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Case Report

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Primary Sternal Osteosarcoma Mimicking a Breast Mass in a Young Female

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Abstract

Primary sternal osteosarcoma is an exceptionally rare entity with a male preponderance. We report a rare case of a 19-year-old nulliparous female who presented with a two-year history of a progressively enlarging right breast mass. Multimodality imaging—including chest radiography, ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI) revealed a large mass arising from the sternum extending into the right breast and anterior mediastinum. Biopsy confirmed high-grade osteosarcoma, characterised by multinucleated giant cells and stromal cells with mild atypia. Immunohistochemistry was positive for vimentin and negative for CK7. Surgical resection was planned; however, the patient declined treatment. This case highlights the importance of considering rare diagnoses in atypical presentations of breast masses and underscores the value of imaging and histopathological correlation in diagnosis and management.

Keywords: Breast disease; Chest wall neoplasms; Histopathology; Magnetic resonance imaging; Osteosarcoma; Sternum

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INTRODUCTION

Primary chest wall sarcomas account for approximately 5% of thoracic malignancies.[1] Osteosarcomas are aggressive mesenchymal neoplasms and typically present in adolescents and young adults, with a bimodal age distribution, and are more common in long bones. Primary involvement of the sternum is exceedingly rare and may present with non-specific symptoms or mimic other thoracic or breast pathologies.[2,3] We report a rare

case that highlights a rare presentation of primary sternal osteosarcoma in a young female, initially misinterpreted as a breast mass. The report underscores the diagnostic value of multimodality imaging and histopathology and demonstrates the importance of a multidisciplinary approach in evaluating and managing such uncommon chest wall neoplasms.

CASE REPORT

A 19-year-old nulliparous woman presented with a two -year history of a progressively enlarging, painless right breast mass. She had no history of trauma or prior malignancy, and no family history of breast cancer. Menarche was at age 12 and her menstrual cycles were regular.

Clinical examination revealed a firm, fixed 10 × 8 cm mass in the right breast extending across the midline, with no overlying skin changes or axillary lymphadenopathy. Systemic examinations and blood investigations were unremarkable.

Chest radiograph revealed a homogenous opacity in the right perihilar region, with obliteration of the right heart border and the "incomplete border sign," suggestive of an extrapulmonary mass (**Figure 1**). No calcifications were observed.

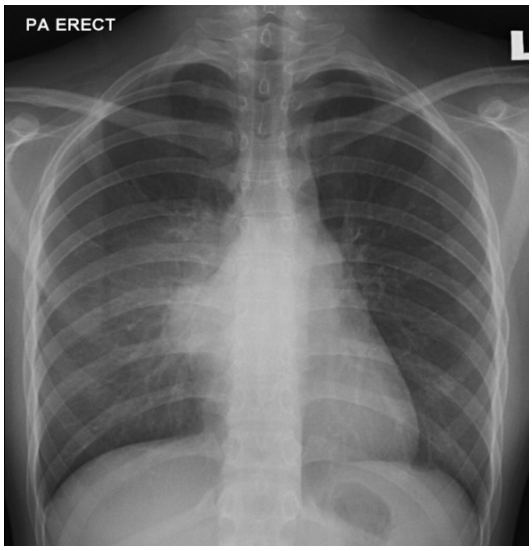

Fig. 1: Chest radiograph shows an ill-defined opacity (arrow) over the right hemithorax with preservation of the hilar overlay sign. The right heart border is obscured, and the lateral, superior, and inferior margins of the mass are poorly defined, with preservation of the medial border—features consistent with the "incomplete border sign."

Ultrasound scan demonstrated a large, heterogeneous, predominantly solid mass with lobulated margins and cystic areas, extending from the right breast to the underlying sternum (**Figure 2a and b**). Increased vascularity was noted on Doppler. The lesion was classi-

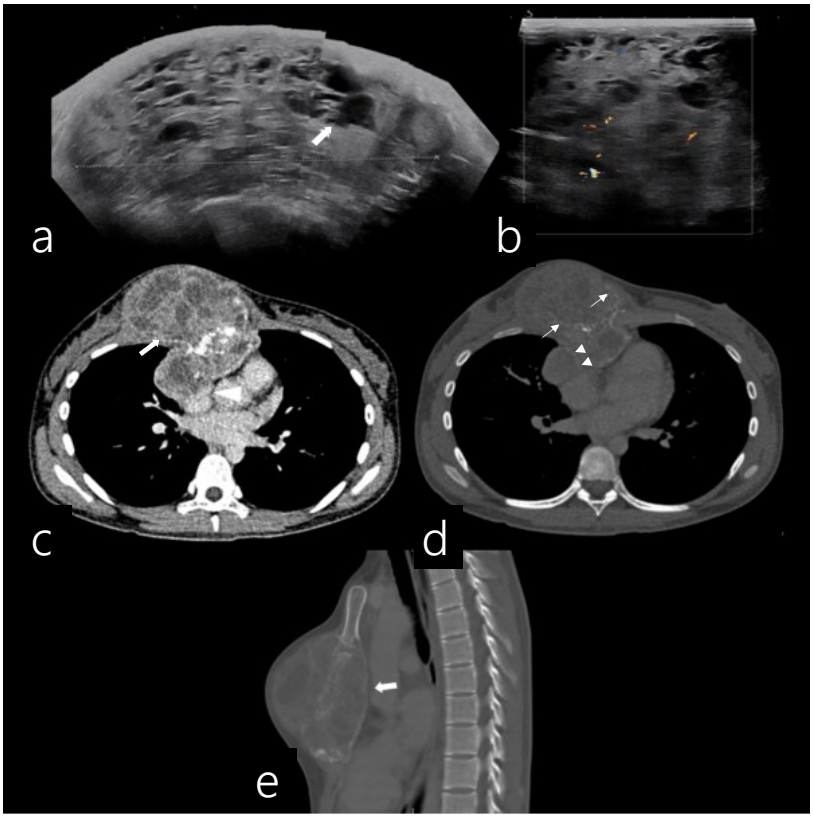

Fig. 2: (a & b) Ultrasound of the right breast shows a large, irregular, lobulated, heterogeneous, predominantly solid mass with cystic components (arrow). Color Doppler demonstrates increased internal vascularity. (c) Axial CT in soft tissue window, (d & e) Axial and sagittal views in bone window: show a large lobulated, heterogeneously enhancing mass (arrow) arising from an expanded and eroded sternum. The mass extends into the right breast and anterior mediastinum, displacing the great vessels posteriorly and abutting the superior vena cava (arrowheads). Hypodense areas likely represent cystic degeneration or necrosis. There is no distinct fat plane between the mass and the pectoralis muscle. Peripheral linear calcifications (line arrows) suggest osteoid matrix formation.

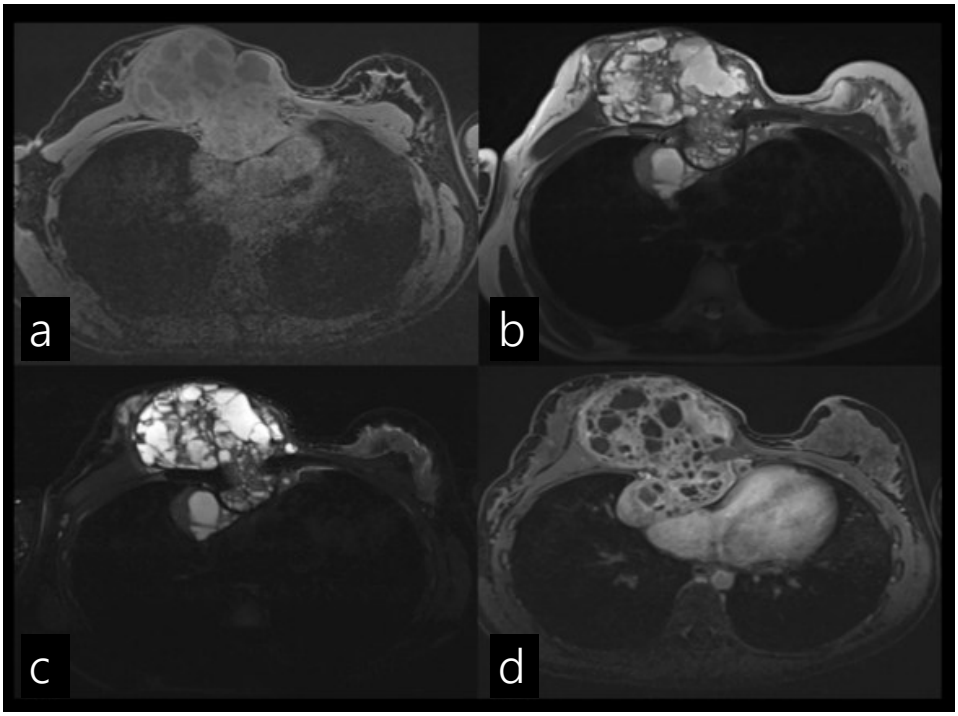

Fig. 3: Axial breast MRI demonstrates a lobulated, multicystic mass arising from the sternum. (a) T1-weighted fat-saturated image shows the mass is isointense to muscle. (b) T2-weighted and (c) STIR images reveal heterogeneous high signal intensity with internal cystic areas (arrowheads). (d) Post-gadolinium T1-weighted image shows heterogeneous enhancement (arrow). The mass extends into the right breast and intrathoracic cavity, displacing the heart and great vessels posteriorly. Disruption of the right second to fourth sternocostal junctions is noted.

classified as ACR BI-RADS 5, indicating high suspicion of malignancy.

A contrast-enhanced computed tomography (CT) scan revealed a 5.3 × 10.6 × 8.3 cm lobulated soft tissue mass arising from an expanded and eroded sternum (**Figure 2c–e**). The mass extended anteriorly into the breast and posteriorly into the anterior mediastinum, displacing the great vessels. Peripheral linear calcifications were noted, consistent with osteoid matrix formation. No fat plane was visible between the mass and the pectoralis muscles. No pulmonary nodules or distant metastases were identified.

Magnetic resonance imaging (MRI) of the breast showed a large lobulated mass originating from the sternal body and extending into the right breast and mediastinum (**Figure 3**). The lesion was isointense to muscle on T1-weighted images and heterogeneously hyperintense on T2-weighted and STIR sequences. Post-contrast sequences showed heterogeneous enhancement. The second to fourth sternocostal junctions were disrupted.

Histopathological examination of a trucut biopsy revealed a tumour composed of multinucleated giant cells within a background of mononuclear stromal cells with mild cytologic atypia. Occasional mitotic figures per 10 HPF) were seen. Adjacent benign breast parenchyma, skeletal muscle, and fibrous tissue were also present. Immunohistochemical staining was positive for vimentin and negative for cytokeratin 7 (CK7), consistent with a mesenchymal origin. The Ki-67 proliferation index ranged from 10–20% (**Figure 4**). A diagnosis of primary sternal osteosarcoma was established.

A multidisciplinary surgical resection involving breast, cardiothoracic, and plastic surgeons was planned. However, the patient and her family declined surgery and further follow-up was not available.

DISCUSSION

Primary chest wall tumours of osseous origin are uncommon, with osteosarcoma of the sternum being particularly rare. Most sternal malignancies represent metastases or direct extension from adjacent structures.[4,5] When primary, they often present with chest wall pain or swelling.[6] The absence of pain in this case, along with the apparent breast involvement, contributed to the diagnostic ambiguity.

Osteosarcomas typically produce osteoid and may show calcification or ossification on imaging. In this case, peripheral linear calcifications on CT suggested

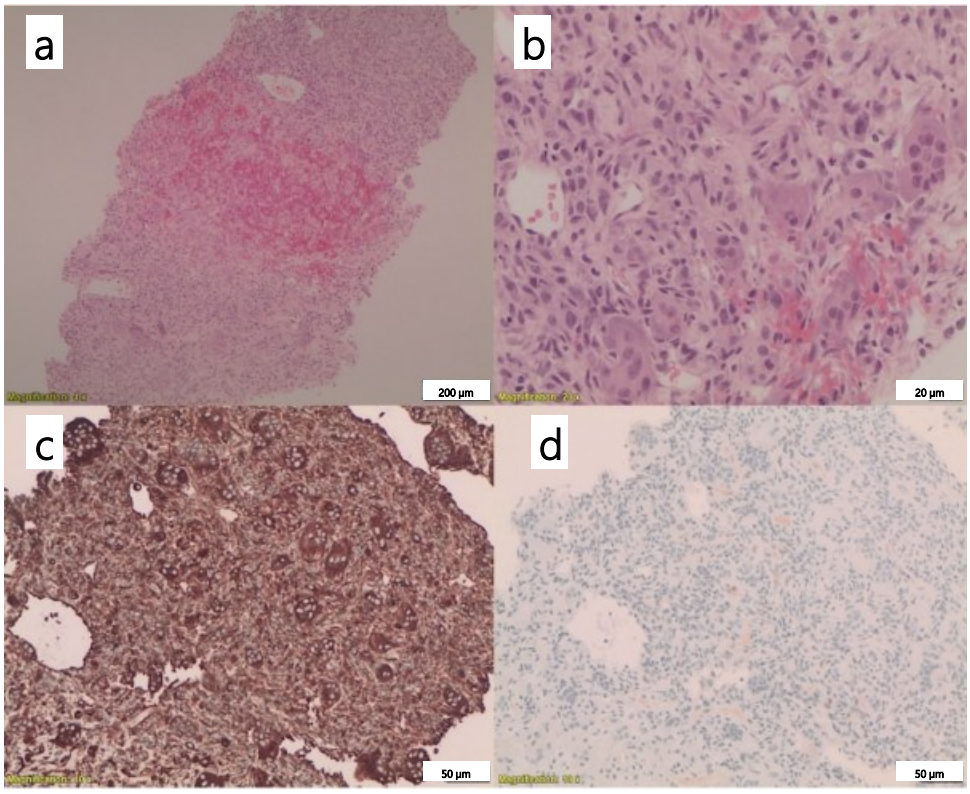

Fig. 4: Histopathological and immunohistochemical features: (a) Low-power view shows tumour core with focal haemorrhage and absence of ductal or epithelial elements (H&E, ×4). (b) Higher magnification reveals numerous multinucleated giant cells in a mononuclear stromal background with mild atypia and no mitosis (H&E, ×20). (c) Strong positive staining for vimentin confirms mesenchymal origin, highlighting the giant cells (Vimentin IHC, ×10). (d) Negative staining for cytokeratin 7 (CK7) rules out epithelial differentiation (CK7 IHC, ×10).

osteoid matrix formation.[7] MRI was instrumental in delineating tumour extent, involvement of adjacent structures, and soft tissue composition. The mass exhibited a characteristic heterogeneous appearance on T2-weighted and STIR images and disrupted the sternocostal joints—a key clue to its osseous origin.[3]

The differential diagnosis for chest wall masses in young adults includes Ewing sarcoma, lymphoma, metastatic disease, and benign lesions such as fibrous dysplasia and lipoma.[3,8] Lymphoma and metastases were considered but ruled out based on imaging and histopathological findings. Ewing sarcoma typically affects younger patients and shows small round blue cell histology, which was not present here.[8]

Histologically, osteosarcoma comprises spindle to polygonal cells producing immature osteoid, often with areas of necrosis and mitosis. The presence of multinucleated giant cells and the immunohistochemical profile—vimentin positive, CK7 negative—supported the diagnosis in this case.[6]

Although a multidisciplinary team (MDT) approach is widely recommended in the management of complex chest wall tumours, including osteosarcoma, this was not fully demonstrated in the present case. Optimal management typically involves coordinated input from radiologists, pathologists, and surgical teams—including breast, cardiothoracic, and reconstructive surgeons—to facilitate accurate diagnosis, staging, and planning of en-bloc resection and reconstruction when feasible.[5,6] In this case, while surgical resection was considered, the patient declined further treatment, precluding full multidisciplinary intervention and definitive histopathological staging.

In the literature, most reported sternal osteosarcomas occur in older adults, often with symptomatic presentations.[6–8] Reports in young females mimicking breast malignancies are extremely scarce, making this case both diagnostically and educationally significant.

Lack of treatment and follow-up data is a limitation. Nonetheless, this case reinforces the principle that not all breast masses in young women are of breast origin. Recognition of atypical features—such as chest wall fixation, deep origin, or sternal involvement—should prompt further cross-sectional imaging and biopsy.[1]

CONCLUSION

Primary sternal osteosarcoma mimicking a breast mass is an exceedingly rare diagnosis, particularly in young females. This case underscores the importance of multimodality imaging and histopathological evaluation in establishing diagnosis. Clinicians must maintain a high index of suspicion for non-breast pathologies in patients with atypical breast masses. Early multidisciplinary involvement is key for timely diagnosis and management, although patient cooperation remains essential for treatment success.

Take Home Message

- Primary sternal osteosarcoma is a rare differential diagnosis for breast masses in young females.
- Multimodality imaging is essential to delineate tumour origin, extent, and characteristics.
- Histopathological confirmation and multidisciplinary management are crucial for accurate diagnosis and planning.

Abbreviations

CT	Computed tomography
MRI	Magnetic resonance imaging
MDT	Multidisciplinary team

Declarations

All the authors declared no competing interests.

Ethical Consideration

Written consent was obtained from all patients for publications of the clinical details and accompanying images.

Acknowledgement

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