revision surgery is required. Most patients with augmentation implants are loathed to remove the prosthesis, as this will result in a smaller breast with possible ptosis. Leaving the implant in place is an acceptable option because the implant doesn't have an adverse effect on the efficacy of treatment if successful breast conservation is feasible (McIntosh & Horgan, 2007).

A final consideration for treatment would be to consider a partial breast irradiation approach. To date, there are no available data concerning partial breast irradiation for women with prior breast augmentation. The small

amount of superficial breast tissue would preclude an interstitial brachytherapy or balloon catheter approach if the implant is sub glandular, but a conformal external beam approach might be considered and may minimize the risk of capsular contracture (Victor et al., 1998).

6. Conclusion:

Mammography is a poor modality for the diagnosis of early breast cancer in women following breast augmentation surgery. Although there are some modified techniques to resolve the problem, the results remain unsatisfactory (Silverstein et al., 1990). Authors would advise the adoption of using another modality in addition to mammography in the screening of women with breast implants; namely MRI mammography or whole breast Ultrasound scan (if available) to avoid missing significant lesions in those women. There are certain factors which need to be addressed such as the cost-effectiveness and a number of significant lesions which could be demonstrated on MRI and will need further assessment.

Finally, the crux of the matter is that the development of early breast cancer in implant augmented women represents a very challenging clinical situation. It is important for such patient to discuss the benefits and the risks associated with the various treatment options with her surgeon as well as a radiotherapy oncologist and a plastic and reconstructive surgeon so that the optimal treatment plan can be formulated.

Financial Support
None.

Conflicts of Interest:
No conflicting relationship exists for any author.

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Received March 14, 2017; revised April 20, 2017; accepted May 10, 2017; published online June 01, 2017.