Imaging of breast augmentation and associated complications

L Xu, JWC Wai, JLF Chiu, HHC Tsang, ACW Lee, KM Chu

Department of Radiology and Imaging, Queen Elizabeth Hospital, Hong Kong SAR

OBJECTIVE:

Breast augmentations are increasingly prevalent for cosmetic purposes or post-mastectomy reconstruction. This review aims to illustrate the imaging features of various types of breast augmentation and their associated complications, including some augmentation techniques that were routinely used in the past or in certain parts of the world but are now less frequently seen.

METHOD:

MRI is considered the gold standard for evaluation of breast augmentation. All cases of breast augmentation with MRI performed in Queen Elizabeth Hospital, a tertiary referral center, over a 9-year period from February 2011 to May 2020, were extracted from the PACS and RIS system and subsequently analyzed.

RESULTS:

A total of 32 breast augmentation cases were included: 1 case of paraffin injection, 3 cases of free silicone injection, 3 cases of PAAG injection, 8 cases of unspecified free injected material, 2 cases of saline implants, 11 cases of silicone implants, 2 cases of both free silicone injection and silicone implants, and 2 cases of unspecified implants. There were various complications associated with injections, such as swelling, migration, granuloma formation and infection; and complications from implants, such as intracapsular, extracapsular rupture and infection. One case of silicone implant also had concurrent breast cancer.

CONCLUSION:

MRI is the imaging tool of choice for breast augmentation. Knowledge of the typical imaging features of different breast augmentation and their associated complications can facilitate surgical planning and appropriate management.

Polyacrylamide gel (PAAG) Injection

PAAG contains 2.5-5% polyacrylamide suspended in 95-97.5% water and has been used for breast augmentation in China, Eastern Europe, and South America since 1997. It has similar intensities as water and is best depicted on MRI in T2W sequences. Complications include gel migration, leakage, infection, deformity, lump formation.

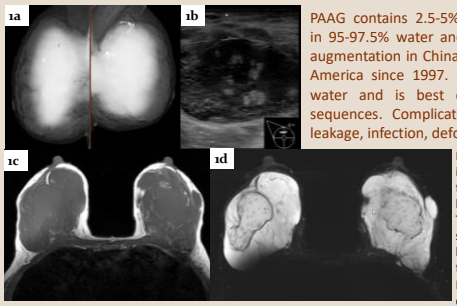

Fig 2. PAAG complicated with infection. 34/F, previously breast feeding, noted engorgement of both breasts with pain and erythema. T2W TSE MRI with fat saturation shows bilateral retroglandular T2W hyperintense collections with fluid-fluid level on the right side (>). Incision and drainage performed drained pus and gelatinous debris.

Fig 1. Uncomplicated PAAG in 41/F. (a) Bilateral MLO mammogram shows dense opacities in the retroglandular region of both breasts. (b) Ultrasound shows hypoechoic retroglandular collections with internal echogenic foci. Collections are usually anechoic to hypoechoic, often with multiple discrete foci of varying echogenicities and sizes. (c) T1W TSE (d) T2W TSE with fat saturation MRI show T1W hypointense and T2W hyperintense collections with several locules. Ideally, PAAG should be a large T2W hyperintense homogenous retroglandular collection without fibrous capsule, but it often cannot form a single blob.

Silicone Implant

Silicone implants are commonly used and can be placed in retroglandular or retropectoral positions. Normally, a thin fibrous capsule surrounds the shell. Complications include infection, capsular contracture, intracapsular/extracapsular rupture, gel bleed.

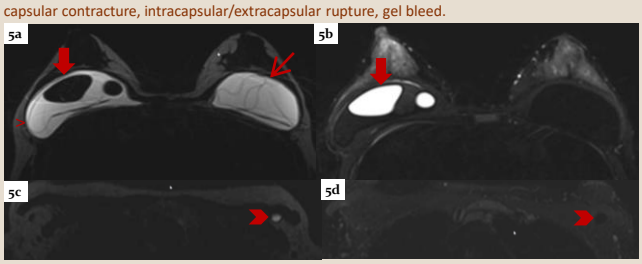

Fig 5. Right intracapsular and left extracapsular rupture of silicone only implant in 41/F. (a) T2W STIR water suppression MRI best illustrates "subcapsular line" (>) and "linguine sign" (thin arrow) of rupture. (b) T2W STIR silicone suppression suppresses internal silicone. T2W hyperintense fluid signals within the right breast implant, previously hypointense on water suppression, are "salad oil/droplet sign" of intracapsular rupture (thick arrows). (c) T2W STIR water and (d) silicone suppression sequences confirm extracapsular rupture on the left side with free silicone in the left axilla (arrow head).

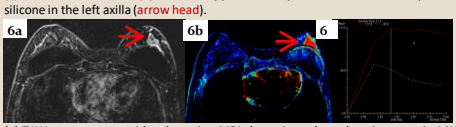

Fig 6. Concurrent left breast cancer anterior to retropectoral silicone implant in 40/F. Left mastectomy was performed with final pathology as invasive ductal carcinoma. (a) T1W post contrast with subtraction MRI shows irregular enhancing mass in L4H of left breast. (b) Corresponding increased color assignment in color overlay perfusion image (arrow). (c) Type II kinetic curve (red line).

Free Silicone Injection

Free silicone injection was introduced in the 1940s and is now banned in most countries, including by US FDA since 1992, but may be seen in older patients or still performed illicitly. Complications include migration, infection, granuloma formation, fibrosis, lymphadenopathy.

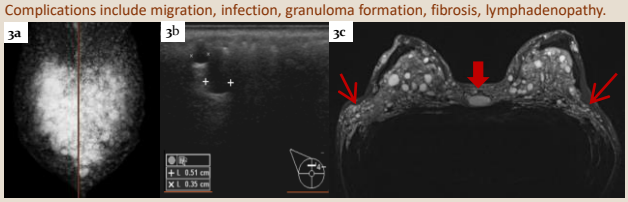

Fig 3. Free silicone injection in 50/F. (a) Bilateral MLO mammogram shows multiple small high density masses throughout both breasts with or without peripheral calcifications. (b) Ultrasound shows multiple anechoic to hypoechoic lesions, but can have "snowstorm appearance" of echogenic foci with posterior shadowing. (c) T2W STIR water suppression MRI is the best sequence for visualizing free silicone, which is hyperintense. Multiple small hyperintense collections are seen in both breasts with migration to bilateral axilla (thin arrows) and pre-sternal region (thick arrow). Pure T2W signal is variable due to fibrosis or granuloma formation, which can decrease T2W signal intensity. Signal should be suppressed on silicone saturated sequence.

Paraffin Injection

Liquid paraffin injection was widely used throughout the world in early 1900s up until the 1970s, but is now banned in most countries. Complications include paraffinoma formation, migration, infection, sinus tract formation, ulceration and necrosis.

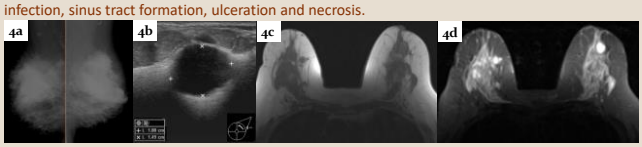

Fig 4. Paraffin injection in 77/F. (a) Bilateral breast MLO mammogram shows high density lobulated masses in both breasts. (b) Ultrasound shows cystic lesions. (c) T1W TSE (d) T2W TSE MRI show multiple T1W hypointense, T2W hyperintense fluid collections. Signal characteristics can vary depending on the degree of fibrosis and solidification.

Saline/Double lumen Implant

Saline implants, also commonly used, can be single lumen or double lumen with inner silicone gel and outer saline or inverse double lumen with inner saline solution, which can be adjusted as necessary. Complications are similar to silicone implant, although rupture is usually detected clinically with rapid implant decompression and ruptured saline can be absorbed into the body.

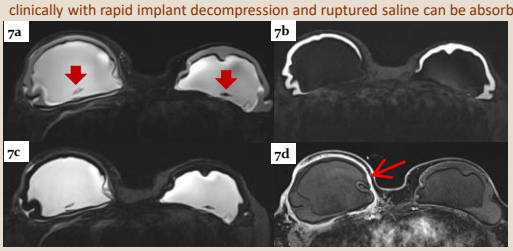

Fig 7. 64/F with inverse double lumen saline implants complicated by infection on the right side. Implants were subsequently removed. (a) T2W STIR MRI shows T2W hyperintense saline in inner lumen with valve (thick arrow) and T2W intermediate silicone gel in outer lumen and adjacent fluid. (b) T2W STIR water suppression shows that inner lumen saline is suppressed while the outer lumen silicone is hyperintense. (c) T2W STIR silicone suppression suppresses the outer lumen silicone. (d) T1W post contrast shows increased circumferential capsular enhancement around right breast implant (thin arrow), suggestive of infection.