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Case Report

A rare case of giant cell tumor of the anterior rib presenting as a breast mass [☆]

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ABSTRACT

Initial diagnostic ultrasound of a 22-year-old female patient presenting with a palpable breast mass revealed a suspicious mass initially thought to arise from the breast. However, follow-up diagnostic mammography was normal without evidence of the 5 cm mass seen on ultrasound, and pathology results from ultrasound-guided core needle biopsy raised suspicion for giant cell tumor, making chest wall origin of the mass more likely. Further CT and MRI imaging indeed revealed a locally invasive mass arising from the anterior fifth rib. The patient was treated with denosumab to decrease tumor burden before surgery, and subsequently underwent successful surgical resection of the tumor with mesh overlay and flap reconstruction of the chest wall defect. This case highlights the importance of keeping chest wall lesions in the differential for lesions presenting clinically as breast lesions. Despite the rarity of giant cell tumor of the anterior rib and its unusual presentation as a breast mass, appropriate diagnostic imaging work-up allowed for successful diagnosis and treatment in this case.

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Introduction

Giant cell tumor of bone (GCT) accounts for 4%-10% of all primary bone tumors. GCT most commonly presents in young adulthood with peak incidence in the third decade of life, and has a slight female predilection. GCT can be locally aggressive, exhibiting bone destruction, cortical expansion, and soft tissue invasion, and has a high propensity of recurrence. GCT is usually benign, but up to 2%-5% are malignant, with a ten-

dency to metastasize to the lungs [1]. GCT most commonly occurs in the metaphyseal region of long bones, such as in the distal femur or distal radius. The rib is a rare site for GCT, with multiple large case series reporting an incidence of around 1% in the ribs [2].

The characteristic radiographic appearance of GCT is a lucent lesion with a well-defined nonsclerotic margin and narrow zone of transition. Aggressive lesions may demonstrate bony expansion, cortical thinning and destruction, and an associated soft tissue mass. Characteristic MRI features of GCT

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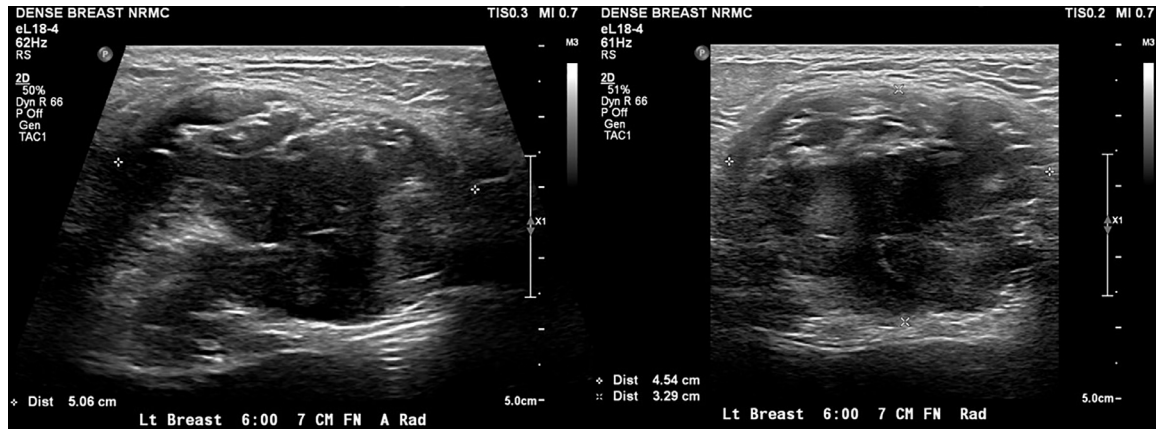


Fig. 1 – Anti-radial and radial ultrasound images of a mass in the left breast at 6 o'clock 7 cm from the nipple. The mass measures 5.1 × 4.5 × 3.3 cm and is irregular and hypoechoic with indistinct margins.

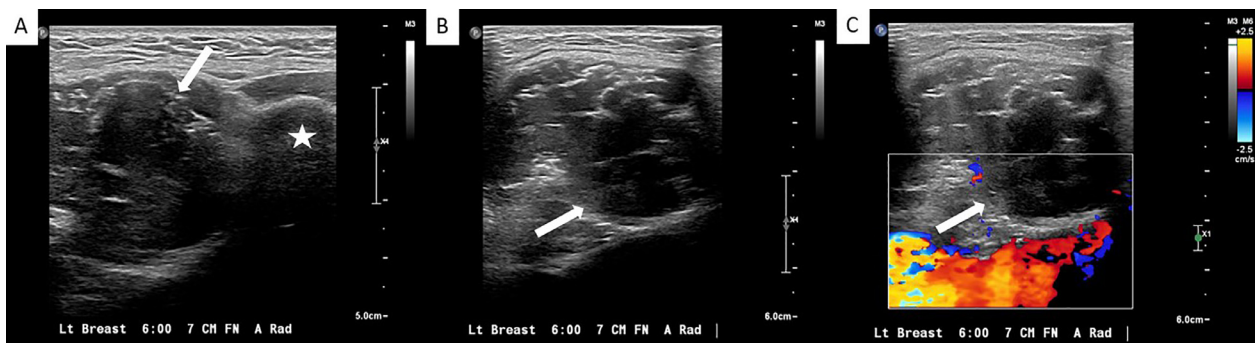


Fig. 2 – Further US examination of the mass (white arrows) revealed its proximity to an anterior rib (white star, A) as well as an anechoic cardiac chamber just deep to it without intervening chest wall musculature (B), with confirmatory color filling of the cardiac chamber with Doppler (C).

include low to intermediate T1 signal intensity, high T2 signal intensity, and heterogeneous postgadolinium enhancement [1].

This is an unusual case of GCT originating from the anterior rib presenting as a breast mass.

Case report

A 22-year-old female patient with no significant past medical history presented to the breast imaging clinic for evaluation of a left-sided breast lump she had noticed 4 months prior and which was causing some discomfort. In accordance with ACR appropriateness criteria for a woman under 30 presenting with a palpable breast mass, diagnostic breast ultrasound was the initial study obtained [3]. Diagnostic ultrasound was significant for an approximately 5 cm mass in the inferior left breast (Fig. 1). The mass demonstrated characteristics suspicious for malignancy, including irregular shape and indistinct margins, and was categorized as BI-RADS 4 (suspicious). The mass also demonstrated proximity to an anterior rib, and a cardiac chamber was seen just deep to the mass without intervening chest wall musculature (Fig. 2). The next most ap-

propriate imaging study, a diagnostic mammogram, was then obtained. However, the mass was not visualized on multiple mammographic views, including exaggerated lateral and medial craniocaudal views (Fig. 3). Ultrasound-guided biopsy of the mass was recommended and completed (Fig. 4), with pathology results consistent with giant cell tumor of soft tissue vs bone. CT of the chest was obtained for further characterization, revealing a mass arising from the left anterior fifth rib (Fig. 5). Giant cell tumor of bone was then considered to be the more likely diagnosis. MRI of the chest was also obtained, with the mass showing characteristics consistent with giant cell tumor of bone, including T1 intermediate signal, heterogeneous T2 hyperintensity, and heterogeneous enhancement on postcontrast images (Fig. 6). The mass demonstrated local invasion into the chest wall and pleural space. Due to concern for possible pericardial invasion, cardiac MRI was obtained for surgical planning purposes. Cardiac MRI did not show evidence of direct extension into the pericardial space or myocardial involvement. Due to the locally invasive nature of the mass, the patient underwent treatment with three injections of denosumab before surgery, which resulted in a decrease in tumor size (Fig. 7). Surgical resection was completed with resection of the mass and fifth rib as well as segmental resections of the fourth and sixth ribs, with mesh overlay and flap

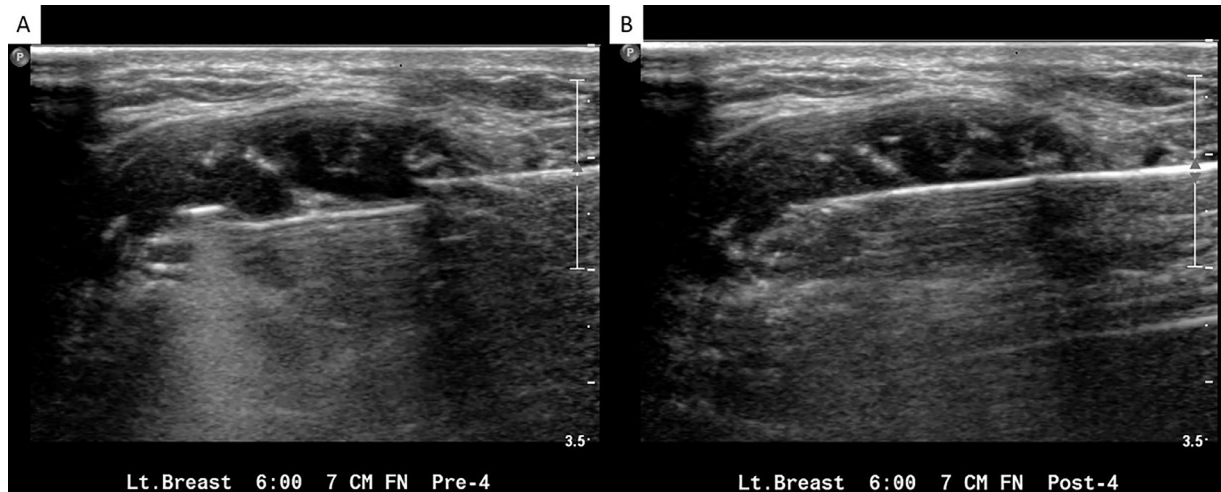


Fig. 3 – US-guided core needle biopsy was taken of the mass with the biopsy needle parallel to the chest wall. (A) demonstrates the biopsy needle within the mass with an open trough, and the (B) demonstrates the biopsy needle after the device was fired.

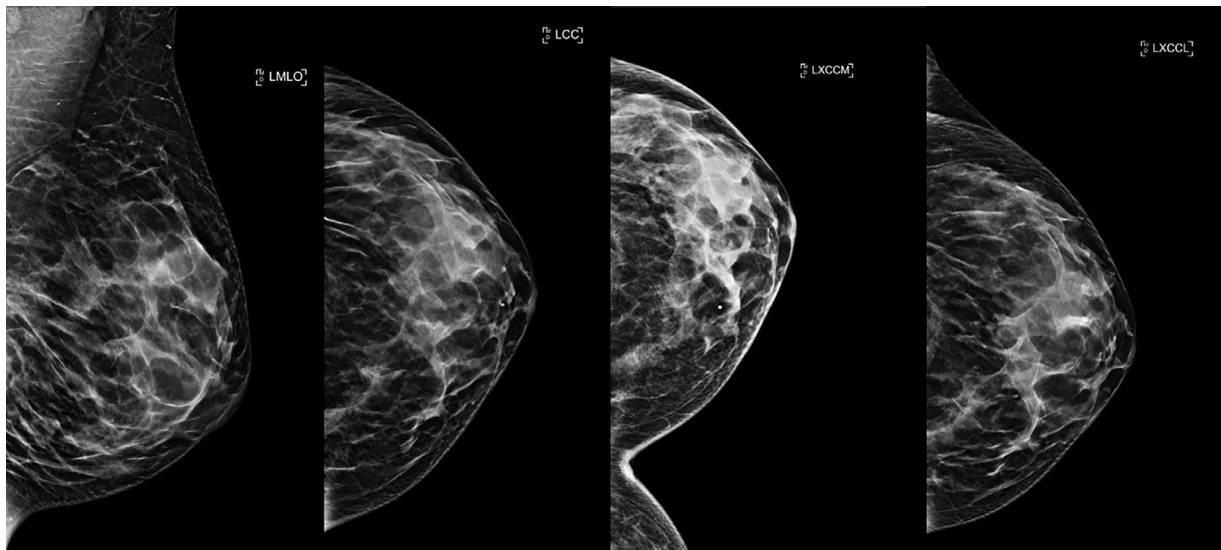


Fig. 4 – Mediolateral oblique, cranio-caudal, exaggerated cranio-caudal medial, and exaggerated cranio-caudal lateral views of the left breast are normal without evidence of the mass seen on ultrasound.

reconstruction of the chest wall defect. Pathology confirmed a giant cell tumor of the bone with denosumab treatment-related changes and negative margins. At follow up, denosumab therapy was terminated given excellent response and negative margins from surgery.

Discussion

This case exemplifies a unique presentation of an osseous tumor, presenting itself through diagnostic breast imaging. There are only two other cases of giant cell tumor of the anterior rib presenting as a breast mass in the literature [4,5].

It is important not to limit one's differential diagnosis to primary breast lesions in a patient presenting with a palpable breast mass. The chest wall beneath the breast is composed

of the pectoralis muscles, anterior ribs, and intercostal muscles. Pathologies of these structures can present as masses on breast imaging. Malignancies such as leiomyosarcoma, rhabdomyosarcoma, and spindle cell sarcoma may arise from the chest wall musculature [7]. Differential considerations for an osseous pathology arising from the anterior ribs include benign entities such as fibrous dysplasia, rib fracture, giant cell tumor, aneurysmal bone cyst, and brown tumor in the setting of hyperparathyroidism [7]. Malignant osseous differential considerations primarily encountered in patients under 30 years old include osteosarcoma and Ewing's sarcoma [7,8]. Chondrosarcoma is most frequently encountered in middle-aged patients, but can occur at any age. Multiple myeloma and metastatic disease of the ribs should also be considered in older patients [7].

Certain ultrasound characteristics that should raise question of chest wall origin of a mass include anterior dis-

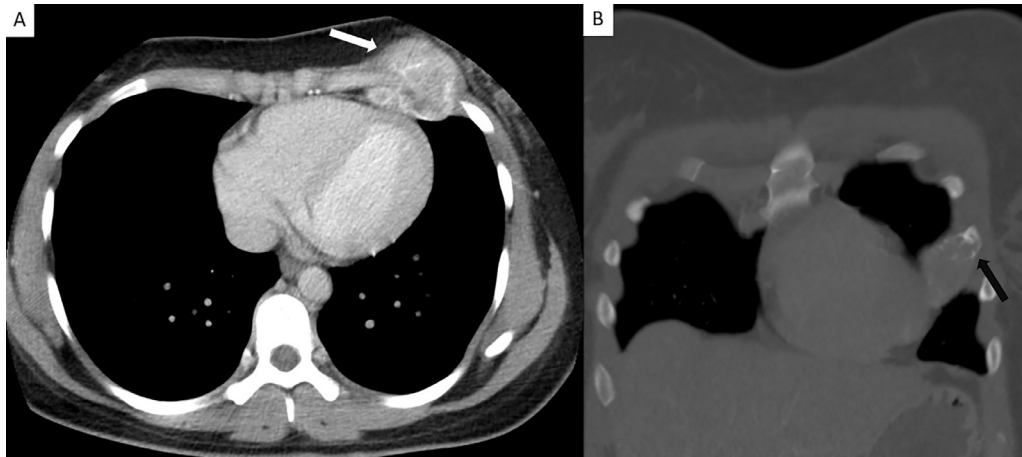


Fig. 5 – Axial contrast-enhanced chest CT (A) demonstrates a heterogeneously enhancing anterior chest wall mass (white arrow) with local invasion of the chest wall musculature and pleura, as well as proximity to the left ventricular apex concerning for pericardial invasion. Coronal bone window CT image clearly shows the mass arising from the anterior fifth rib (black arrow).



Fig. 6 – The mass demonstrates intermediate signal on axial T1-weighted MRI (A), heterogeneous enhancement on axial T1-weighted post-contrast MRI (B), and heterogeneous T2 hyperintensity on coronal T2-weighted MRI (C, white arrow).

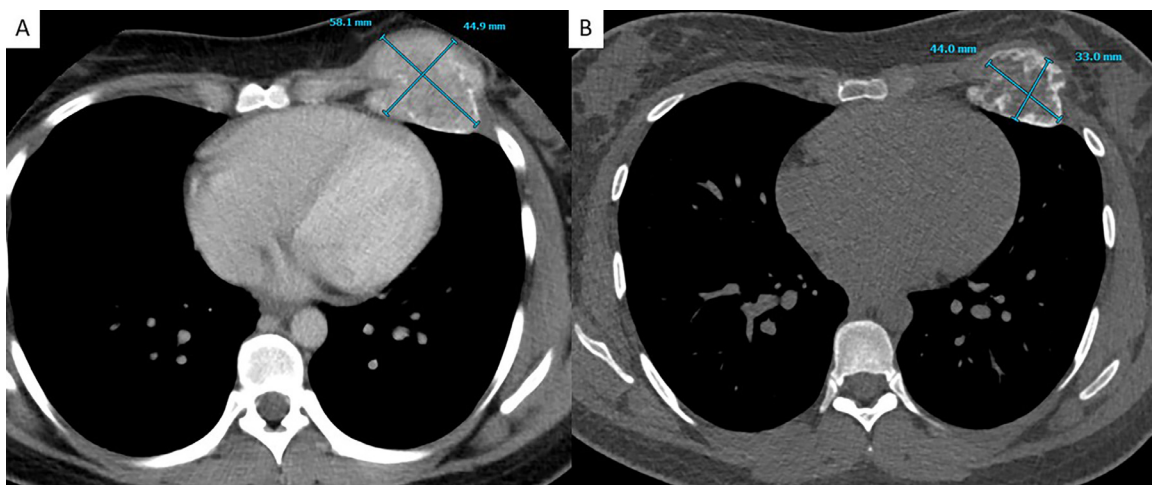


Fig. 7 – Initial axial CT of the mass (A) compared to axial CT of the mass taken 3 months later after 3 cycles of denosumab (B), demonstrating decrease in size from 5.8 × 4.5 cm to 4.4 × 3.3 cm as well as increased peripheral sclerosis.

placement of the breast tissue, presence of retro-mammary fat anterior to the lesion, and obtuse angle to the chest wall [8]. Additionally, visualization of a posterior depth mass on ultrasound with a concurrent, technically adequate normal mammogram, as in this case, should raise suspicion for possible chest wall origin. Further workup with CT and/or MRI should be done for better evaluation of chest wall mass morphology, origin, enhancement pattern, and extent of tumor disease by direct invasion or distant metastases. Given the unique nature of this case, cardiac MRI was also performed, which was essential to evaluate for pericardial invasion prior to surgical resection.

Biopsy is required for definitive diagnosis of a chest wall mass, and can be performed under ultrasound guidance, as in this case. Identification of anatomy in such a biopsy is of the utmost importance, primarily identifying the chest wall musculature, as the pleura lies just inferior. In all cases it is important to position the needle parallel to the chest wall so as not to disrupt the pleura, but especially in cases like this where the pleura and heart lie just beneath the mass.

There are a few other cases of giant cell tumor arising from the anterior rib in the literature, all of which were treated with complete resection as in this case [2,6,9]. Although almost always benign, GCT should be resected to avoid morbidity from local invasion. For example, one case in the literature describes a GCT of the anterior rib left untreated for 7 years, which grew to 16 cm and resulted in compression of the heart and disabling dyspnea [10]. Complete resection is the treatment of choice for GCT whenever possible due to its high recurrence rate, especially after removal by curettage alone [1]. In this case, denosumab, a human monoclonal antibody that inhibits RANKL, thereby blocking osteoclast function and decreasing bone resorption in GCT, was given prior to surgery. Denosumab has been shown to decrease GCT size before surgery and prevent progression of disease [11,12]. Giant cell tumors treated with Denosumab can develop osteosclerosis, as in this case, which is indicative of a positive therapeutic response [11]. Denosumab therapy did decrease tumor size in this case, helping to limit potential surgical morbidity and risk of injury to surrounding structures.

This case report signifies the importance of maintaining a broad differential to include chest wall lesions, including giant cell tumor, when findings are suggestive of an anterior chest wall mass on diagnostic breast imaging.

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Patient consent

Informed consent was obtained from the patient on January 14, 2024.