Learning objectives

• To become familiar with the different manifestations of fat necrosis in order to avoid unnecessary biopsies;

• To understand the histologic determinants of imaging findings of fat necrosis of the breast.
Fat necrosis of the breast is a benign inflammatory process resulting from saponification of fat that may mimic malignancy clinically and radiographically. It occurs as a consequence of an insult to the breast that leads to a varying amount of an inflammatory response depending on the intensity of the primary insult. It most commonly occurs in the setting of trauma (either iatrogenic like any invasive breast manipulation, or accidental) and radiotherapy. Other less frequent causes include spontaneous hemorrhage by anticoagulation (warfarin), breast infection, polyarteritis nodosa, idiopathic nodular panniculitis and granulomatous angiopanniculitis. Extravasation of blood into the parenchyma causes oedema and swelling of the trabecular framework of the breast which leads to pressure ischemia and necrosis with disruption of adipocytes. Cystic degeneration may then occur, resulting in a cavity that contains oily fluid secondary to necrotic fat - oil cyst or the intervening macrophages can form lipophagic granulomas. Its histologic nature varies throughout the process with fibrosis and calcifications occurring in later stages where it can resemble malignancy. In general, the more necrotic is the process (and the ensuing inflammation) the more sinister is the presentation of the condition [2].
Findings and procedure details

Fat necrosis may present as a firm painless ill-defined mass/nodule that may enlarge, remain unchanged or regress. It is frequently periareolar and superficial in location although some are adherent to skin. Nipple retraction and lymphadenopathy may be associated features, similarly to what is seen in carcinoma [3].

Imaging appearances are varied and mainly determined by the extent of fibrosis, the amount of liquefied fat and hemorrhage and the presence of calcifications [1][2].

Mammographic features reflect the amount of fibrosis: if minimal, the mass appears radiolucent or as an oil cyst, the latter being a pathognomonic finding [4]; if important, it can lead to a focal asymmetric density or an irregular spiculated mass. Dystrophic calcifications are the most common mammographic finding followed by radiolucent oil cysts [2]. Oil cysts may present with fat-fluid levels, serous-hemorrhagic contents, spherical densities (fibrin balls) or a uniform continuous eggshell calcification. Calcifications sometimes are the only mammographic finding. They are usually smooth, round or curvilinear, however they may be worrisome with branching, rodlike or angular appearance. It is important to categorize the BIRADS for mammography first before performing the ultrasonography to minimize the chances of overlooking malignancy, as ultrasonography is less specific than mammography [4].

Sonographically it may appear as a cystic or solid mass, either with benign or suspicious features of malignancy. Cystic lesions can be complex with mural nodules or internal echogenic bands. Solid masses may have well-circumscribed, indistinct or spiculated margins, sometimes with posterior acoustic shadowing, and are often associated with distortion of the breast parenchyma [2]. The most specific feature on fat necrosis on ultrasonography consists of a mass with echogenic internal bands that shift in orientation with changes in patient position [1], but the most common finding is of hyperechogenicity in the subcutaneous tissue, a reliable predictor of benignity [4]. Lack of Doppler is a supportive feature of fat necrosis but it doesn't seem to be a reliable discriminator between benign and malignant nodules [4].

Fat necrosis can mimic malignancy on MRI on the basis of morphology or contrast kinetics. Some lesions may enhance with a variable pattern after contrast injection depending on the intensity of the ongoing inflammation. Pure oil cysts (round, well circumscribed hyperintense areas on T1-weighted images), areas of oedema (hyperintense zone on T2-weighted images) and hemorrhage (diffuse decrease in signal intensity on both T1-and T2-weighted images because of abundant iron-containing siderophages) are fairly well identified, but lipophagic granulomas are difficult to
distinguish from malignancy. Fibrosis exhibits variable intensity of signal on T1-weighted images. Fat necrosis can resemble a breast cancer recurrence on MRI. Peripheral irregular enhancement with a non-enhancing central area of necrotic fat may be seen but this can also occur in malignant lesions which have necrotic centers. It may also appear as cystic lesion with a fat-fluid level without enhancement or with a surrounding spiculated enhancement without a washout. Fat suppression can be used to distinguish between enhancing breast cancers and enhancing regions of fat necrosis because fat exhibits a high intensity pattern which interferes with the detection of enhancing lesions. Biopsy may be avoided if the MRI signal is similar to that of the adjacent fat on unenhanced images and the lesion shows no internal enhancement [1].
Fig. 1: Histologically confirmed fat necrosis of the breast. a) mammogram depicts typical oil cysts with peripheral mural calcification ("eggshell calcification"). b) sonography study shows a well defined nodule, globally hypoechogenic with some hyperechoic foci, measuring 15 mm, in the retroareolar region of the left breast. Elastography shows a mixed green /blue lesion corresponding to a score 3/4 according to the Sonographic Classification by the Italian Multi-Center Team of Study, corresponding to the transition of an elastic to a prevalently rigid lesion.

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Fig. 3: A 45-year-old patient presented a small, painless nodule on the left breast. Mamogram (a) exhibited a radiodense nodular lesion with microlobulated contours. This has sonographic expression (b) as a solid nodule with heterogeneous ecogenicity, predominantly hypoecogenic of about 10mm. Excision biopsy pathology revealed fat necrosis of the breast associated with multiple foci of ductal carcinoma in situ, diffusely spread in the breast tissue adjacent to the nodule.

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Fig. 4: Multiple sonographic presentations of histologically confirmed fat necrosis of the breast in different patients who had previous segmental mastectomy for breast cancer. a) fat necrosis presented in a US follow up as a spiculated area with posterior acoustic shadowing in the cicatricial zone. b) cystic complex lesion with solid component and irregular margins in the cicatricial area. c) nodular mass of 32mm, with irregular contours, presenting with some heterogeneous internal ecogenicity, although predominantly hypoecogenic. d) complex lesion on the left axilla after node dissection. e) heterogeneous ill-defined lesion of about 20x10mm with irregular margins located near the surgical scar. f) homogeneous hypoecogenic circumscribed oval nodule in relation with the surgical scar.

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Conclusion

There are some typical imaging findings of fat necrosis on mammography and ultrasonography that can support the diagnosis without a need for further workup but lesions may present with suspicious features of malignancy. These will need a biopsy if MRI is not conclusive as fat necrosis and cancer can overlap considerably in MRI manifestations and no discriminating imaging feature can assure for the benignity of the process in these cases.
References


