



# The Role of the Orthopaedic Oncologist in Chest Wall Resections and Reconstructions

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Tumors of the bony thorax are rare and present unique challenges in achieving optimal oncologic results. Negative margins can be quite difficult to obtain because of the proximity to vital structures, hence rendering wide resection challenging. Chest wall resections are also complex because of the necessity for restoration of a functional chest wall with adequate soft tissue coverage to prevent paradoxical respiration and to mitigate pulmonary complications. Traditionally, thoracic surgeons have treated chest wall tumors. However, at some centers, orthopaedic oncologists have performed resections and reconstructions of these tumors with minimal perioperative morbidity. Previous studies have shown both an increase in the number of wide resections and a survival benefit for the treatment of these tumors when care is provided at a sarcoma center of excellence with a multidisciplinary team. We recommend a multidisciplinary treatment algorithm for these tumors with a musculoskeletal oncologist, thoracic surgeon, and plastic surgeon to bring about successful wide resection of the tumor, restoration of functional chest wall kinetics, and appropriate soft tissue coverage. Oper Tech Orthop 24:62-67 Published by Elsevier Inc.

**KEYWORDS** chest wall tumor, chest wall resection, chest wall reconstruction, chondrosarcoma

## Introduction

Chest wall tumors are rare, representing 1%-2% of primary tumors.<sup>1-3</sup> Chondrosarcoma represents the most common histiotype.<sup>4</sup> Tumors of the chest wall present a difficult situation, as they occur in locations where obtaining negative margins is difficult and true wide resection is challenging.<sup>1,5</sup> Because of the rarity of these tumors, few studies have been done on a particular histiotype other than reports on chondrosarcoma.<sup>4-6</sup> Differentiation between benign and malignant tumors from radiographic and pathologic analyses is also difficult,

necessitating similar workup and treatment principles for both.<sup>1,2,7,8</sup>

Chest wall tumors have historically been treated by thoracic surgeons and there is little published in the orthopaedic literature on the treatment of these tumors.<sup>5,9</sup> However, at some sarcoma centers, orthopaedic oncologists have treated a significant number of these tumors.<sup>10</sup> A report in the thoracic literature advocated for the treatment of chest wall tumors at a sarcoma center based on significant improvement in negative margin rate and 10-year survival.<sup>4</sup> Another sarcoma center demonstrated that chest wall resections and reconstructions performed with the involvement of orthopaedic oncologists resulted in oncologic results consistent with previous reports in the thoracic literature while maintaining minimal morbidity.<sup>10</sup>

Negative margins are imperative in preventing local recurrence and improving survival.<sup>4,11</sup> Orthopaedic oncologists are experts in sarcoma treatment principles, focusing on obtaining negative margins and ensuring functional reconstruction after resection, which has facilitated their role in chest wall surgery. As in most complex oncologic cases, a team approach to these tumors is the gold standard. The involvement of a musculoskeletal oncologist, cardiothoracic surgeon, and plastic surgeon is a recipe for successful eradication of the tumor

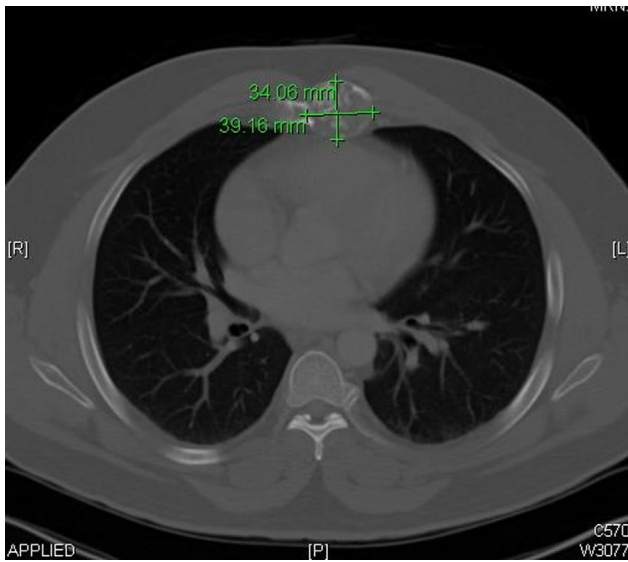
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**Figure 1** Axial CT scan of a 47-year-old patient with 6-8 months of sternal pain and mass. CT scan demonstrates expansile, aggressive sternal chondroid tumor. (Color version of figure is available online.)

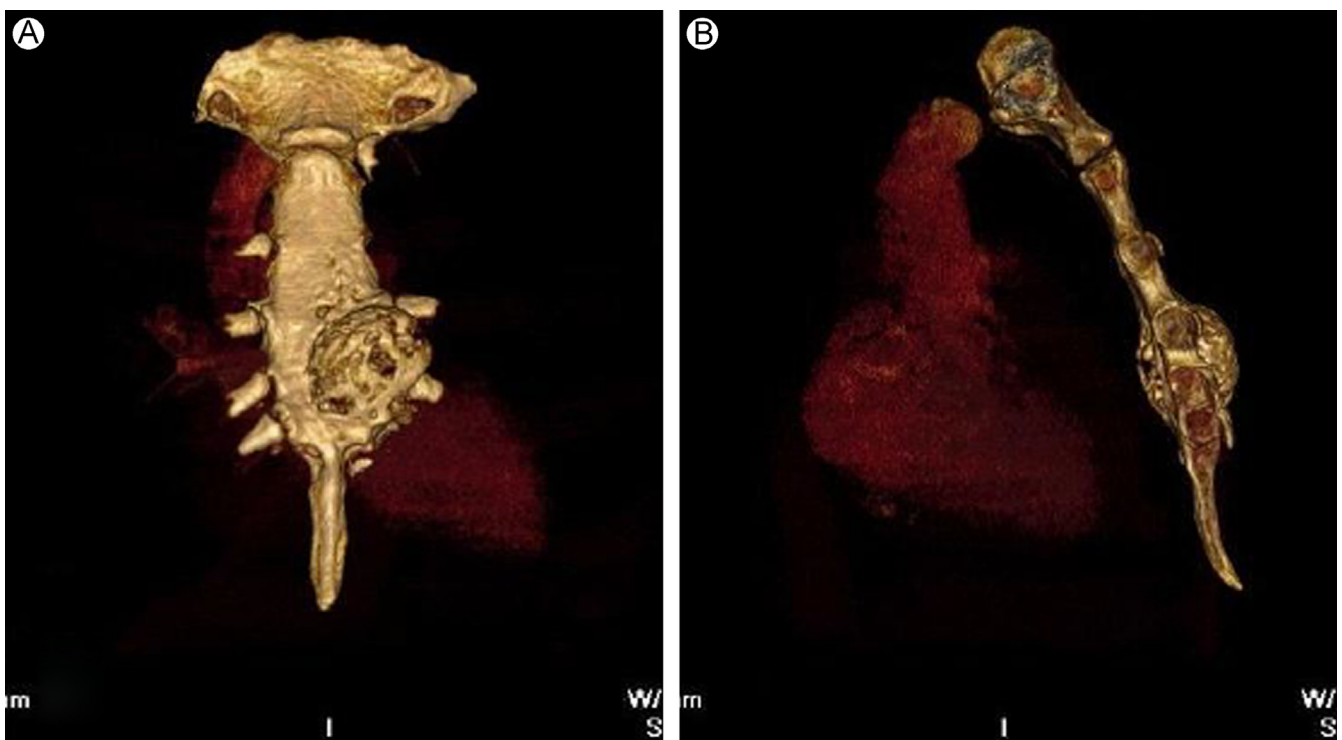
with negative margins, proper restoration of chest wall kinetics, appropriate coverage, and functional mechanics.

## Workup

Chest wall tumor evaluation begins with the physical examination, focusing on location and size. The anterolateral chest, sternal area, and other locations in close proximity to the

inferior border of the scapula are of particular importance. The diagnostic workup begins with plain radiographs, although unlike the long bones of the skeleton, plain radiographs are rarely diagnostic for chest wall tumors. However, chest wall (rib head and sternal) aneurysmal bone cyst, fibrous dysplasia, and chondrosarcoma have characteristic features, even in the chest. Cross-sectional imaging is also required for these tumors.

Computed tomography (CT) offers 3-dimensional (3D) imaging, providing precise information on size, location, and the degree of bony involvement as well as the detection of pulmonary metastases (Fig. 1).<sup>7,12</sup> For sternal tumors, the most helpful imaging is CT with 3D reconstructions and cardiac modeling. Similar to the pelvis, we recommend acrylic modeling with the use of the CT digital imaging and communications in medicine (DICOM) data for complex sternomanubrial tumors with relation to the rib heads and heart (Fig. 2). Magnetic resonance imaging (MRI) is an additional 3D imaging modality that provides enhanced soft tissue information regarding soft tissue extension and proximity to vital structures and can be augmented with the use of contrast (Fig. 3).<sup>12</sup> Advanced preparation and communication is required with the musculoskeletal and chest radiographers. We recommend cardiac sequencing which subtracts the motion artifact of the beating heart, facilitating the decision for pleural or pericardial resection based on the presence of a fat plane between the tumor and vital anatomical structures. Even if CT and MRI suggest the possibility of chondroid pathology, beware of the temptation to observe an otherwise seemingly benign chondroid lesion; axially based chondroid lesions should be considered to represent chondrosarcoma until proven otherwise.



**Figure 2** CT with 3D reconstructions and cardiac modeling of the same patient provides further detail of sternal mass, centered on left-sided seventh rib. (Color version of figure is available online.)

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