Imaging findings in Breast Implants

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Learning objectives

- Describe radiological findings observed by different imaging tests in patients with breast implants.

- Analyze radiographic complications associated with breast implants.
Background

In recent times there has been an increase in the number of patients with breast implants, mainly due to two reasons:

- Advances in the diagnosis and treatment of breast cancer.
- Increased number of patients who undergo breast surgery for cosmetic reasons.

History of breast implants dates back to 1895, when Czerny performed the first breast augmentation. He transferred a hip lipoma to the breast of a patient who had a defect after the resection of an adenoma. From then until today many materials have been used, some of them with adverse effects.
TYPES OF BREAST IMPLANTS
Currently silicone gel implants contained by a silicone elastomer outer shell are used. There are also saline implants, which are used as expanders after breast surgery, until the skin and subcutaneous tissue are distended and saline implants are replaced by silicone implants (Figures 2 and 3).

Depending on the location we talk about subglandular or subpectoral implants. In subglandular location (Figure 4), breast tissue covers the implant, which favors the preservation of its original shape and allows better radiological access. However, the glandular tissue is displaced and compressed by the implant. Subglandular implants are at increased risk of capsular contracture.

Subpectoral location (Figure 5) implies a lower incidence of capsular contracture, since the pectoral muscle massages the implant with its movements, although that can favor light displacement of the implant. This location allows better radiologic study of breast tissue, however the study of the implant is more difficult because it is in a posterior location.

COMMON FINDINGS
There are radiographic findings which are often found in imaging studies of breast implants and which are not usually associated with complications.
1. Capsular calcifications appear on mammography as dystrophic calcifications around the implant. They may be secondary to long-standing capsular contracture (Figure 6).

2. Cover folds are a common finding in uncomplicated implants. They may also be related to capsular contracture. It is important to distinguish them from findings associated with intracapsular rupture (Figure 7).

3. The presence of fluid around the implant results because of an exudative reaction to the implant, which is a foreign body (Figure 8).

4. Another common finding is the herniation of the implant through a tear in the fibrous capsule. It appears as a lobulation of the implant. Clinically, it can be felt as a nodule (Figure 9).

COMPLICATIONS
1. CAPSULAR CONTRACTURE
The body reacts to the implant as with any foreign tissue forming a fibrous capsule which is soft, elastic and not palpable. When capsular contracture occurs, this capsule becomes hard and strangles the implant decreasing its compressibility. This fact is very important since the implant is less compressible than normal breast tissue and the capsular contracture makes mammography even more difficult and increases the risk of implant rupture.
The diagnosis of capsular contracture is clinical although imaging test can reveal an excessive pericapsular fibrosis (Figure 10). The etiology of this complication has been associated with silicone leakage, inflammatory reaction and infection. It has been reported lower incidence of capsular contracture with subpectoral implants because the pectoral muscle massages the implant with the movement, decreasing the formation of pericapsular fibrosis.

2. IMPLANT RUPTURE

It is important to distinguish between intracapsular and extracapsular rupture. In extracapsular rupture, the implant outer shell breaks and the silicone gel comes out through the fibrous capsule into the adjacent tissues. In intracapsular rupture the implant outer shell breaks but the silicone gel remains contained by the fibrous capsule.

The age of the implant, subglandular location and capsular contracture are factors favoring the implant rupture. Old age of implants carries a higher risk of rupture. Subglandular location is at greater risk of implant rupture than retropectoral location because in this case, the implant is covered by the pectoral muscle. Capsular contracture can compress the implant breaking it.

2.1. INTRACAPSULAR RUPTURE

Clinical diagnosis of intracapsular rupture is sometimes difficult. Patients may complain of pain and changes in consistency, shape or size of the implant. Intracapsular rupture can go unnoticed in mammography. In some cases we may see a separation between the outer shell and the fibrous capsule due to the presence of silicone (Figure 11).

Ultrasound often shows the "snow storm" sign, due to multiple interfaces of the outer shell and the silicone gel, however a characteristic sign of intracapsular rupture is the "stepladder" sign. It consists in parallel echogenic thin lines which represent the broken outer shell collapsed between the silicone gel (Figure 12).

MRI is the best technique for diagnosis of intracapsular rupture. The "linguine" sign is very specific and it consists in the outer shell broken and collapsed inside the fibrous capsule, surrounded by silicone gel (Figure 13). Another radiological sign which indicates intracapsular rupture is the "bull’s eye" sign. It is more sensitive but less specific than the "linguine" sign. When the outer shell breaks, silicon gel remains inside the fibrous capsule, between the implant folds (Figure 14).

2.2. EXTRACAPSULAR RUPTURE

Extracapsular rupture usually associates an increased breast volume with inflammatory acute signs (Figure 15). Often in mammography there is a diffuse increase of density due to the output of silicone gel to the adjacent tissues and due to the edema secondary to the inflammatory process (Figure 16).

Ultrasound findings consist in the "snow storm" sign.

MRI can find the same signs as described in the intracapsular rupture, demonstrating the presence of extracapsular silicone.

3. SILICONOMAS

Siliconomas are caused by the migration of silicone and secondary production of granulomas. May be caused because of the exudation of the silicone gel through the cover, which is semipermeable, or due to extracapsular rupture. In mammography they appear as high-density nodules (Figure 17). In ultrasound the "snow storm" sign is the
most frequent appearance, however siliconomas can also simulate complex cysts or hyperechoic nodules (Figure 18). In recent times we have seen several cases of patients with siliconomas secondary to free silicone injections (Figure 19 and 20).
Fig. 2

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TYPES OF BREAST IMPLANTS: FILL MATERIAL

There are saline implants, which are used as expanders after breast surgery, until skin and subcutaneous tissue are distended properly to introduce the silicon implant.

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Fig. 3

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TYPES OF BREAST IMPLANTS: SUBGLANDULAR LOCATION

ADVANTAGES:
- Allows a better radiological study of the implant
- Promotes conservation of the original shape of the implant

DISADVANTAGES:
- Increased risk of capsular contracture
- Breast tissue appears compressed and displaced by the implant

Fig. 4

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TYPES OF BREAST IMPLANTS: SUBPECTORAL LOCATION

ADVANTAGES:

- Allows a better evaluation of breast tissue
- Lower incidence of capsular contracture

DISADVANTAGES:

- Technical difficulties during surgery
- Difficult radiological study of the implant
- Promotes the implant movement

Fig. 5

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COMMON FINDINGS: CAPSULAR CALCIFICATION

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Fig. 6

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COMMON FINDINGS: COVER FOLDS

Mammography, ultrasound and MRI (STIR).

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Fig. 7

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Fig. 8

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Fig. 9

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COMPPLICATIONS: CAPSULAR CONTRACTURE

Axial MRI after intravenous administration of Gadolinium (VIBRANT). Fibrous tissue surrounding the right implant.

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Fig. 10

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Mammography shows silicone between the outer shell and the fibrous capsule. This finding supports the diagnosis of intracapsular rupture at an early stage.

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Fig. 11

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COMPLICATIONS: INTRACAPSULAR RUPTURE

Ultrasound shows the “snow storm” sign, due to multiple interfaces of the ruptured outer shell and the silicone gel.
COMPLICATIONS: INTRACAPSULAR RUPTURE

Sagital T2-weighted MRI. “Linguini” sign. The second image corresponds to a patient who felt a sudden and intense pain after mammography study. MRI showed intracapsular rupture of the implant.

Fig. 13

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Fig. 14

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COMPLICATIONS: EXTRACAPSULAR RUPTURE

Patient with breast implant with a significant increase in volume and acute inflammation in a patient with breast implants.

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Fig. 15

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COMPLICATIONS: EXTRACAPSULAR RUPTURE

Fig. 16

Retropectoral implant. The first study showed the implant without signs of complication. In the second study the patient presented breast enlargement and pain. Mammography showed diffuse increased density secondary to extracapsular rupture. The implant was removed and replaced with a new one.

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Fig. 17

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COMPLICATIONS: SILICONOMAS

Axial and sagittal MRI (VIBRANT sequence after intravenous contrast administration and STIR sequence). High signal intensity siliconomas located in axillary and internal mammary region.

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Fig. 18

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COMPLICATIONS: SILICONOMAS

Patient who underwent silicone injections presented multiple high density nodules of different sizes.

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Fig. 19

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Chest CT (axial and sagittal reconstruction). High density nodules of different sizes.

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Fig. 20

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Conclusion

Radiologists dedicated to breast imaging should be familiar with common radiological findings of breast implants and should be able to diagnose their complications.
Personal Information


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References