Diagnostic and Interventional Radiology in Idiopathic Granulomatous Mastitis

Irmak Durur-Subasi

ABSTRACT

Idiopathic granulomatous mastitis is a chronic, benign, inflammatory disease of the breast. If the radiological findings are known, patients can be referred for biopsy in the early period. The diagnosis of the disease must be based on a histologic confirmation. After diagnostic and therapeutic management, a radiological follow-up is conducted using an appropriate imaging tool. In this study, we highlight the radiologic evaluations for idiopathic granulomatous mastitis and present specific cases.

Keywords: Diffusion-weighted imaging, doppler ultrasonography, elastography, granulomatous mastitis/diagnostic imaging, magnetic resonance imaging

Introduction

Idiopathic granulomatous mastitis is a chronic, inflammatory, benign disease of the breast. Benign and malignant breast diseases show similarity with regard to clinical and radiological outcomes [1]. Therefore, it is essential to evaluate the imaging findings accurately and provide a fast, conclusive diagnostic path [2]. A pathologic confirmation not only provides discrimination from malignancy, but also enables the provision of the most appropriate treatment regimen to the patient.

The etiology of autoimmunity, pregnancy-lactation, hyperprolactinemia, oral contraceptives, alpha 1 antitrypsin deficiency, smoking, and trauma has been demanded [3]. The most common clinical symptoms of idiopathic granulomatous mastitis include erythema, edema, variable sized-sensitive-palpable unilateral breast mass, nipple retraction, ulceration, discharge, and axillary lymphadenopathy [4]. However, patients may also have more bizarre presentations, particularly in subclinical forms.

Interventional Procedures

The disease must be diagnosed through a pathological evaluation. Fine needle aspiration is principally supportive in detecting purulent secretions at the early stage. Nevertheless, it could not be satisfactory in distinguishing malignant and other benign inflammatory disorders. A core biopsy should be preferred for this purpose. Although larger tissues can be obtained, vacuum-assisted biopsies may result in fistula development. A diagnostic excisional biopsy is not preferred due to substantial scratching, loss of breast symmetry, breast deformity, and the possibility of unhealed ulcers or sinus tract formation [5, 6].

For the diagnostic management of granulomatous mastitis, not only the tool but also method is of great importance. Particularly, as mentioned below, sampling of lesions with different radiological and pathological components, such as edema, inflammation, necrosis, and abscess, requires skill and expertise. Sample collection from the thick walls of the necrotic lesions or abscesses and specimens of inflamed areas having vascular signals will provide an adequate pathological result (Figure 1).

With this aim, the radiology of idiopathic granulomatous mastitis is reviewed in the light of literature and exemplary cases.

Mammography

A mammogram may show thickening of the skin, focal or global asymmetry, irregular focal mass, trabecular coarseness or distortion in the parenchyma, smooth-edged mass, calcification, or lymphadenopathy

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ORCID IDs of the authors:
I.D.S. 0000-0003-3122-4499

Department of Radiology, University of Health Sciences, Diskapi Yildirim Beyazit Training and Research Hospital, Ankara, Turkey

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Correspondence to: Irmak Durur-Subasi
E-mail: irmakdurur@yahoo.com

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findings [7, 8]. Mammography may not show any findings particularly in dense breasts (Figure 2).

Ultrasonography

Thickening of the skin, an irregular hypo-echogenic mass with tubular extensions, smooth-edged hypo-echogenic mass, hypo-hyperechoic-heterogeneous mass, masses that tend to coalesce, heterogeneous parenchyma, parenchymal edema, distortion, acoustic shadowing, abscess, sinus tract formation or lymphadenopathy may be detected [9] (Figure 3). On a greyscale, granulomatous mastitis lesions are seen as very heterogeneous lesions with a wide range of brightness. Based on this idea, a study on the texture analysis of granulomatous mastitis and carcinoma lesions showed that texture analysis may be a proficient method in differentiating between granulomatous mastitis and breast carcinoma. It may offer measurable statistics about the lesions and an unbiased evaluation compared to a visual inspection [10].

Additionally, ultrasonography is the main follow-up tool after an appropriate treatment regimen.

Figure 1. a-d. Identification of idiopathic granulomatous mastitis should be established histologically. A tubular, hypo-echogenic, well-bordered lesion without acoustic shadowing is sampled using a core biopsy device (arrow) (a). Lesions having necrotic constituents should be evaluated carefully and necrotic portions (stars) should not be sampled (b). Thick walls (c) and vascularized areas (d) have to be chosen for a proper histologic result during the biopsy procedure.

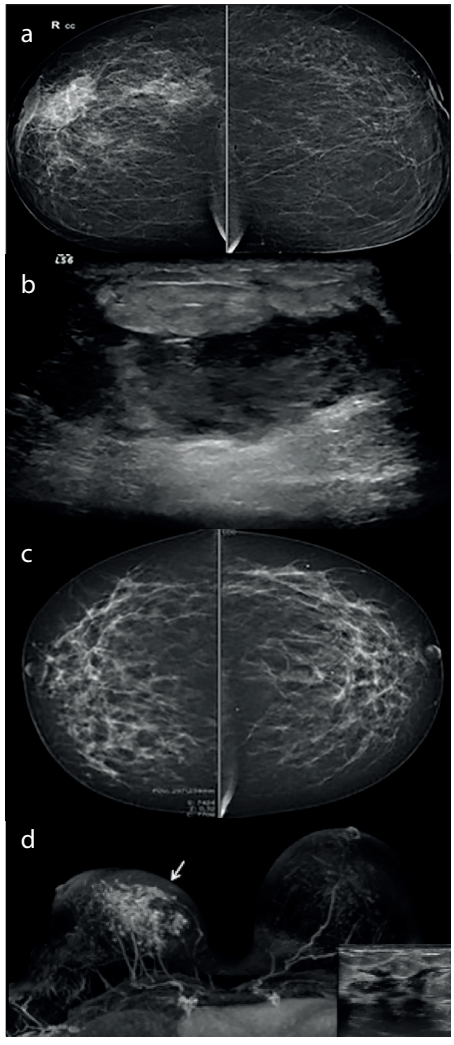

Figure 2. a-d. Bilateral CC mammography of a patient pathologically proven to have idiopathic granulomatous mastitis (a). In the outer part of the right breast, a low-density mass and patchy increases of parenchymal density are seen. In the sonogram of the patient (b), edematous fat lobules and a heterogeneous hypo-hyper-echogenic mass with acoustic enhancement are appreciated. Another idiopathic granulomatous mastitis patient has a subtle parenchymal coarseness in the inner part of the right breast compared to the left side (c). Magnetic resonance imaging and corresponding ultrasonography image reveal a more prominent disease (d).

Doppler Ultrasonography

Prominent arterial and venous Doppler signals can be found in the inflamed parenchyma [11]. In addition, Doppler signals are also helpful for a biopsy guidance. During a classical biopsy procedure, it has to be avoided a biopsy trace falling into any vascular structure. In contrast, if granulomatous mastitis is suspected, biopsy specimens must be obtained from vascularized

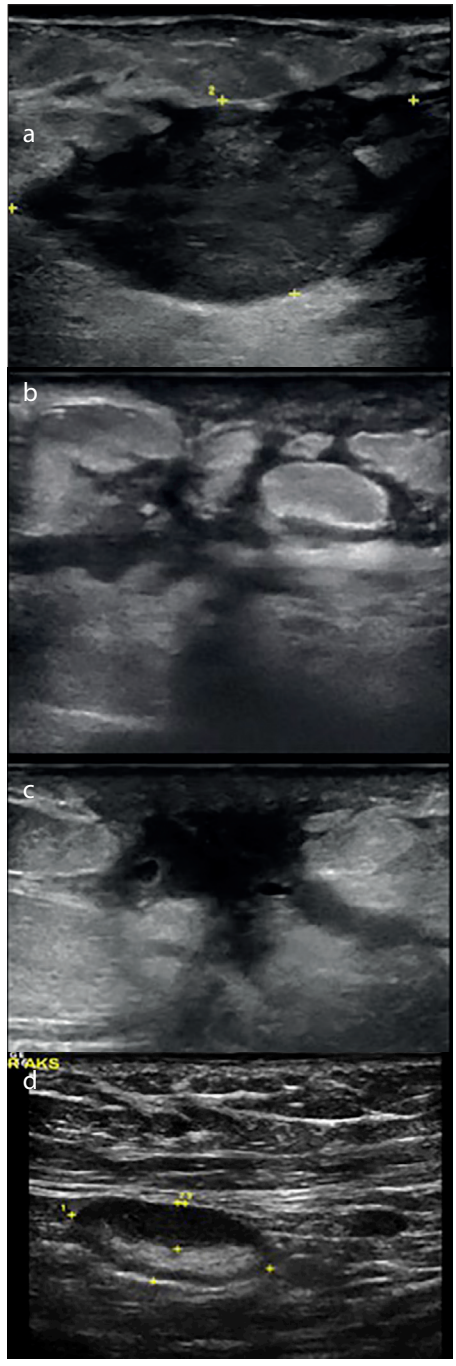

Figure 3. a-d. Heterogeneous hypo-echogenic mass with some spiculated extensions (a), tubular extensions to the skin with a skin-located component (b), dilated pus containing ducts (c), are the ultrasonography findings of granulomatous mastitis. In a sonogram, diffuse enlarged, tender lymph nodes can be seen (d).

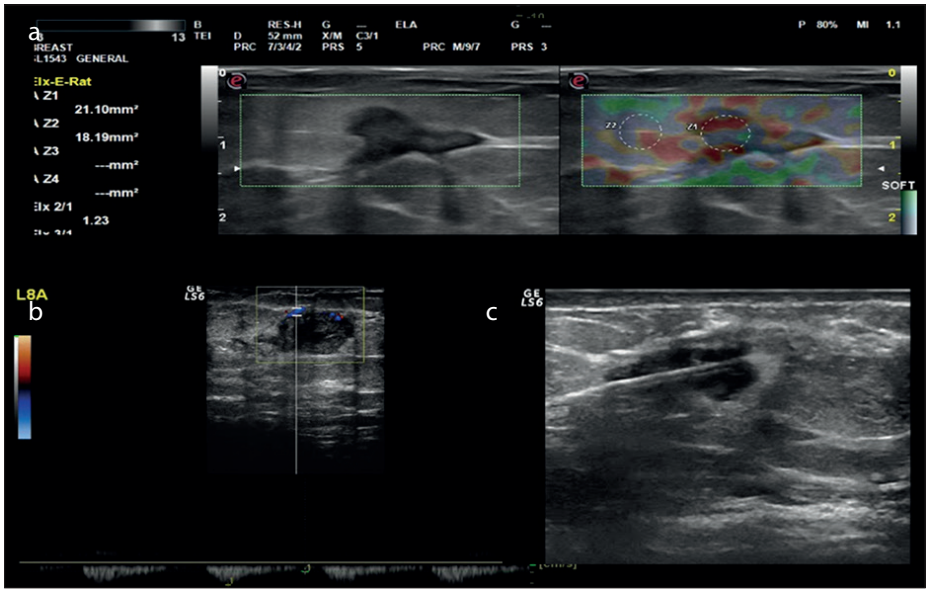

Figure 4. a-c. Compressive sonoelastography image (a) obtained by the dual mode of an idiopathic granulomatous mastitis lesion demonstrates its soft nature with a low elasticity score (2) and strain ratio (1.23). The Doppler image (b) shows low resistant arterial flow, and core biopsy (c) is performed for this vascular lesion.

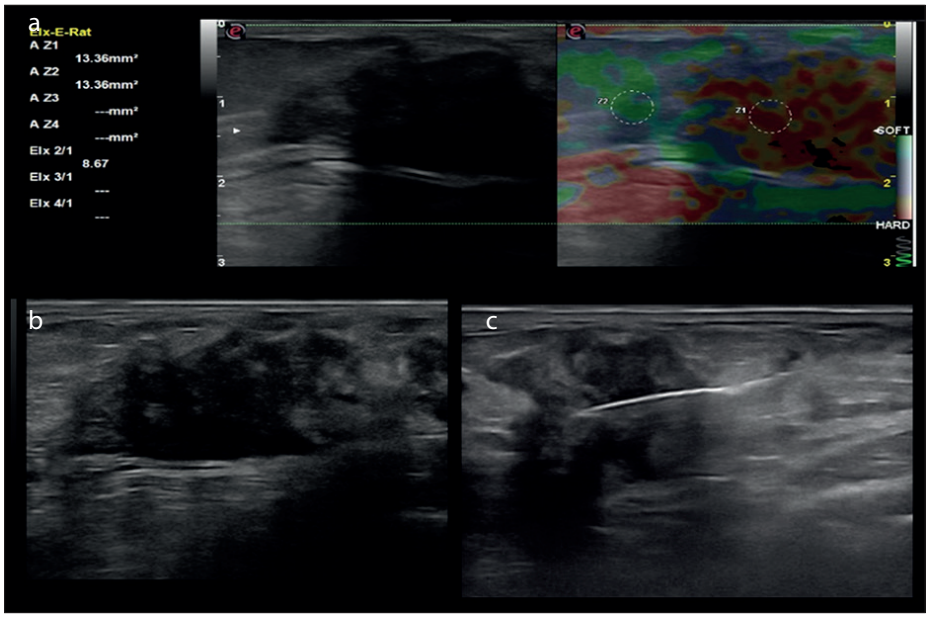

Figure 5. a-c. Firm (elasticity score: 4, strain ratio: 8.67) mass lesion is seen upon compressive sonoelastography (a). Ultrasonography reveals an extremely hypo-echogenic mass with subtle borders (b), and the core biopsy is performed (c).

areas to achieve an appropriate histologic diagnosis and to obtain the biopsy specimen from viable parts, as stated before.

Elastography

Compressive sonoelastography in idiopathic granulomatous mastitis shows soft properties with low elasticity scores and strain ratios [12] (Figures 4 and 5). These features can be attributable to the pathologic properties. Non-caseating granulomas concentrated in the lobules, an inflammatory environment, and lymphoplasmocytic migration may be observed. Microabscesses, necrosis, sinus tracts, and duct ectasia are frequently observed [3, 13]. Using acoustic radiation force impulse imaging, idiopathic granulomatous mastitis has been reported to have low median marginal and internal velocities compared to malignant lesions [14].

Magnetic Resonance Imaging

Upon magnetic resonance imaging, skin alterations owing to inflammation; T1, T2, and STIR intensity changes; and intense contrast uptake, progressive, plateau or washout pattern; mass lesions with ring enhancement; segmental-regional non-mass enhancement; diffusion changes; necrosis-abscess; fistula tracts; skin abscess; dilated ducts with dense content; enhanced ductal walls, and lymphadenopathy can be perceived [5, 15, 16].

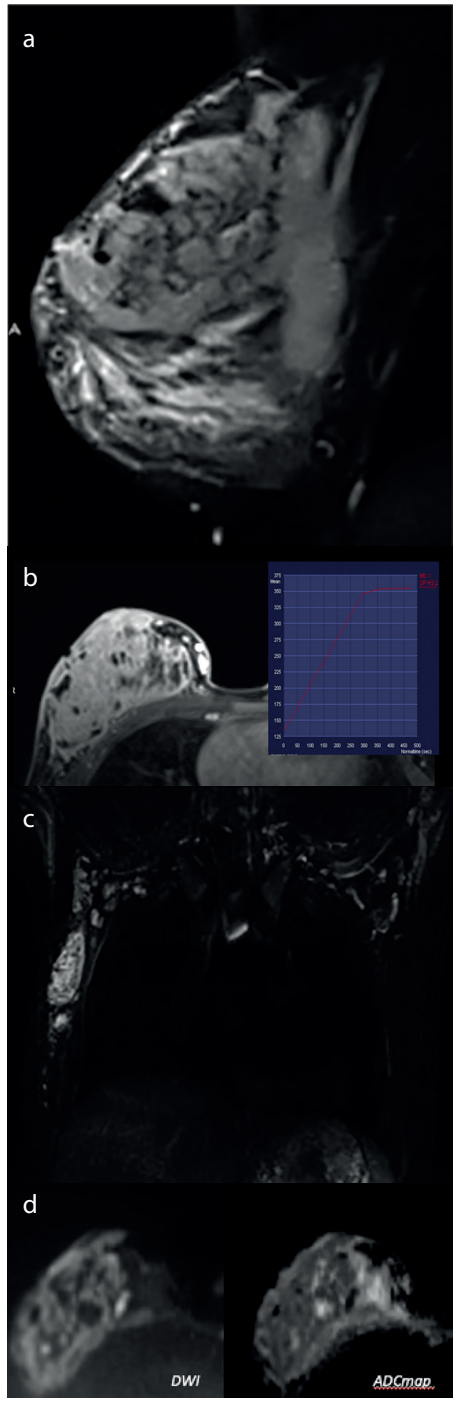

Figure 6. a-d. Sagittal fat suppressed T2-weighted image shows edematous breast lobules with an increase in the volume and hypointensity (a). The complete upper quadrants are enhanced after contrast administration and show a progressive enhancement pattern (b). Right axillary enlarged lymph nodes and inflamed parenchyma are seen on coronal short tau inversion recovery sequence (STIR) (c). A diffusion-weighted image shows lesions with diffusion restriction (d).

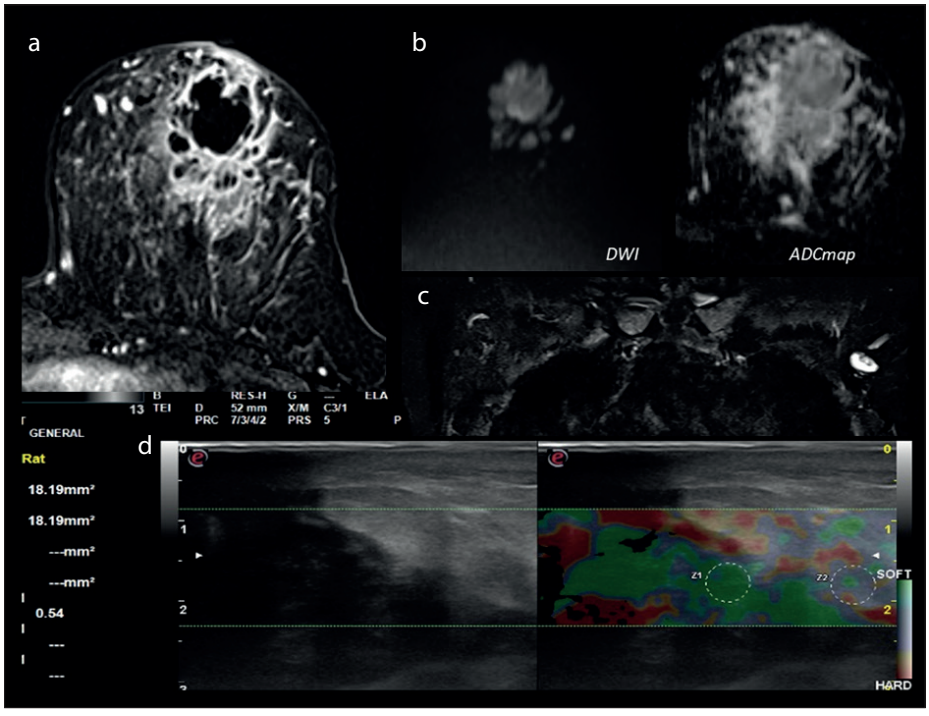

Figure 7. a-d. Multi-loculated, necrotic mass with peripheral and septal intense enhancement is seen in the subareolar region of the left breast (a). A diffusion-weighted image of the lesion shows prominent restriction (b). A coronal STIR image shows enlarged left axillary and oval lymph node (c). Upon compressive sonoelastography (d), the lesion appears very soft (elasticity score: 1, strain ratio: 0.54).

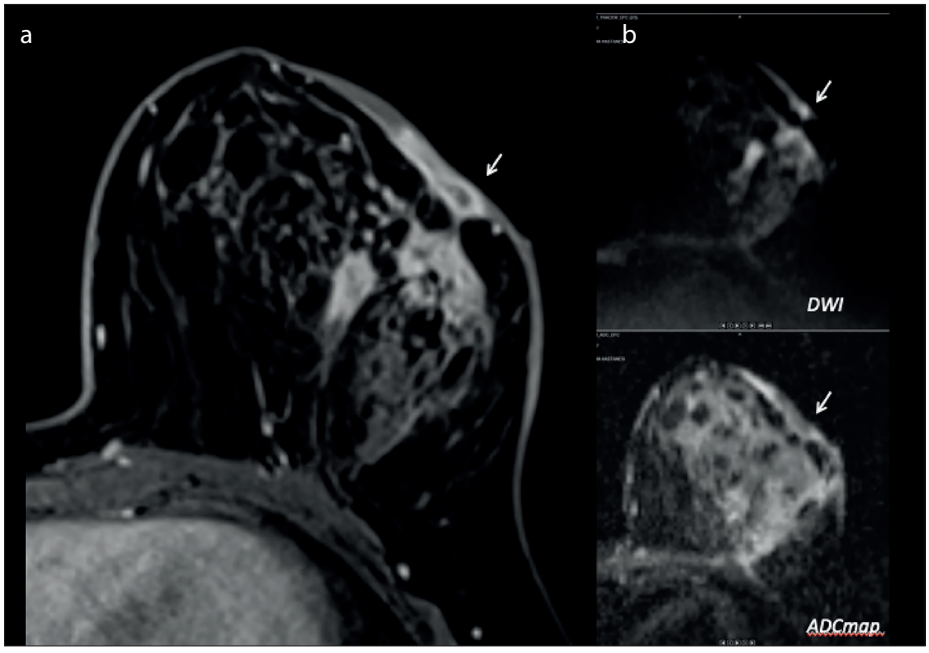

Figure 8. a-b. Idiopathic granulomatous mastitis of the left breast. There are irregular enhancing (a) and diffusion restricting (b) areas. Pay attention to the components located in the skin (arrows). These microabscesses are enhancing peripherally and restricting diffusion as well.

Idiopathic granulomatous mastitis is often seen in premenopausal women presenting with signs of mastitis and a mass. Therefore, their initial evaluation is based on ultrasonography rather than mammography and magnetic resonance imaging. An appropriate antibiotic therapy and immediate follow-up are recommended at the first admission. Thereafter, the biopsy has to be performed when there is no clinical improvement. In this clinical setting, magnetic resonance imaging should be used for the evaluation of advanced-aggressive-unresponsive disease when the sensitivity of ultrasonography and mammography is limited due to parenchy-

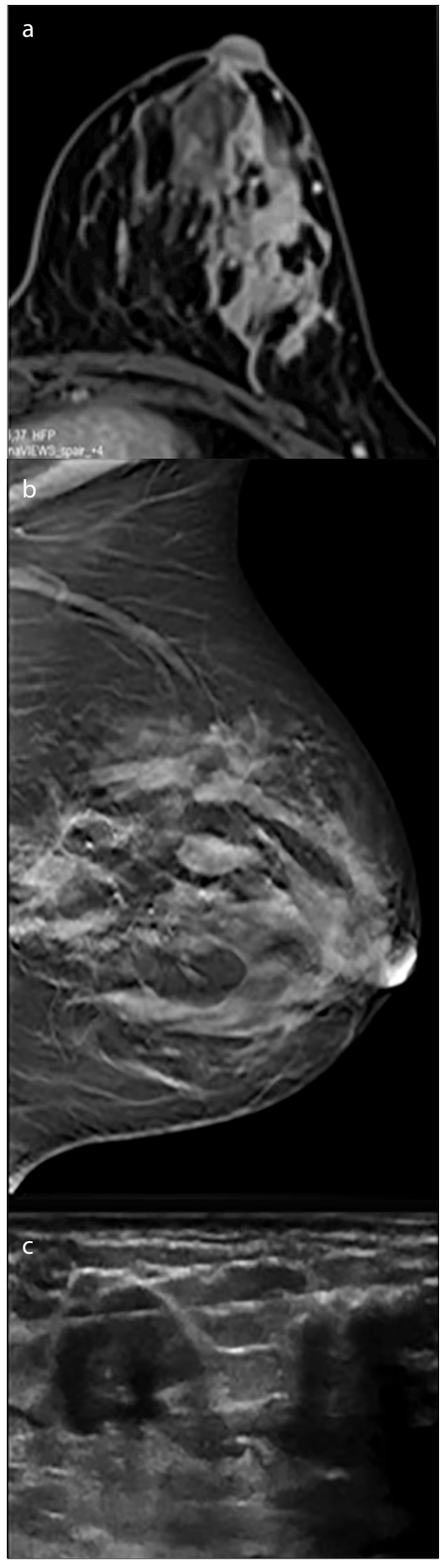

Figure 9. a-c. A 28-year-old woman with breast carcinoma. The outer part of the left breast shows intense enhancement with segmental configuration (a). Because of microcalcification suspicion during the ultrasonographic guiding tomosynthesis has been performed before the biopsy. Suspicious calcifications, spiculated margins, and parenchymal distortions are seen (b). Core biopsy confirmed the malignancy (c).

mal edema, biopsy guidance, a standard follow-up imaging tool especially in extensive involvement, evaluation of residual disease after treatment, and evaluation of the other breast [8, 17, 18] (Figures 6-8).

A recent study on T1 perfusion magnetic resonance imaging showed that the perfusion properties of benign inflammatory lesions, including pathologically proven idiopathic granulomatous mastitis, were similar to those of malignant lesions. K_{trans} is the transfer constant from the plasma to interstitium, K_{ep} is the reverse transfer constant, and V_e is the extracellular matrix volume fraction. K_{trans} and K_{ep} values were higher and V_e values are lower, similar to malignant lesions [19].

In diffusion-weighted imaging, inflammatory conditions can show diffusion alterations due to edema, inflammatory cell migration, high viscosity, and cellular debris [16, 20].

Conclusion

With only imaging findings, idiopathic granulomatous mastitis cannot be easily distinguished from malignancy. Clinical and radiologic features can be confounding and cannot differentiate between particularly diffuse breast carcinomas or specific subtypes of breast carcinoma. Thus, an early pathologic confirmation is a must when antibiotics do not work (Figure 9). The response to treatment must be monitored using ultrasonography. Magnetic resonance imaging is a follow-up tool in aggressive, diffuse, and irresponsive disease.

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