

## Sonographic features of anterior chest wall lesions detected on breast sonography in women: A pictorial essay

Hyun Kyung Jung

Department of Diagnostic Radiology, Inje University Haeundae Paik Hospital

### Abstract

Although anterior chest wall lesions rarely occur and the associated imaging findings are nonspecific, various disease processes can affect the chest wall. It is important for radiologists to understand the anatomic relationship between the chest wall and breast and differentiate the tumor origin. This pictorial essay presents the sonographic features of various anterior chest wall lesions that were detected on breast ultrasonography.

**Keywords:** chest wall; breast; ultrasonography

### Introduction

Anterior chest wall lesions are found incidentally or may present as breast lumps. The categorization of chest wall lesions based on tissue origin is useful in the performance of differential diagnosis: fat, bone and soft tissue, including nerves, blood vessels, lymphatic vessels, muscles, cartilages and fibrous connective tissues. It is important to identify whether a lesion originates from the chest wall, as this can affect patient management [1].

Oliff et al [2] and Kuhlman et al [3] suggested the use of the radiologic approach for the evaluation of chest wall lesions; however, no protocols have been established so far. While patients undergo assessments using plain film radiography, US, computed tomography (CT), magnetic resonance imaging (MRI) and <sup>18</sup>F-fluorodeoxyglucose-positron emission tomography, CT and MRI are associated with a better assessment. The imaging findings associated with chest wall lesions are nonspecific

and have not been extensively described. Therefore, their evaluation may be challenging for radiologists. Although ultrasonography (US) is not considered the first imaging modality for the evaluation of chest wall lesions, such lesions may be initially encountered during breast US, especially if women complain of a palpable lump. In this pictorial essay, we illustrate the sonographic features of various anterior chest wall lesions that were detected on breast US.

Bilateral whole-breast US examinations in a supine position were performed using high-resolution US equipment with 7-12 MHz linear array transducers (iU22; Philips Healthcare, Bothell, WA). Grayscale images were obtained routinely and additional images such as color Doppler images were obtained if necessary. The US findings were evaluated according to the American College of Radiology (ACR) Breast Imaging Reporting and Data System (BI-RADS) lexicon. When needed, US-guided core needle biopsy using a 14-gauge semiautomatic core biopsy needle (Stericut, TSK Laboratory, Tochigi, Japan) was performed.

### Benign chest wall lesions

#### *Lipoma*

In adults, a lipoma is the most commonly observed benign soft-tissue tumor, and does not require treatment until the tumor size is large. Lipoma is a sharply circumscribed encapsulated mass composed of adipose tissue.

Received 21.04.2020 Accepted 01.07.2020

*Med Ultrason*

2021, Vol. 23, No 3, 348-354

Corresponding author: Hyun Kyung Jung, MD

Department of Radiology,

Inje University Haeundae Paik Hospital,

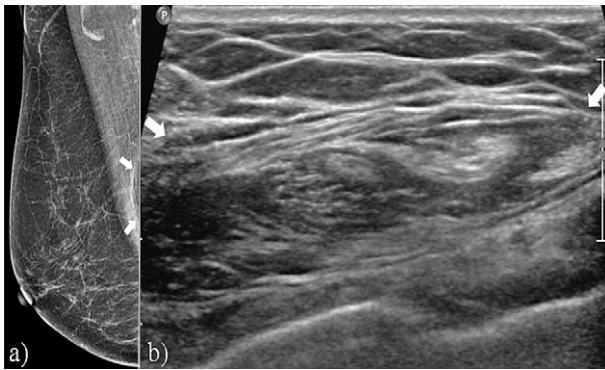
875 Haeun-daero, Haeundae-gu,

Busan 48108, Republic of Korea

Phone: 82-51-797-0363

Fax: 82-51-797-0373

E-mail: drsjung@gmail.com



**Fig 1.** A 65-year-old woman with a palpable mass in the right breast. Mediolateral oblique mammography of the right breast shows a fatty mass in the right upper breast (white arrows) (a). Transverse ultrasonography of the right breast shows an oval-shaped heterogeneous echoic mass with fine internal echoes in the right upper chest wall (white arrows) (b). These findings are suggestive of lipoma.

On US, lipoma appears as a well-circumscribed hyperechoic/isoechoic mass compared to adjacent muscle, with fine internal echoes oriented parallel to the long axis of the tumor (fig 1) [4].

#### **Hematoma**

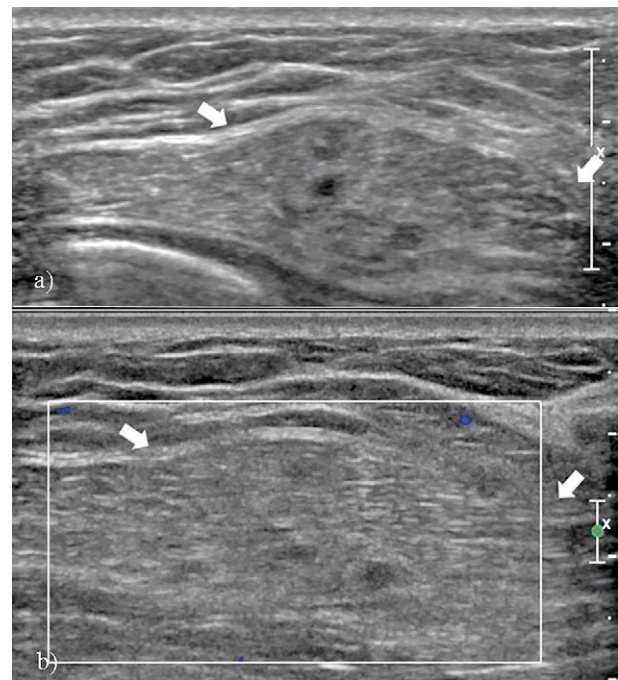
Soft-tissue hematoma may occur during direct compression trauma or after biopsy and surgery [5]. Clinical history and follow-up imaging studies help in the diagnosis establishment, as hematomas regress over time [5]. On US, an acute hematoma is observed as a homogeneous echogenic mass with a fluid-fluid level, whereas chronic hematoma appears as a heterogeneous hypoechoic mass (fig 2) [6].

#### **Abscess**

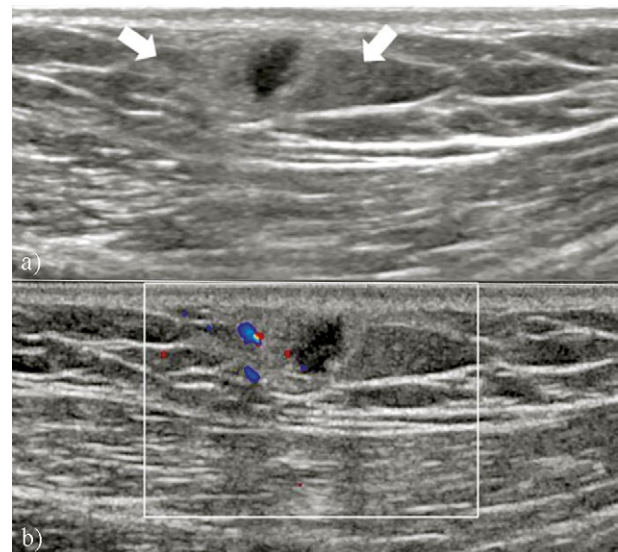
Abscess formation in the chest wall is most commonly observed in intravenous drug users and after trauma or surgery, and requires immediate surgical drainage [7]. Breast abscess is a complication of infectious mastitis. On US, breast abscess presents as a variable shaped and sized multi-loculated mass, with a thick peripheral wall that has increased vascularity (fig 3) [8].

#### **Injection granuloma related to mammoplasty**

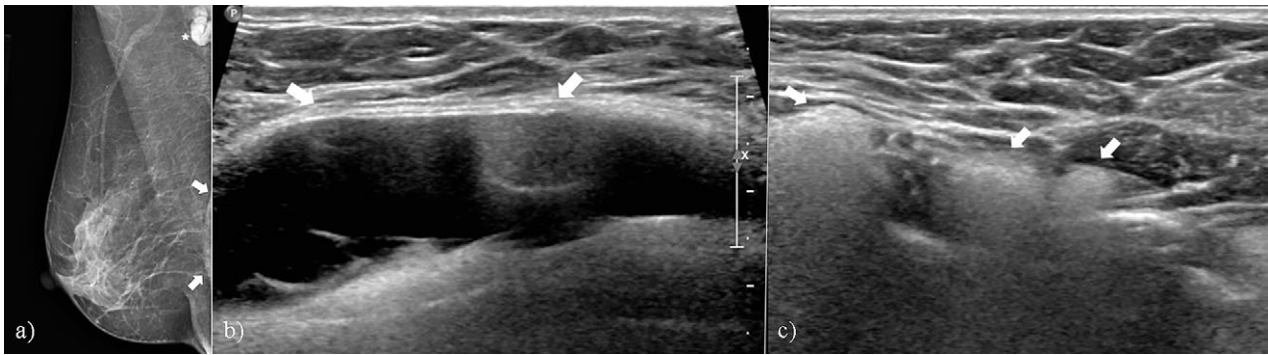
In the past, direct injection of liquid silicone or liquid paraffin into the breast was frequently performed for the augmentation of appearance [9]. Injection granulomas can occur after the implantation of various materials and these represent the final stage of inflammation and the wound-healing process. On US, injection granulomas present as multiple variable sized nodules with posterior acoustic shadowing (i.e. a snowstorm appearance) (fig 4) or a peripheral hyperechoic rim in the subcutaneous fat layer, obscuring the underlying breast parenchyma [9].



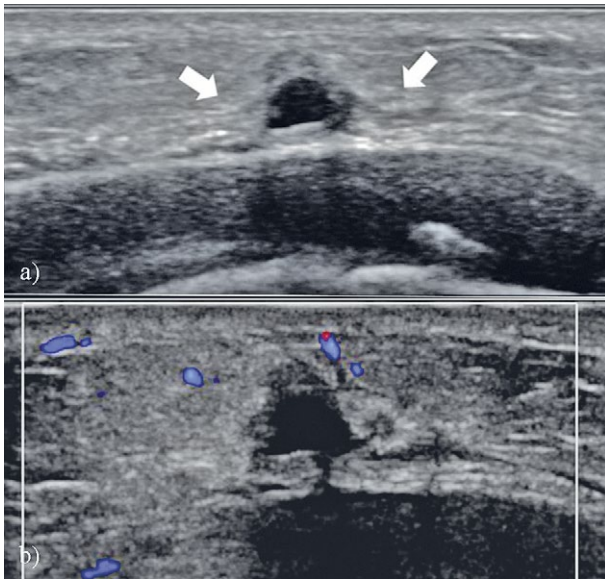
**Fig 2.** A 57-year-old woman with left breast pain that aggravated when she lifted her left arm. She had slipped and fallen down 8 days previously. Transverse sonography of the left breast shows an indistinct heterogeneous echoic mass in the left upper chest wall (white arrows) (a), without vascularization (white arrows) (b). The mass disappeared on follow-up sonography after 1 year. This is suggestive of hematoma.



**Fig 3.** A 27-year-old woman with a palpable mass in the right upper chest wall. Transverse sonography of the right breast shows a hypoechoic mass with an irregular shape, microlobulated margin, and increased surrounding fat echogenicity (white arrows) (a). Color Doppler image shows increased surrounding vascularity (b). Excisional biopsy was performed and the mass was diagnosed as an abscess.



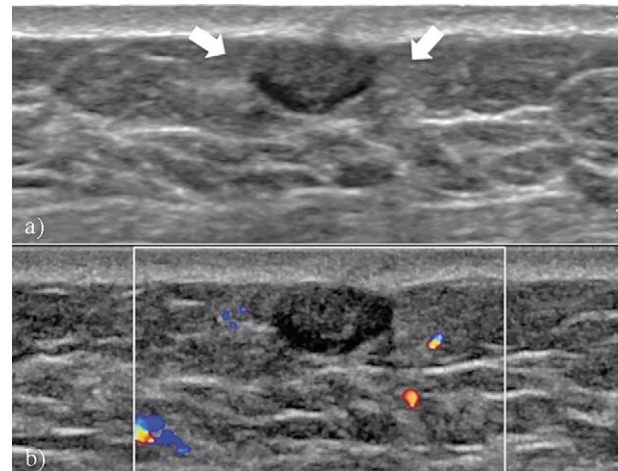
**Fig 4.** A 48-year-old woman with a palpable mass in her right chest wall for several months. She had undergone a direct injection of liquid silicone for cosmetic reasons as well as its subsequent removal. Mediolateral oblique mammography shows a fatty mass in the right upper breast (white arrows) and an enlarged lymph node in the right axilla (asterisks) (a). Transverse ultrasonography (US) shows focal fluid collection with two solid nodules (white arrows) (b). US shows diffuse acoustic shadowing by foreign body materials in the right axilla (c). US-guided fine needle aspiration of the fluid was performed and the aspiration was bloody only. The patient subsequently underwent excisional biopsy with right axillary dissection and the diagnosis was silicone granuloma.



**Fig 5.** A 55-year-old woman with a palpable mass in the left chest wall; status post-left mastectomy and adjuvant chemotherapy for breast cancer. Transverse sonography shows a complex cystic and solid mass in the left chest wall (white arrows) (a). Color Doppler image shows the absence of vascularity in the mass (b). US-guided core needle biopsy was performed and the diagnosis was fat necrosis with foreign body reaction.

#### **Fat necrosis**

Fat necrosis of the breast is a non-suppurative inflammatory process and may occur after trauma, surgery, biopsy, breast reconstruction, fat graft, and radiotherapy. It is detected incidentally or presents as a lump. On US, its appearance varies from a simple cyst to a hypoechoic or complex cystic and solid mass depending on the time - which is related to inflammation or fibrosis within the lesion (fig 5) [10].



**Fig 6.** A 56-year-old woman with a palpable mass in the right breast. Longitudinal sonography shows a complex cystic and solid mass in the subcutaneous layer (white arrows) (a). Color Doppler image shows the absence of vascularity in the mass (b). Excisional biopsy was performed, and the mass was diagnosed as an epidermal cyst.

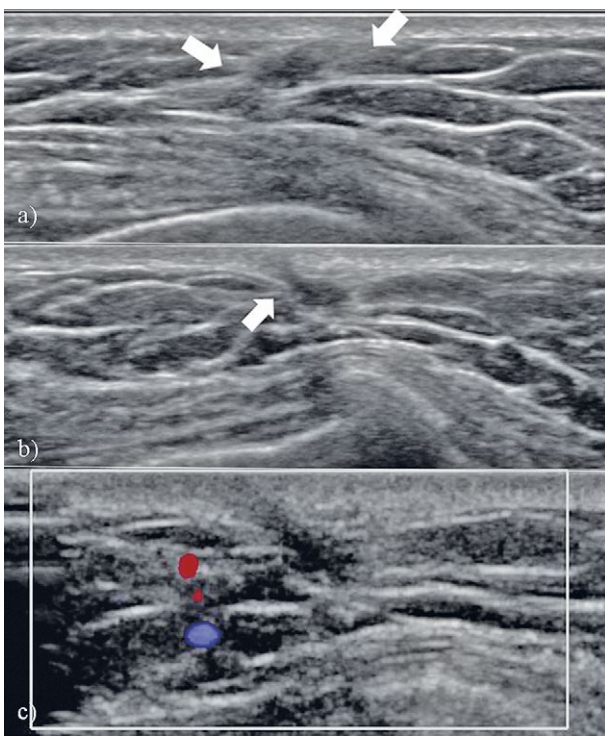
#### **Epidermal inclusion cyst**

Epidermal inclusion cysts are commonly occurring cutaneous lesions that represent the proliferation of epidermal cells within a circumscribed dermal or subdermal space. Clinically, they present as firm, non-tender lumps and are typically located on the scalp, face, neck, trunk, and back. On US, they are seen as well-circumscribed predominantly hypoechoic masses, with an ovoid or a spherical shape (fig 6) [11]. However, if they rupture, they may show variable imaging findings and can mimic infection.

#### **Nodular fasciitis**

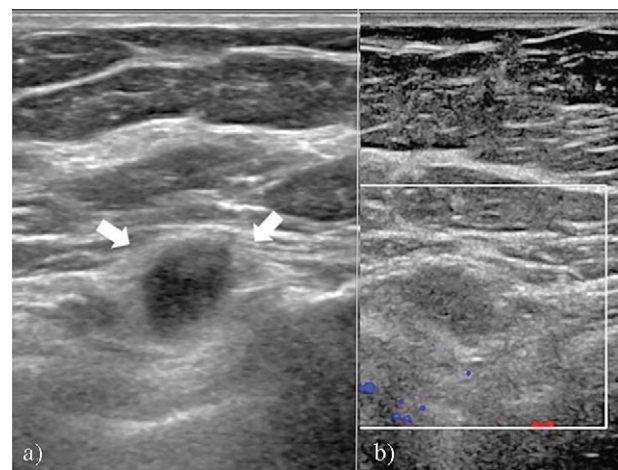
Nodular fasciitis is a benign mesenchymal tumor characterized by the proliferation of fibroblasts and my-





**Fig 7.** A 47-year-old woman with a palpable mass in the left breast. Transverse sonography of the left breast shows a hypoechoic mass with an indistinct margin and irregular shape in the left upper chest wall (white arrows) (a). Longitudinal sonography shows that the mass was connected with the skin (white arrow) (b) and has no vascularization (c). Excisional biopsy diagnosed a nodular fasciitis.

ofibroblasts in the subcutaneous tissues. The most commonly observed sites are the upper extremities, with chest wall involvement noted in only 9% of all cases [12]. It commonly occurs in adults aged 20-50 years and presents as a rapidly growing mass [12]. Surgical excision is the treatment of choice. On US, it is seen as an inhomogeneous hypoechoic mass with a non-circumscribed



**Fig 8.** A 59-year-old woman underwent screening breast ultrasonography (US). Transverse US of the right breast shows a hypoechoic mass with an oval shape and indistinct margin in the right chest wall (white arrows) (a). Color Doppler image shows indefinite mass vascularity (b). Excisional biopsy diagnosed an intramuscular cellular myxoma.

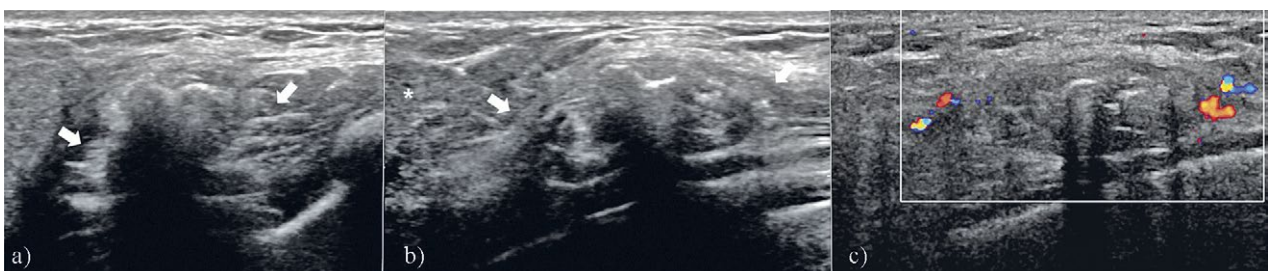
margin, an irregular shape, and an echogenic rim (fig 7) [13].

#### *Intramuscular myxoma*

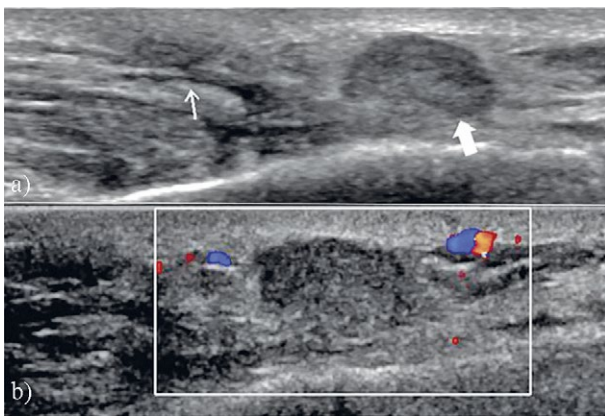
Myxoma is a rare benign mesenchymal neoplasm that occurs most commonly in an intramuscular compartment, especially the thigh. Intramuscular myxoma rarely involves the chest wall [14]. On US, it presents as a well-defined anechoic mass with some internal echoes and a surrounding rim of fat (fig 8).

#### *Myositis ossificans*

Myositis ossificans is a benign heterotopic ossification of a soft-tissue mass that occurs in muscle and rarely in the chest wall. This lesion can be observed after localized trauma or neurologic injury [15]. The imaging findings are characterized by its stage of development. Calcifications (osteogenesis) become apparent 3-8 weeks after



**Fig 9.** A 34-year-old lactating woman with a hard mass in her right chest wall. She had noticed the mass three years before but had not undergone evaluation. The mass had been growing recently. Longitudinal (a) and anti-radial sonography (b) of the right breast shows a hypoechoic mass with internal dense calcification in the right chest wall (white arrows) apart from the adjacent lactating breast (asterisks). Color Doppler image shows peripheral vascularity in the mass (c). US-guided fine needle aspiration was performed and mature fat cell clusters admixed with inflammatory cells were seen. Excisional biopsy was performed, and benign osseous tumor with suspicions of heterotopic ossification was diagnosed.



**Fig 10.** A 52-year-old woman with a hard mass at the sternal area; status post-mastectomy. Anti-radial ultrasonography (US) shows a hypoechoic mass with an oval shape and microlobulated margin (thick white arrow) in the chest wall near the previous operation site (thin white arrow) (a). Color Doppler image shows the absence of increased vascularity in the mass (b). US-guided core needle biopsy showed recurrent invasive ductal carcinoma.

onset, starting peripherally and progressing centrally in a zonal pattern. They evolve from faint irregular floccular calcification to dense calcification and, ultimately, to lamellar bone with well-defined cortex forms (fig 9) [15].

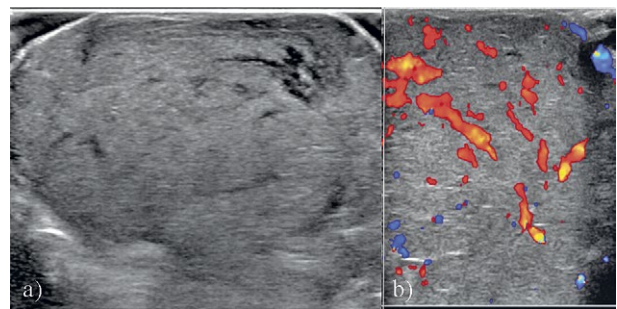
### Malignant chest wall lesions

#### Breast cancer recurrence

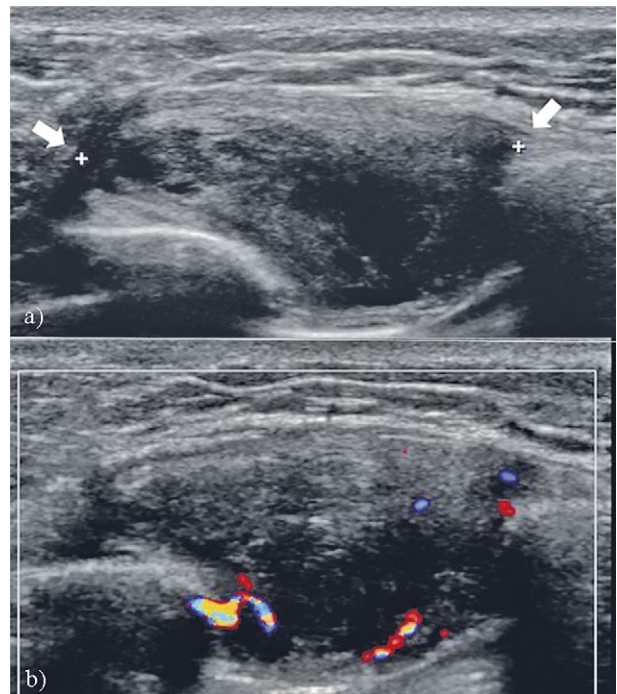
Modified radical mastectomy (MRM) is among the surgical treatments for breast cancer. The rate of local recurrence in the chest wall after MRM ranges between 5% and 10%. Chest wall invasion may occur either by direct extension of the tumor through the pectoral fascia and into the pectoral muscles or by indirect extension via interpectoral nodes [16]. Tarja et al [17] reported that the sensitivity of US in the detection of local recurrence is higher than that of a clinical examination. On US, while most recurrent cancers appear as a hypoechoic mass, they may occasionally manifest as a hyperechoic mass (fig 10) [17]. Accurate diagnosis may be achieved with US-guided fine needle aspiration even in superficially located lesions or small lesions [1].

#### Malignant phyllodes tumor

The Phyllodes tumor is a rare fibroepithelial tumor of the breast. It is typically a large, fast-growing mass, arising from the periductal stroma of the breast. Its occurrence is most common between the ages of 40 and 60 years, before menopause onset. Although most phyllodes tumors are benign, some are malignant or borderline. Wide local excision is usually the first choice of treatment. Imaging features are similar for benign and ma-



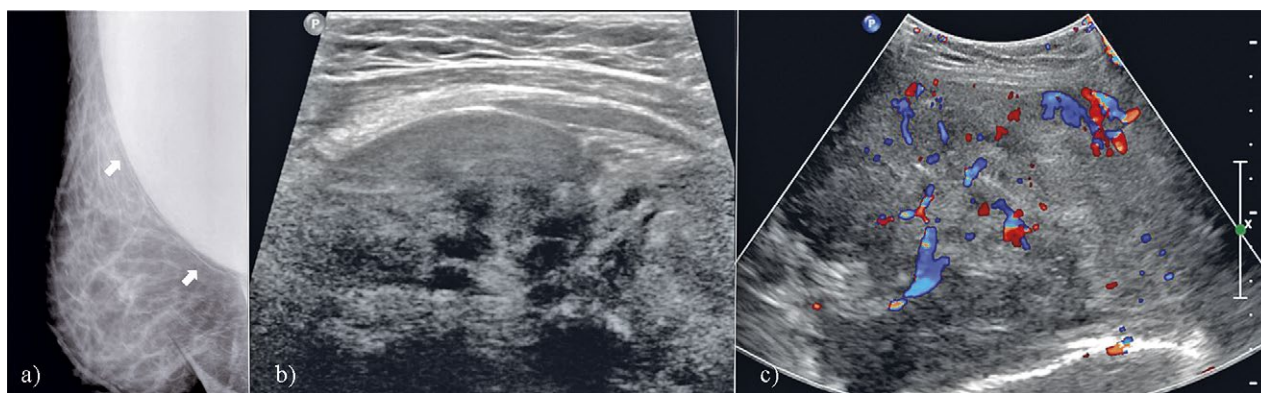
**Fig 11.** A 47-year-old woman with a palpable mass that was present in the chest wall for 3-4 months; status post-left mastectomy for a recurrent borderline phyllodes tumor. Transverse sonography shows a large heterogeneous echoic mass with an indistinct margin at the left mastectomy site (a). Color Doppler image shows increased vascularity in the mass (b). The patient underwent modified radical mastectomy and the mass was diagnosed as a malignant phyllodes tumor.



**Fig 12.** A 36-year-old woman with a palpable mass in the left chest wall and previous ultrasound (US)-guided fine needle aspiration showing a possible spindle cell tumor. Longitudinal US shows a hypoechoic mass with an indistinct margin and irregular shape in the left chest wall, extending into the intercostal space (white arrows) (a). Color Doppler image shows increased vascularity in the mass (b). Excisional biopsy was performed in our hospital and biphasic-type synovial sarcoma was diagnosed.

lignant phyllodes tumors but tumor diameter  $\geq 3$  cm is associated with a higher likelihood of malignancy development [18]. On US, it is usually a well-defined heterogeneous echoic mass without acoustic attenuation (fig 11).





**Fig 13.** A 64-year-old woman with a palpable mass in the right breast for 3 months. Mediolateral oblique mammography of the right breast shows a high-density mass in the right axilla (white arrows) (a). Transverse sonography shows a large heterogeneous hypoechoic mass in the right chest wall (b). Color Doppler image shows increased vascularity in the mass (c). Excisional biopsy was performed, and the mass was diagnosed as a malignant fibrous histiocytoma.

### *Synovial sarcoma*

Synovial sarcoma is a malignant soft-tissue tumor of unknown histogenesis that most commonly occurs near the large joints of the extremities in young adults. Synovial sarcoma arising from the chest wall is extremely rare [19]. It is clinically and morphologically a well-defined and slowly enlarging soft-tissue mass. The imaging findings associated with this tumor type are nonspecific, showing a heterogeneous and predominantly hypoechoic mass (fig 12).

### *Malignant fibrous histiocytoma*

Malignant fibrous histiocytoma (MFH) is the most commonly observed soft-tissue sarcoma in adults, which has more recently been classified as undifferentiated pleomorphic sarcoma. It shows an aggressive biological behavior and offers poor prognoses and rarely occurs in the chest wall. There are several histologic subtypes, including the storiform-pleomorphic, myxoid, inflammatory, giant cell, and angiomatoid forms [19]. While the US findings associated with this tumor type are not well-known, one case of MFH appearing as a well-defined inhomogeneous low-echoic mass on US has been reported (fig 13) [20].

### **Conclusion**

Although anterior chest wall lesions are uncommon and the imaging findings are nonspecific, various chest wall lesions may be detected on breast US. US can be used as an initial imaging modality for the evaluation of palpable chest wall lesions. It is important for radiologists to understand the anatomic relationship between the chest wall and breast and the imaging findings associated with these disease entities for the appropriate management of chest wall lesions.

**Conflict of interest:** none

### **References**

1. Youk JH, Kim EK, Kim MJ, Oh KK. Imaging findings of chest wall lesions on breast sonography. *J Ultrasound Med* 2008;27:125-138.
2. Oliff MC, Birdwell RL, Raza S, Giess CS. The breast imager's approach to nonmammary masses at breast and axillary US: imaging technique, clues to origin, and management. *Radiographics* 2016;36:7-18.
3. Kuhlman JE, Bouchardy L, Fishman EK, Zerhouni EA. CT and MR imaging evaluation of chest wall disorders. *Radiographics* 1994;14:571-595.
4. Paunipagar BK, Griffith JF, Rasalkar DD, Chow LTC, Kumta SM, Ahuja A. Ultrasound features of deep-seated lipomas. *Insights Imaging* 2010;1:149-153.
5. Harish MG, Konda SD, MacMahon H, Newstead GM. Breast lesions incidentally detected with CT: what the general radiologist needs to know. *Radiographics* 2007;27 Suppl 1:S37-S51.
6. Meuwly JY, Gudinchet F. Sonography of the thoracic and abdominal walls. *J Clin Ultrasound* 2004;32:500-510.
7. O'Sullivan P, O'Dwyer H, Flint J, Munk PL, Muller N. Soft tissue tumours and mass-like lesions of the chest wall: a pictorial review of CT and MR findings. *Br J Radiol* 2007;80:574-580.
8. Trop I, Dugas A, David J, et al. Breast abscesses: evidence-based algorithms for diagnosis, management, and follow-up. *Radiographics* 2011;31:1683-1699.
9. Yang N, Muradali D. The augmented breast: a pictorial review of the abnormal and unusual. *AJR Am J Roentgenol* 2011;196:W451-W460.
10. Tayyab SJ, Adrada BE, Rauch GM, Yang WT. A pictorial review: multimodality imaging of benign and suspicious features of fat necrosis in the breast. *Br J Radiol* 2018;91:20180213.

11. Lee HS, Joo KB, Song HT, et al. Relationship between sonographic and pathologic findings in epidermal inclusion cysts. *J Clin Ultrasound* 2001;29:347-383.
12. Suh JH, Yoon JS, Park CB. Nodular fasciitis on chest wall in a teenager: a case report and review of the literature. *J Thorac Dis* 2014;6:108-110.
13. Yen HH, Chiou HJ, Chou YH, Chen CH, Guo WY. Nodular fasciitis: sonographic-pathologic correlation. *Ultrasound Med Biol* 2017;43:860-867.
14. Kim SJ. Sonographic appearance of an intramuscular myxoma of the pectoralis major muscle. *J Clin Ultrasound* 2014;42:505-508.
15. Subhawong TK, Fishman EK, Swart JE, Carrino JA, Attar S, Fayad LM. Soft-tissue masses and masslike conditions: what does CT add to diagnosis and management? *AJR Am J Roentgenol* 2010;194:1559-1567.
16. Yilmaz MH, Esen G, Ayarcan Y, et al. The role of US and MR imaging in detecting local chest wall tumor recurrence after mastectomy. *Diagn Interv Radiol* 2007;13:13-18.
17. Rissanen TJ, Makarainen HP, Mattila SI, Lindholm EL, Heikkinen MI, Kiviniemi HO. Breast cancer recurrence after mastectomy: diagnosis with mammography and US. *Radiology* 1993;188:463-467.
18. Liberman L, Bonaccio E, Hamele-Bena D, Abramson AF, Cohen MA, Dershaw DD. Benign and malignant phyllodes tumors: mammographic and sonographic findings. *Radiology* 1996;198:121-124.
19. Tateishi U, Gladish GW, Kusumoto M, et al. Chest wall tumors: radiologic findings and pathologic correlation: part 2. Malignant tumors. *Radiographics* 2003;23:1491-1508.
20. An JK, Oh KK. Malignant Fibrous Histiocytoma of Chest Wall. *Yonsei Med J* 2005;46:177-180.