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Case Report

Iatrogenic breast pseudoaneurysm in a lactating female: A rare breast emergency treated with ultrasound guided thrombin administration ☆

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ABSTRACT

Pseudoaneurysm development is a well-recognized consequence of arterial injury, frequently observed in procedures involving arterial groin access. Breast emergencies are infrequent but need prompt attention. We present a notable case of breast pseudoaneurysm postcore needle biopsy, incidentally, identified through subsequent magnetic resonance imaging. Remarkably, the patient's lactating status emerged as a unique risk factor. Our report thoroughly explores the pathogenesis, etiology, preventive measures, and treatment strategies specific to breast pseudoaneurysms. A comprehensive understanding of this phenomenon is essential for radiologists at large, with particular importance for specialists in breast imaging.

Case report

A 37-year-old lactating female presented for gradually increasing right breast mass, which she had first noticed prior to her pregnancy. Bilateral diagnostic mammogram (Fig. 1A and B) was performed, which showed a large 8 cm high density mass in the posterior upper outer right breast in the region of palpable concern. Additionally, an enlarged right axillary lymph node was noted. In the contralateral left breast, there was an oval circumscribed outer central mass. Targeted right breast ultrasound demonstrated that the palpable large 8 cm dominant mass at 11:00, 5-10 cm from the nipple had suspicious features, appearing hypoechoic, vascular, and with irregular margins. Right axilla demonstrated 2 cortically thickened lymph nodes. Targeted left breast ultrasound (Fig. 1C and D) showed a 1.8 cm oval circumscribed mass at 4:00, 4 cm from the nipple, corresponding to the mammographic finding. Overall, the diagnostic work-up was given a BI-RADS 5 assessment, highly suggestive of cancer. We recommended ultrasound guided biopsies for the dominant right breast mass at 11:00, suspicious right axillary lymph node, and left breast mass at 4:00.

☆ Competing Interests: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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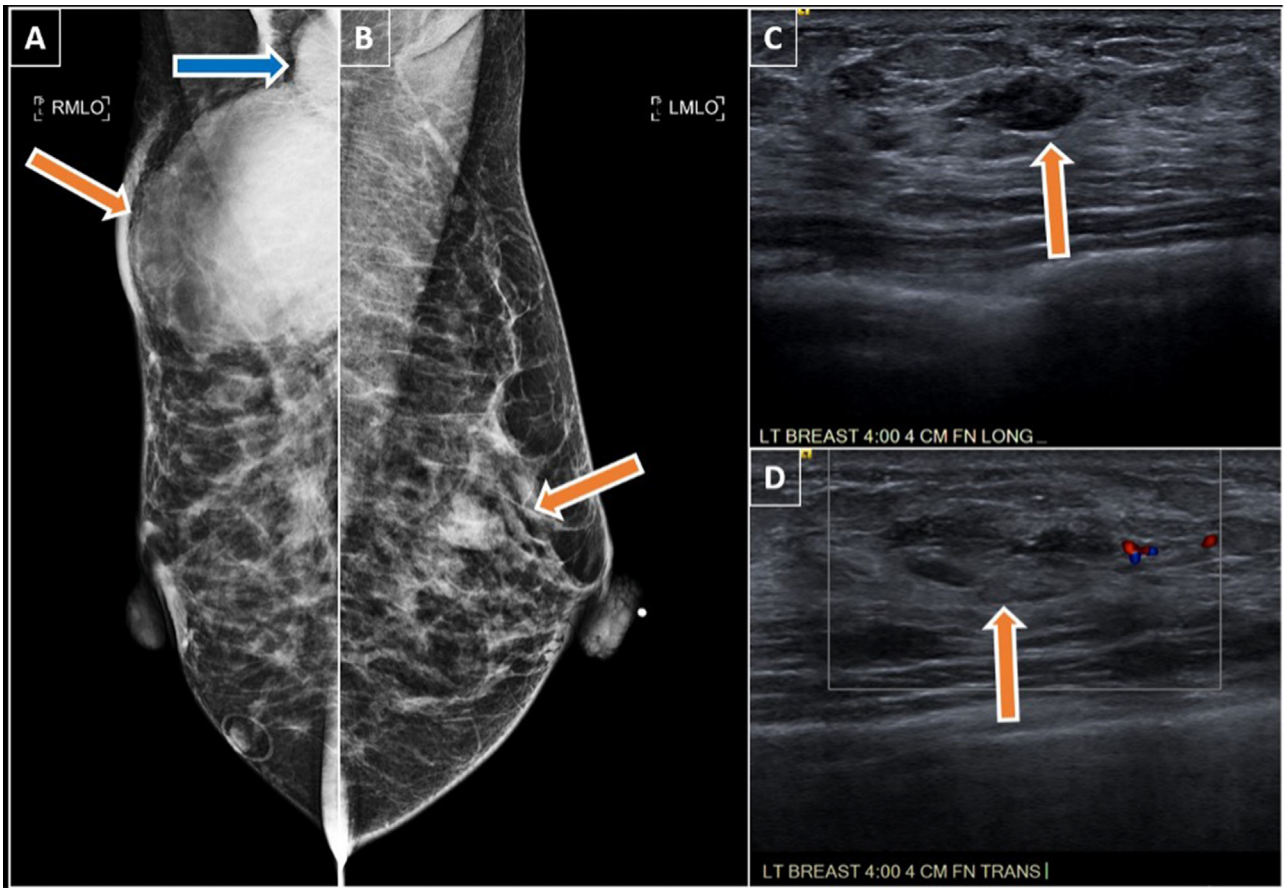

Fig. 1 – Image (A) right breast mediolateral oblique mammogram view demonstrates a large high-density mass (orange arrow) in posterior upper right breast measuring approximately 8 cm. Right axillary lymphadenopathy also noted (blue arrow). Image (B) left breast mediolateral oblique mammogram view demonstrates an oval circumscribed mass (orange arrow) in the left breast, measuring up to 1.8 cm. Images (C) and (D) are the longitudinal and transverse sonographic views of the oval left breast mass (orange arrows).

Recommended ultrasound guided biopsies were subsequently performed, and post biopsy mammogram demonstrated appropriate positions of all biopsy clips (Fig. 2). There was no bleeding or any other complication at the time of the biopsies. The biopsy report showed invasive ductal carcinoma in the dominant right breast mass at 11:00, and metastatic disease in the right axillary lymph node. Biopsy report of the left breast mass at 4:00 demonstrated benign fibroadenoma with apocrine metaplasia. We recommended surgical referral and bilateral breast magnetic resonance imaging (MRI) with and without intravenous contrast to evaluate disease extent.

Subsequently, MRI breasts showed the large 8 cm enhancing mass in the upper outer right breast, corresponding to biopsy-proven invasive ductal carcinoma, and more than 3 abnormally enlarged level 1 and 2 right axillary lymph nodes. Incidentally, in the region of the previously biopsied left breast mass at 4:00, there were 2 large flow voids, measuring 2 cm and 1 cm each, noted adjacent to a vessel and demonstrating brisk enhancement, concerning for pseudoaneurysms (Fig. 3). Doppler ultrasound evaluation of the vascular left breast masses was recommended. Additionally, she was referred to interventional radiology for treatment of the suspected pseudoaneurysms. The patient denied any left breast symptoms.

In the interventional radiology suite, targeted ultrasound demonstrated a 1 cm vascular mass with to-and-fro flow and yin-yang sign on color doppler, consistent with a patent pseudoaneurysm, and adjacent to it was a 2 cm thrombosed pseudoaneurysm, correlating with the second pseudoaneurysm identified on MRI (Fig. 4A-D). The neck of the patent pseudoaneurysm measured approximately 0.1 cm. Given its small neck size, compression with the ultrasound probe was attempted for 20 minutes (Fig. 5A). Following 20 minutes of compression, persistent flow was still noted within the pseudoaneurysm. At this juncture, we proceeded with ultrasound guided thrombin injection for prophylactic thrombosis. Under ultrasound guidance, a thrombin solution of 1000U/mL was slowly injected into the pseudoaneurysm, for a total of 0.5 mL, without evidence of reflux into the parent vessel (Fig. 5B and C). Immediate post procedural ultrasound demonstrated no flow within the pseudoaneurysm.

After treatment with thrombin, repeat ultrasound in 24 hours was recommended to ensure that the pseudoaneurysm does not get recanalized soon after the successful thrombo-

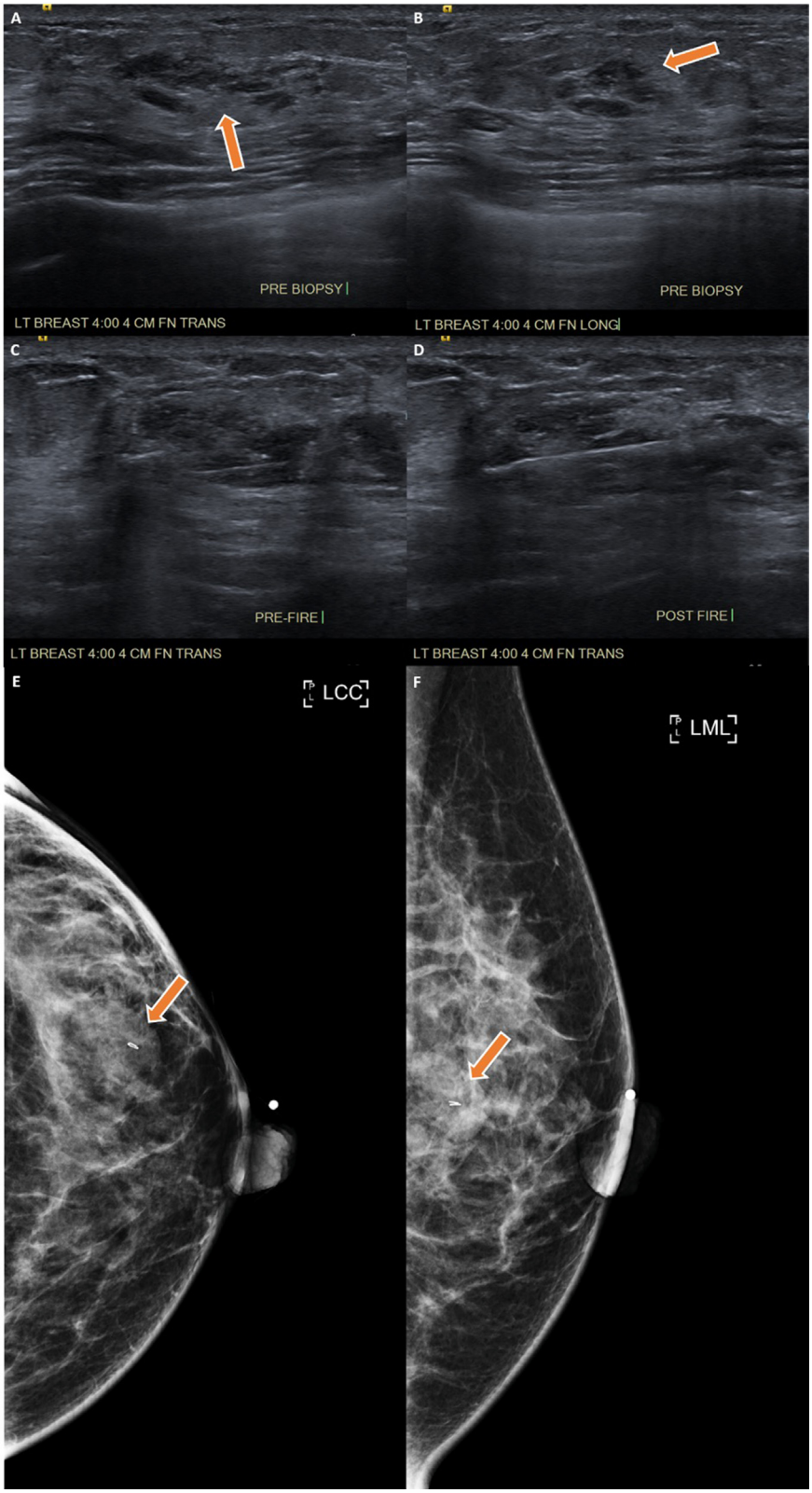

Fig. 2 – Images (A) and (B) transverse and longitudinal sonographic views demonstrate pre-biopsy appearance of circumscribed left breast mass (orange arrows). Image (C) demonstrate proper needle trajectory and image (D) confirms appropriate tissue sampling position postfire. Postbiopsy left breast mammogram, craniocaudal view (E) and mediolateral oblique view (F) demonstrate the biopsy clip in appropriate position within the mass (orange arrows) and no evidence of immediate postbiopsy hematoma.

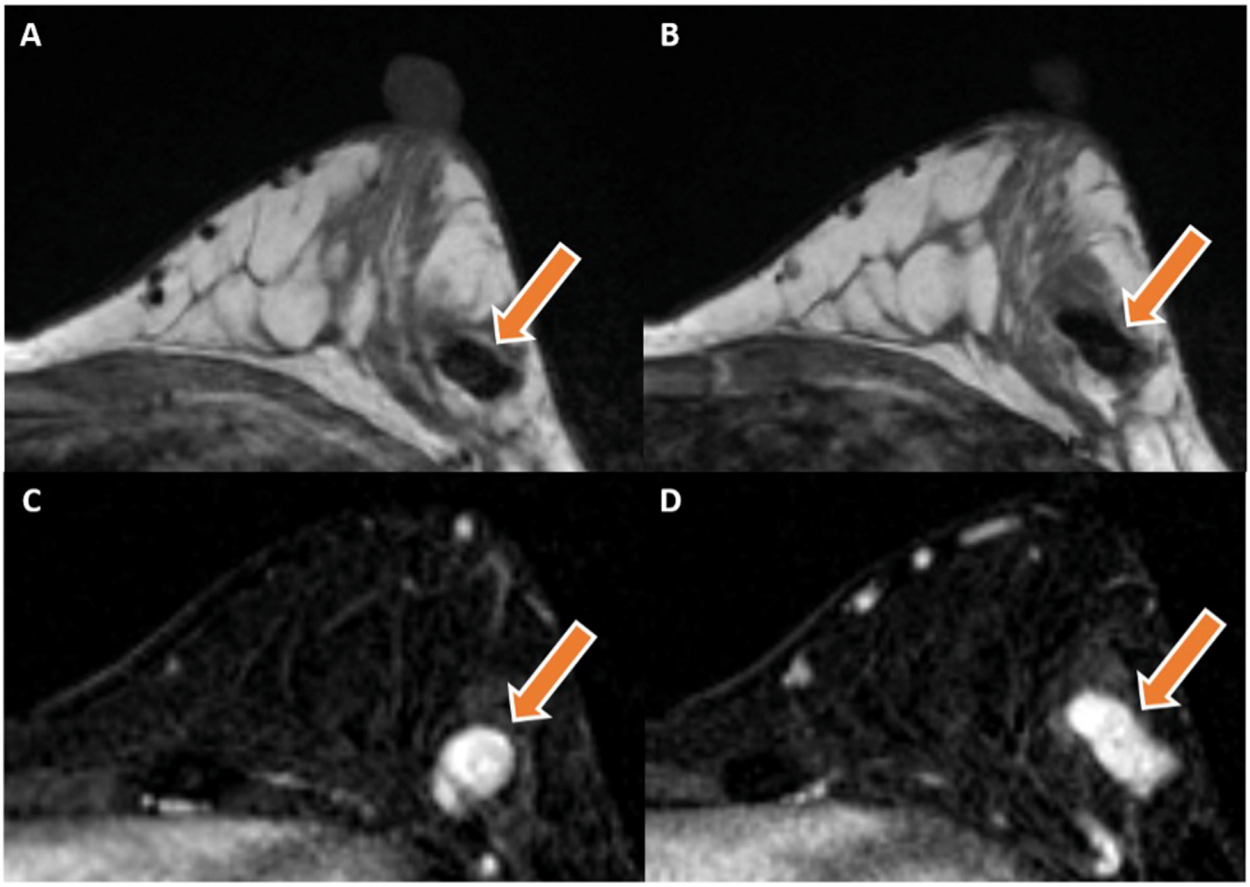

Fig. 3 – Images (A) and (B) axial T1 weighted MRI views of the left breast demonstrate large flow voids (orange arrows) in the outer central breast in the region of recent biopsy. Images (C) and (D) axial postcontrast T1 weighted subtraction views show brisk enhancement (orange arrows) in the previously identified flow voids in the location of the recently biopsied left breast mass.

sis. On the following day, repeat ultrasound demonstrated no flow within both thrombosed pseudoaneurysms (Fig. 5D), one which had self-thrombosed and the second in which thrombin was injected. She continues to follow up with breast surgery and multidisciplinary oncology team for further management of right breast cancer and has stayed asymptomatic for the left breast. She is currently on neoadjuvant chemotherapy prior to her surgery.

Discussion

Breast emergencies include a spectrum of conditions, ranging from more common entities like mastitis and breast abscess to less frequent occurrences such as seat-belt injuries and postprocedural complications, like hematoma, milk fistula, wire migration, and pseudoaneurysm [1]. Pseudoaneurysm of the breast, while infrequent, arises from the transmural rupture of the arterial wall, leading to blood leakage, and the formation of a saccular collection that remains in communication with the arterial lumen [2]. Distinguished from true aneurysms by lacking the 3 vessel wall layers (intima, media, and adventitia), pseudoaneurysms are contained by perivascular tissue [3].

Incidence and etiology

The existing literature on breast pseudoaneurysms suggests a low incidence, although no specific incidence rates are reported [2]. Most instances are associated with trauma, surgery, local infection, malignancy, or diagnostic procedures such as core needle biopsies. However, spontaneous pseudoaneurysms may occasionally arise in patients with hypertensive disease, underlying atherosclerosis, or those on anticoagulation medication [3]. The patient in our case report had no relevant medical history, systemic diseases, or anticoagulation therapy. However, she was postpartum and was lactating at the time of her biopsy. Increased vascularity and vascular permeability during pregnancy and lactation can be predisposing factors for pseudoaneurysm formation [4,5].

Before breast biopsies, color Doppler is employed to map nearby vessels, ensuring a safe needle path to avoid complications like hematomas and pseudoaneurysms [3]. Despite these precautions, pseudoaneurysms can occur in the presence of risk factors.

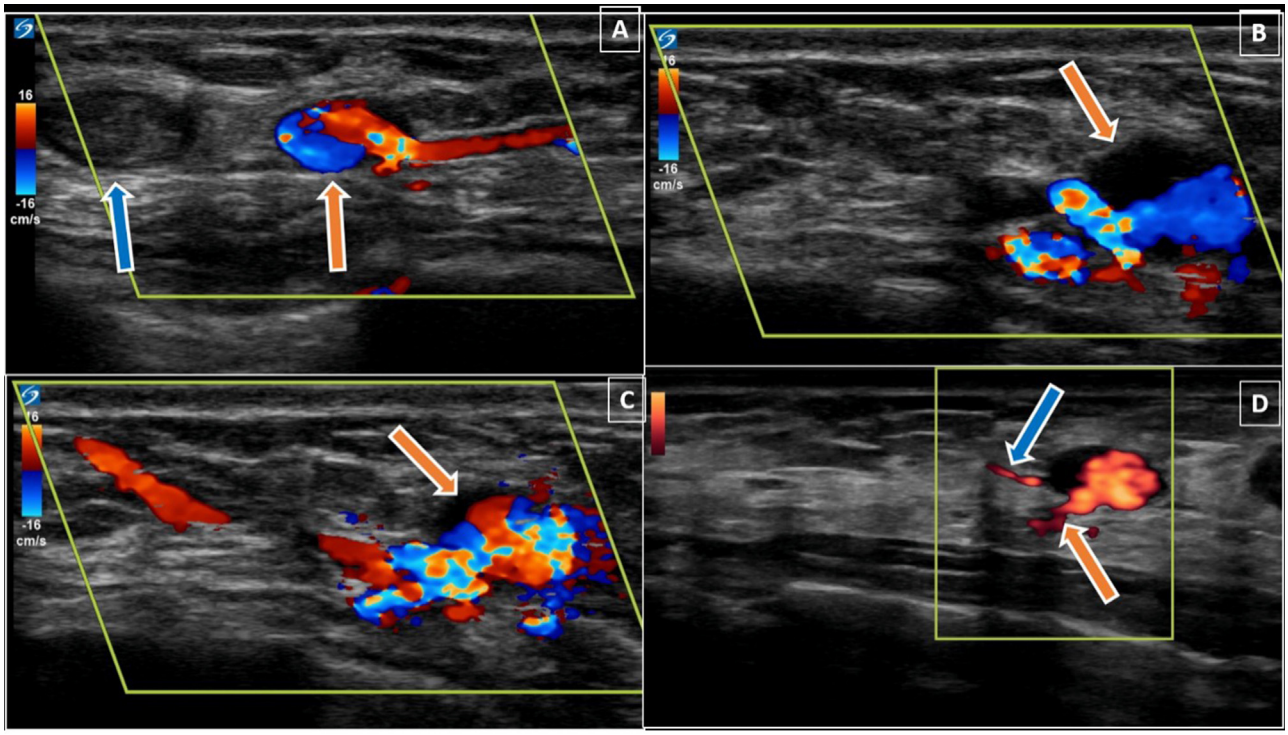

Fig. 4 – Multiple sonographic images demonstrate pseudoaneurysms. There is characteristic "yin-yang" sign within one of the pseudoaneurysms (orange arrows in images A, B, C). There are at least 1 or 2 feeding vessels within that pseudoaneurysm (blue and orange arrows in image D), indicative of patency. Adjacent to the patent pseudoaneurysm (orange arrow in image A), there is a second pseudoaneurysm with no flow, indicative of spontaneous thrombosis (blue arrow in image A).

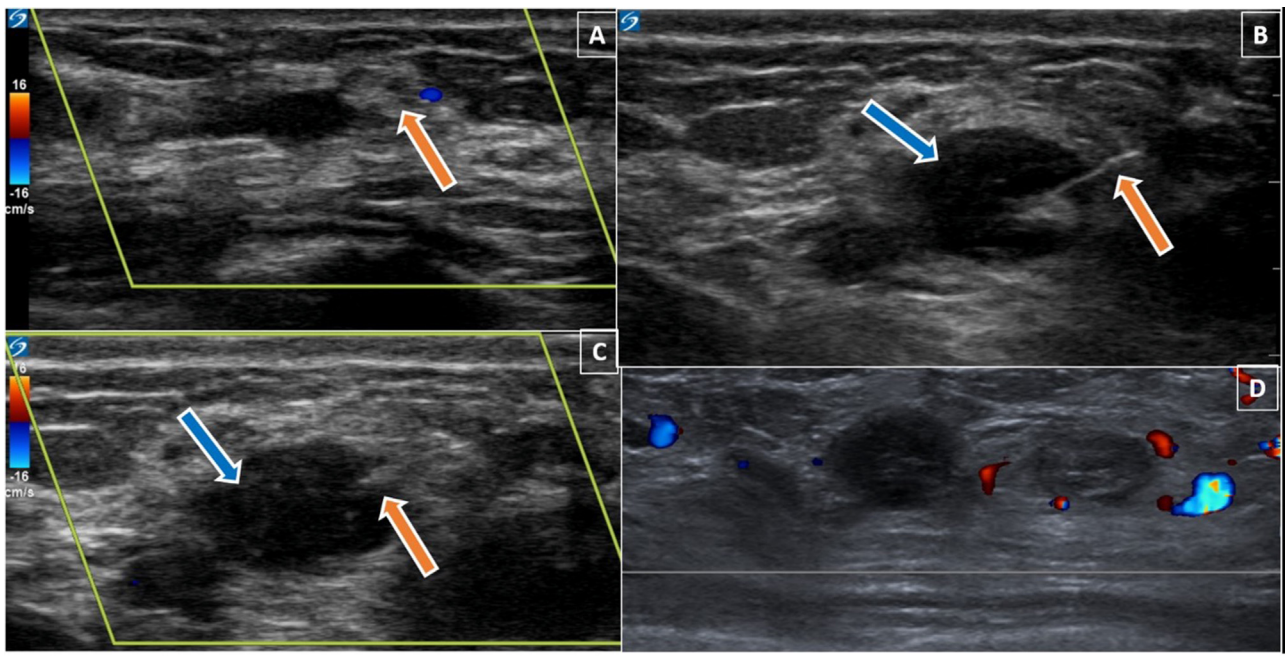

Fig. 5 – Image (A) demonstrates attempt at ultrasound-guided compression as initial treatment of pseudoaneurysm. Images (B) and (C) are images confirming needle position (orange arrows) for thrombin delivery within the pseudoaneurysm (blue arrows). Image (D) is the 24-hour follow up ultrasound after thrombin injection demonstrating 2 thrombosed pseudoaneurysms.

Clinical presentation and imaging findings

Breast pseudoaneurysms may present as palpable, pulsating masses at the biopsy site, typically measuring 1 to 3 cm. They can present immediately or weeks to months postbiopsy or could be asymptomatic, as in our patient's case.

Color Doppler ultrasound is the preferred modality for the diagnosis of pseudoaneurysm. On the B mode ultrasound, breast pseudoaneurysm has non-specific appearance. It can appear as a mixed echogenicity circumscribed mass, adjacent to the biopsy or trauma site. However, key distinctive features can be seen with doppler, demonstrating a direct connection to an artery. The spectral analysis performed during Doppler examination illustrates antegrade flow during systole and retrograde flow during diastole, generating a characteristic swirling pattern recognized as the classic yin-yang sign on color Doppler [6]. This unique vascular flow pattern, when coupled with a pertinent history of recent trauma or procedural intervention, serves as a diagnostic hallmark, consolidating the accuracy of pseudoaneurysm diagnosis.

Typically, the diagnosis of pseudoaneurysm does not require the use of other imaging modalities. On mammogram, a pseudoaneurysm may present as an equal density, round, and circumscribed mass. On MRI, it can exhibit flow voids on T1-weighted images owing to turbulent flow, or it might appear hyperintense on both T1 and T2-weighted images, indicating hemorrhagic content and shows avid enhancement on post-contrast images.

Differential diagnosis

On imaging, circumscribed breast masses, including hematomas, oil cysts, and complex cystic solid masses, may closely mimic the appearance of pseudoaneurysms. However, the utilization of Color Doppler ultrasound proves to be a reliable tool for effectively differentiating pseudoaneurysms from the other circumscribed masses [7].

Aneurysms and pseudoaneurysms are both vascular masses and share similarities on imaging. Breast aneurysms, which arise from abnormal dilatation of all three arterial wall layers, are extremely rare and may be associated with previous trauma [7]. However, on color Doppler, aneurysms show an absence of the to-and-fro or yin-yang flow pattern.

Treatment and prognosis

Due to their fragile walls, pseudoaneurysms are at risk of rupture with hemorrhage and need prompt attention. Spontaneous thrombosis may occasionally occur, particularly in small asymptomatic lesions with narrow necks in patients who are not on anti-coagulants, making careful monitoring a viable option in such cases [8]. In our patient, 1 of the 2 pseudoaneurysms did undergo spontaneous thrombosis.

Definitive treatment options include focused compression, percutaneous thrombin injection, embolization, and surgery [3,9,10]. Imaging-guided percutaneous thrombin injection has proven more successful than sonographically guided compression. Risks associated with coil embolization include higher costs, pseudoaneurysm rupture, and coil migration. Surgical repair is reserved for refractory cases.

The natural progression of breast pseudoaneurysms is not well known, as this is an uncommon condition. However, spontaneous thrombosis has been noted with peripheral pseudoaneurysms less than 3 cm size. Considering all factors, surveillance and watchful monitoring can be a reasonable approach in small breast pseudoaneurysms.

Conclusion

Breast emergencies, though infrequent, require prompt diagnosis and intervention. Pseudoaneurysm of the breast, a rare emergent condition often caused by trauma or biopsy, demands immediate attention due to risk of rupture. Our presented case highlights biopsy in lactating state as a predisposing factor for breast pseudoaneurysm formation. Radiologists must be well-versed in recognizing this condition and understanding its imaging characteristics. Notably, as demonstrated in our case, pseudoaneurysms may be incidentally detected during postbiopsy imaging. While some pseudoaneurysms may undergo spontaneous resolution, others require intervention, including ultrasound compression, ultrasound-guided thrombin injection, or in rare cases, surgical measures. A comprehensive understanding of these aspects is crucial for effective patient care and optimal outcomes in managing this unique breast emergency.

Patient consent

We confirm that a written informed consent for publication was obtained from the patient discussed in this case report.

REFERENCES

[1] Mahoney MC, Ingram AD. Breast emergencies: types, imaging features, and management. AJR Am J Roentgenol 2014;202:W390–9.
[2] Dixon AM, Enion DS. Pseudoaneurysm of the breast: case study and review of literature. Brit J Radiol 2004;77:694–7.
[3] Swain B, Castelhano R, Litton K, Chaudhary A. Core needle biopsy causing a pseudoaneurysm in the breast. Ann R Coll Surg Engl 2022;104(1):e21–4.
[4] Pesce K, Chico MJ, Fernando Binder F. Breast pseudoaneurysm after core needle biopsy in a pregnant patient. Radiol Case Rep 2021;16(1):35–9.
[5] Chamadoira JPS, Figueiredo CC, D'Avila GO, Rosati Rocha APCM, Endo E. Pseudoaneurysm after an ultrasound-guided breast core needle biopsy in a lactating woman. J Radiol Case Rep 2021;15(10):10–19.
[6] Lupattelli T. The yin-yang sign. Radiology 2006;238(3):1070–1.
[7] Omisore AD, Olasehinde O, Towoju AG, Akinsulore RY, Fadirepo AC, Omoyiola OZ. Pseudoaneurysm of the breast following blind palpation-guided core needle biopsy: a case report and literature review. Radiol Case Rep 2022;17(9):3385–8.
[8] El Khoury M, Mesurolle B, Kao E, Mujoomdar A, Tremblay F. Spontaneous thrombosis of pseudoaneurysm of the breast related to core biopsy. AJR Am J Roentgenol 2007;189(6):W309–11.

[9] Farrokh D, Fallah-Rastegar Y, Abbasi B. Pseudoaneurysm of the breast after core needle biopsy: Successful treatment with focused ultrasound-guided compression. Breast J 2019;25(2):312–13.

[10] Adler K, Samreen N, Glazebrook KN, Bhatt AA. Imaging features and treatment options for breast pseudoaneurysms after biopsy: a case-based pictorial review. J Ultrasound Med 2020;39(1):181–90.