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CASE STUDY

ROLE OF MR MAMMOGRAPHY IN WOMEN WITH BREAST IMPLANTS

***Maha Mohamed Abd Al-Raof, Noha Mohamed Osman and Muhamed Adel Abd Al-Azim Amin**

Professor of Radio-diagnosis Ain Shams University, Lecturer Of Radio-diagnosis Ain Shams University, M.B.B.CH., Ain Shams University

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ABSTRACT

Mammography is rapid and inexpensive, but it is of limited usefulness in detecting implant rupture in women with silicone implants. It is very inaccurate for intracapsular rupture and will reliably detect extruded silicone only in an extra capsular rupture.

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INTRODUCTION

Since the reintroduction of breast implants in breast augmentation has become the most common cosmetic surgical procedure (Gribelyuk *et al*., 2012). Mammography ultrasonography, computed tomography, and magnetic resonance imaging (MRI) have been used to assess the integrity of breast implants. In previous studies, MRI has been shown to be superior compared with other methods (Cher *et al*., 2014).Magnetic resonance imaging should be considered the method of choice for investigating breast implants, and the standardization of magnetic resonance imaging criteria may improve magnetic resonance imaging accuracy (Rietjens *et al*., 2014).Clinical information is usually helpful and is occasionally crucial .The normal appearance of certain types of implants can be confusing, and can simulate the appearance of rupture; knowledge of implant type can minimize the likelihood of diagnostic error (McNamara and Middleton 2011).In evidence of intracapsular rupture Mammography is typically normal, and the rupture is identified only on three-dimensional imaging, such as MRI (De Paredes 2007).Regular magnetic resonance imaging has been recommended for the purpose of screening for implant rupture (McCarthy *et al*., 2008).

Location of implant: Could be in any of the following locations (Querci della Rovere *et al*., 2008):

- Retrommammary
- Retromammary sub fascial
- Sub pectoral
- Complete sub muscular
- Dual plane

Retromammary (subglandular or retroglandular) placement maximizes the augmentation effect of the implant, but obscures more tissue on the mammogram, while subpectoral (or retropectoral) is a more involved surgery and has less of a cosmetic augmentation effect, but may enables better visualization of the tissue for subsequent mammography. For women who have implants placed after mastectomy, the implant is always placed behind the muscle (Liberman and Berg, 2005).

Magnetic resonance imaging of breast implants

Table 1.MRI Sequences and Resulting Signal Intensities of Silicone, Fat, and Water (Liberman and Berg, 2005). Sagittal plane imaging is helpful to evaluate implant contour and to identify extra-capsular silicone. Identifying extra-capsular silicone with greater confidence is achieved by the combination of a sequence in which silicone is of high signal with a corresponding sequence in which the silicone signal is low (Potterton, 2002).

Contrast administration: Knowledge of the clinical question is essential when planning the protocol for MRI in a woman with breast implants.

****Corresponding author:*** **Maha Mohamed Abd Al-Raof,**
Professor of Radio-diagnosis Ain Shams University, Lecturer Of Radio-diagnosis Ain Shams University, M.B.B.CH., Ain Shams University.

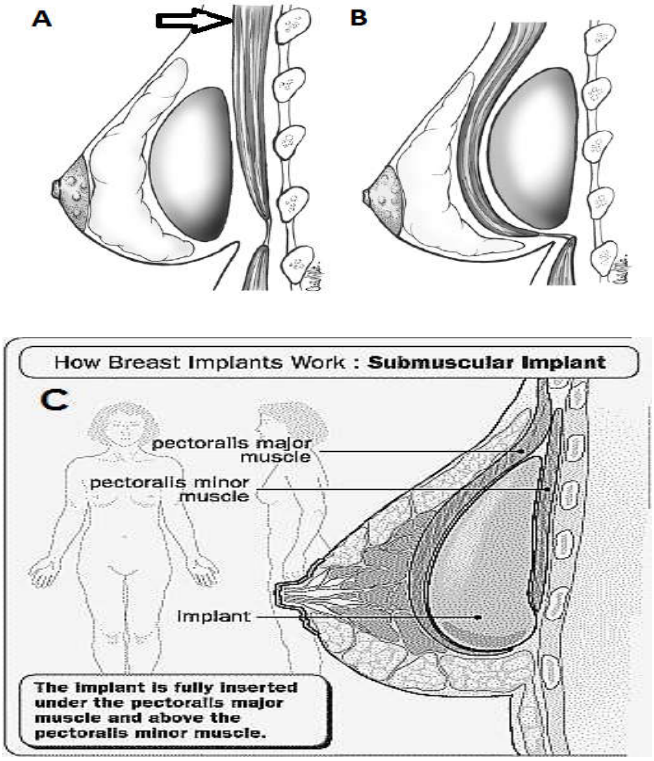

Fig. 1. Diagrams showing location of breast implants: A. Subglandular B. & C. Submuscular: diagram A. arrow indicates pectoralis major muscle (Pittet *et al*., 2005).

Table 1.MRI Sequences and Resulting Signal Intensities of Silicone, Fat, and Water (Liberman and Berg, 2005)

Pulse Sequence	Signal Intensity		
	Silicone	Fat	Water
Sagittal T2-weighted FSE (TR 4,000/TE 170)	Medium	Medium	High
Axial T2-weighted FSE with water suppression (TR 5,000/TE 300)	High	Medium	Low
Axial T1-weighted FSE with silicone suppression (TR 600/TE 15)	Very low	Low	Medium
Axial IR with water suppression (TR 5700/TE 30/TI 160)	High	Low	Low

If the MRI is being performed to assess silicone implant integrity, the appropriate examination is a non-contrast study, with use of axial and sagittal images and specific sequences described previously to evaluate the internal structure of the implant and to assess for extravasated silicone. If the MRI is being performed for cancer detection, the appropriate examination is a study optimized for parenchymal breast MRI, with pre-contrast and post-contrast images, ideally using fat suppression and subtraction. If the clinician desires both assessment of implant integrity and evaluation for possible cancer (e.g., a vague palpable finding that may or may not be related to the implant), and mammography and sonography are not definitive, it may be necessary to perform MRI sequences designed for implant evaluation as well as those for parenchymal assessment (Liberman and Berg, 2005).

Breast implant classification: Middleton and McNamara, 2000 described and illustrated various types of implants with special attention for correlating MR imaging appearance of implants with their actual construction. This could allow a better understanding of breast implants by radiologists and aid in implant imaging. They provided an MR-oriented breast implant classification scheme based on implant construction and MR imaging appearance.

Single-lumen gel:- Silicone gel-filled

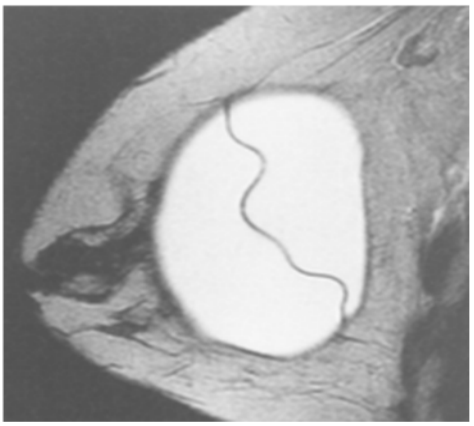

Fig. 2. Sagittal fast spin-echo T2-weighted water-suppressed MR image of single-lumen, silicone gel–filled implant with smooth implant shell. A normal fold of the implant shell, seen here as a dark thin line "within" the gel, can be seen extending all the way across the implant (Middleton and McNamara, 2000).

Single-lumen adjustable:-Silicone gel-filled,to which can be added a variable amount of saline at time of placement.

Saline-filled, dextran-filled:- Dextran-filled (some early implants), PVP-filled (Bioplasty), and the rest saline-filled.

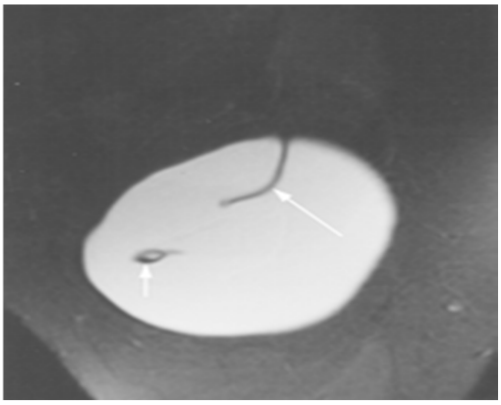

Fig. 3. T2-weighted fast spin-echo silicone-suppressed MR image of saline-filled breast implant with a retention valve, showing a cross section through the proximal round neck of the valve (short arrow). A peripheral fold is also seen (long arrow) (Middleton and McNamara, 2000).

Standard double-lumen:-Silicone gel inner lumen,saline outer lumen.

Fig. 4. Sagittal T2-weighted fast spin-echo water-suppressed MR image of gel-gel double-lumen implant.. Shown here is the decreased T2 signal from the more highly crosslinked inner-lumen gel (a) and the brighter gel from the (ruptured) outer lumen (b). The smaller (shared) upper back patch for the inner lumen is seen here as a darker, thicker line adjacent to the thicker gel layer of the inner lumen (arrow) (Middleton and McNamara, 2000).

Triple-lumen: Silicone gel inner and middle lumens, saline outer lumen.

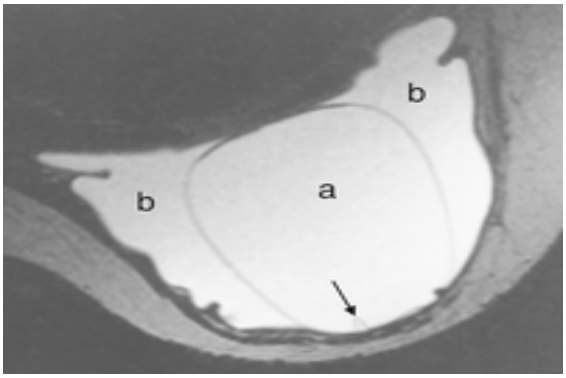

Fig. 5. Axial T2-weighted fast spin-echo water-suppressed MR image of triple-lumen implant showing silicone gel in the inner (a) and middle (b) lumens of this triple-lumen implant. The saline is gone from the outer lumen of this implant. Note the usual buckled appearance (arrow) of the fold in the inner lumen shell anteriorly, adjacent to the middle lumen. This is not a sign of rupture (Middleton and McNamara, 2000).

Breast Implants Complications

Implant failure: MRI has been shown to exceed other imaging modalities in identifying and characterizing rupture with a high sensitivity and specificity for rupture (Gorczyca *et al*., 2007).

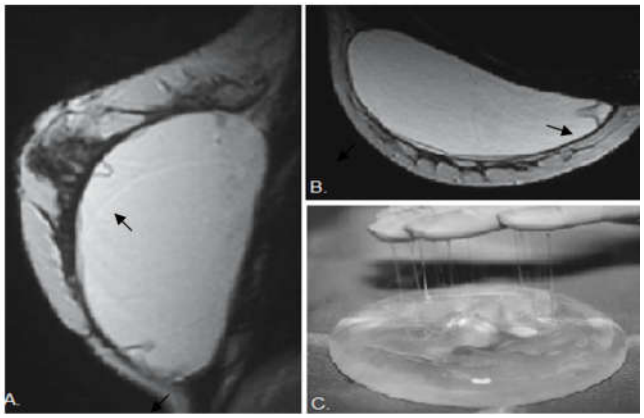

Fig. 6. Leakage/minimally collapsed rupture imaged by MRI in a woman with silicone implants placed 10 years previously. (A) Sagittal fast spin echo T2- weighted MRI (TR 5700, TE 199, 4mm slice thickness) shows the noose sign (arrows). (B) Axial FSE T2-weighted MRI (TR 5700, TE 119, 4mm slice thickness) shows the sub-capsular line (curved arrows) and noose (straight arrow) signs. (C) Intraoperative photograph demonstrates the sticky contour of the leaking implant. No gross violation of the implant shell was found at surgery (Liberman and Berg, 2005).

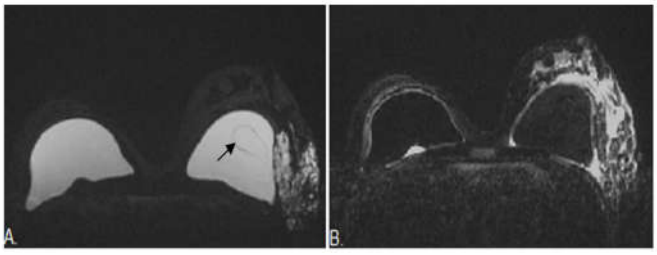

Fig.7. Bilateral single lumen silicone implants. On the patient's left there is intracapsular and extracapsular rupture. (A) Axial water-suppressed fast spin echo T2-weighted MRI (TR 5200, TE 304, 4mm slice thickness, FOV 20cm) silicone only image demonstrates a linguine sign (arrow) also there are droplets of silicone signal within the breast tissue lateral to the implant. (B) Axial, silicone suppressed T1-weighted MRI (TR 950, TE 11, 4mm slice thickness, FOV 20cm) fluid only image confirms the presence of extra capsular silicone, which now returns low signal. There is also considerable oedema of the breast tissue (Potterton, 2002).

Herniation and Migration

Capsular Contracture

Fluid Collections

Infection: Pus and fibrous strands may also be found inside the ruptured implant. It is not possible to tell the difference between a sterile and a septic rupture of an outer saline implant, but follow-up MR imaging may help differentiation (Fig. 62). In cases of infection, fluid persists around the implant, whereas in cases of sterile rupture the fluid would be expected to reabsorb quickly (Gribelyuk *et al*., 2012).

Haematoma

Solid masses

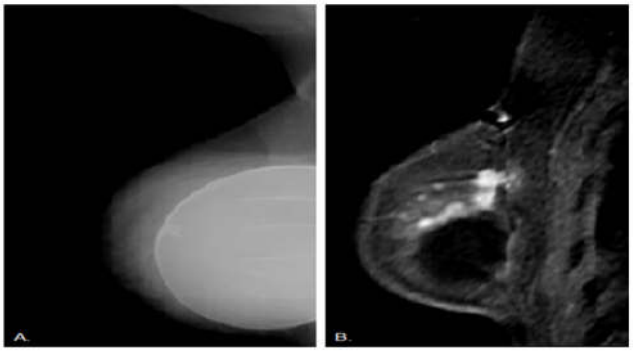

Fig. 8. A 59-years old woman with breast implants who had a history of left lumpectomy and axillary dissection 5 years previously for invasive lobular carcinoma. (A) Digital mammogram medio-lateral oblique view shows that the left breast is moderately dense with a retro-glandular saline implant. No suspicious findings are seen. (B) Sagittal, contrast-enhanced, fat-suppressed T1-weighted image MRI of the same case (TR 17, TE 2.276, slice thickness 3mm, FOV 20cm) shows extensive suspicious enhancement in the upper outer quadrant, supero-lateral to the implant, which further was confirmed multifocal invasive lobular carcinoma at mastectomy & histological analysis (Liberman and Berg, 2005).

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