Mammographic and sonographic features of fat necrosis of the breast

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Abstract

Imaging features of fat necrosis vary depending on its stage of evolution and can mimic malignancy in late stages. Imaging may suffice to differentiate fat necrosis in the early stages from malignancy and thus avoid unnecessary biopsy. In this pictorial essay, we present combination of benign features in mammography and/or ultrasonography (USG) that can lead to imaging diagnosis of fat necrosis. The follow-up imaging features of fat necrosis which mirror its pathophysiological evolution have also been demonstrated. To summarize, in the appropriate clinical setting, no mammographic features suspicious for malignancy should be present. When the typical mammographic features are not present, USG can aid with the diagnosis and follow up USG can confirm it.

Key words: Breast lump; complex nodule; fat necrosis; imaging; solid nodule

Introduction

Fat necrosis is a benign non-suppurative inflammatory process of adipose tissue. The incidence of the disease is estimated to be 0.6%, accounting for 2.75% of all benign breast lesions.[1] Majority present with a palpable lump, typically periareolar,[2] that can clinically mimic malignancy and pose a diagnostic challenge.

If a patient presents for evaluation in the early stages of fat necrosis, a systematic approach using American College of Radiology (ACR) guidelines[3] can help to avoid misdiagnosis and ensure confident exclusion of malignancy. In this essay, we highlight the various combinations of imaging features of fat necrosis that suggest benignity in appropriate clinical setting.

Clinical Features

The presentation can vary from being clinically occult to a hard lump with skin changes highly suspicious for malignancy. A history of accidental trauma raises the suspicion of fat necrosis in a breast lump. The other common predisposing causes include surgery and radiation.[2] The possibility of malignancy should not be overlooked in these cases. The absence of history of trauma does not exclude fat necrosis.[4]

Evolution of Fat Necrosis and Corresponding Imaging Findings

Imaging appearances of fat necrosis depend on its stage of evolution.[2] In the early phase, when there is hemorrhage in the fat, initiating edema of the breast trabeculae, it may be seen as an area of hyperreflectivity on USG.

Those which do not resolve, progress to cystic degeneration within weeks to months and are seen as oil-containing cavities on gross pathology.[2] If large, the corresponding imaging findings at this stage would include oil cyst on mammogram, and if small, these would be anechoic areas within the hyperreflective area on USG. Calcification and fibrotic reaction occur late over months or years and imaging appearances at this stage can mimic malignancy[2] unless...
the characteristic benign lucent-centered or coarse rim calcifications are seen.

The diagnosis can be confirmed on the basis of either serial imaging studies that show chronological changes compatible with the evolution of fat necrosis or improvement in clinical symptoms (lump no longer detectable on palpation).

Histological confirmation may be reserved for indeterminate or suspicious imaging features.
Mammographic Appearances

Mammography is the most important diagnostic tool in early fat necrosis. However a normal mammogram does not always exclude underlying pathology and the same holds true for fat necrosis.

A radiolucent well-defined cyst [Figure 1] is one of the pathognomonic mammographic features seen in early fat necrosis when there is little associated fibrosis. Fat-fluid level when observed [Figure 2] is due to oil and serosanguinous fluid layering. Benign lucent-centered calcification, a characteristic late stage feature [Figure 3], also requires no additional workup.

If a soft tissue density mass with partial halo [Figure 4] or focal asymmetric density without architectural distortion [Figure 5] is seen on mammogram at site of palpable abnormality, US can confirm diagnosis of fat necrosis.

When any suspicious features for malignancy such as dense/irregular/spiculated mass, architectural distortion, or suspicious calcification are found on mammogram, the categorization would be BIRADS 4 or 5 (suspicious for malignancy) and biopsy should be considered according to ACR recommendation. It is important to categorize the BIRADS for mammography first before performing the USG to minimize the chances of overlooking malignancy, as USG is less specific than mammography. Hence, even if the USG features appear probably benign, combined BIRADS 4a categorization with biopsy would be considered more appropriate than BIRADS 3 [Figure 6].

Sonographic Appearances

USG plays an important role in ruling out malignancy and suggesting fat necrosis as the diagnosis. The USG examination is abnormal in almost all the cases including those cases with normal mammogram.

An echogenic band within an oil cyst that shifts in orientation with changes in patient position [Figure 7] is the most specific feature of fat necrosis.

Hyperechogenicity in the subcutaneous tissue [Figure 8], which is a reliable predictor of benignity, is the most common
presentation of fat necrosis on USG and often seen in all cases with history of trauma.\textsuperscript{14} In the anterior superficial plane of the breast, there is subcutaneous fat with connective tissue, but in the deeper parenchymal layer, fat is interspersed in between the fibroglandular tissue.\textsuperscript{9} Hence, one needs to be cautious about hyperechoic nodule in the deeper tissue planes, and findings like “taller-than-wide” morphology, irregular shape, posterior acoustic shadowing need to be given due importance when considering the nature of the lesion.\textsuperscript{10} The plane of location [Figure 7] is not particularly important when an oil cyst can be identified as it is a very specific sign for fat necrosis.

Parallel orientation, an USG feature supportive of benign etiology, is very important to note in cases with solid abnormality [Figure 9]. Lack of flow on Doppler [Figure 10] is a supportive feature of fat necrosis,\textsuperscript{2} but literature suggests that it is not a reliable discriminator between benign and malignant nodules.\textsuperscript{11}

The criteria for probably benign nodule are solid mass with oval shape, circumscribed margins, and parallel orientation as per the BIRADS lexicon.\textsuperscript{3} However, in the study by Soo...
et al., the BIRADS criteria pertaining to shape and margins were not fulfilled by the solid nodules. Some malignant and indeterminate features on USG which may be observed include noncircumscribed (indistinct) border with anechoic areas within [Figure 11] and posterior acoustic shadowing [Figure 12].

**Follow-up Imaging**

The recommended follow-up of probably benign USG lesions includes repeat imaging at 6-monthly interval for a year and annually for either 1or 2 years with a diagnostic mammogram and/or USG.[11] The common findings in follow-up USGs include normalization of the subcutaneous reflectivity, development of anechoic areas [Figures 8 and 13], and solid and complex lesions becoming more cystic. The lesion size either remains stable or decreases.[10] The lesions can become more solid or increase in size.[10] In cases of uncertainty, especially with a complex nodule at initial presentation, fluid....

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**Figure 10:** USG image of an anechoic lesion in superficial location showing no vascularity within the color box

**Figure 11:** A 34-year-old female with breast lump and history of trauma. USG image of the palpable lump shows an ill-defined iso- to hyperechoic area in the superficial tissues with anechoic areas within. No obvious architectural distortion (BIRADS 3). The lump resolved in 12 months time

**Figure 12:** USG image of cytologically proven fat necrosis shows superficially located ill-defined hyperreflective lesion with marked posterior acoustic shadowing (*)

**Figure 13:** Follow-up USG image of the lesion shown in Figure 8 at 3 months, which shows anechoic component within the lesion. Edge shadowing seen here (arrow) is neither a benign nor a malignant feature

**Figure 14:** Follow-up image at 4 months of the lesion shown in Figure 7, which shows flattening of the ovoid lesion. Excision biopsy for signs of infection at 10 months showed no evidence of malignancy

**Figure 15:** USG image of an oil cyst with echogenic band (arrow) is shown on the left. Follow-up scan at 3 months (right) shows resorption of much of the fluid component
临床病史可疑脂肪坏死

- Mammography
  - 阴影透明囊
  - 粗糙边缘钙化
  - 有益于钙化
  - 复杂性结节位于浅层
  - 浅部hyperreflective结节，有或无无回声区，平行定向，探头压痛，无血管性
  - 其他结节
    - 垂直于宽
    - 非平行定向

- Ultrasound
  - 正常
  - 良性肿块
  - 异位密度斑块
    - 突起/致密肿块
    - 建筑性扭曲
    - 可疑钙化
  - 简单油性囊

- Aspiration
- Follow-up USG scans for at least 2 years
- Ultrasound and biopsy

**figure 16**: A suggested approach for diagnosis of fat necrosis

为确定脂肪坏死，如果吸出物为油性物质，排除恶性复杂性肿块，并确认脂肪坏死。当出现血性液体时，应保留活检。

其他发现包括病变的扁平化[图14]和油性脂肪的吸收[图15]。

总结，当临床怀疑脂肪坏死时，乳房X线摄影是最重要的诊断工具。如果乳房X线摄影没有可疑恶性特征，则可依赖超声波诊断早期脂肪坏死。卵巢囊肿是超声波诊断的特异征象。其他特征包括复杂性结节位于浅层位置或有或无无回声区，平行定向。

超声波随访可能足以确认诊断。然而，在乳房X线摄影存在可疑恶性特征的情况下，应考虑活检，尽管超声波呈良性。

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**References**


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