RESEARCH PAPER

Chondrosarcoma of the Rib: A Case Report

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ABSTRACT

Chondrosarcoma is a malignant cartilage-forming tumor that represents one of the most common primary malignant bone tumors in adults. Primary chondrosarcomas of the rib are relatively uncommon, accounting for a small percentage of all chondrosarcomas. We present a case of a 75-year-old male who presented with a history of pain and swelling in the right-sided ribs. Computed tomography (CT) of the chest revealed an expansile, lytic lesion involving the 8th rib on the right side, demonstrating a Type III pattern of bone destruction. The lesion matrix showed characteristic chondromatous calcifications in arc, ring, and linear patterns, with an associated soft tissue component exhibiting similar calcifications. The zone of transition was wide, and no fat was identified within the matrix. Based on these classic imaging features, a diagnosis of chondrosarcoma of the rib was made, which was subsequently confirmed by histopathological correlation. This case highlights the pivotal role of CT imaging in identifying the pathognomonic features of chondrosarcoma, particularly matrix calcifications, which are essential for accurate diagnosis and appropriate surgical planning.

Keywords: Chondrosarcoma, Rib, CT Chest, Chondromatous Calcifications, Primary Bone Tumor

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1. Introduction

Chondrosarcoma is a malignant neoplasm characterized by the production of cartilaginous matrix by tumor cells. It is the third most common primary malignant bone tumor, following multiple myeloma and osteosarcoma, accounting for approximately 20-27% of all primary osseous malignancies (1). Unlike osteosarcoma, which predominantly affects younger individuals, chondrosarcoma typically presents in middle-aged and older adults, with a peak incidence in the fourth to sixth decades of life (2).

Primary chondrosarcomas arise *de novo* from normal bone, while secondary chondrosarcomas develop from pre-existing benign cartilaginous lesions such as osteochondromas or enchondromas (3). The most common sites of involvement include the pelvis, proximal femur, proximal humerus, and ribs. Chondrosarcomas of the rib cage are relatively rare, accounting for approximately 10-15% of all chondrosarcomas (4). These tumors often present with nonspecific symptoms such as localized pain, swelling, or a palpable mass, leading to diagnostic challenges.

Imaging plays a crucial role in the diagnosis, characterization, and staging of chondrosarcoma. Computed tomography (CT) is particularly valuable for evaluating cortical destruction, matrix mineralization, and the extent of soft tissue involvement (5). The presence of characteristic chondromatous calcifications—described as arc, ring, stippled, or popcorn-like—is a hallmark of cartilaginous neoplasms and is essential for differentiating chondrosarcoma from other malignant bone tumors (6). We report a case of primary chondrosarcoma of the rib in a 75-year-old

male, emphasizing the classic CT findings that guide diagnosis and management.

2. Case Presentation

A 75-year-old male presented to the outpatient department with a chief complaint of pain and swelling localized to the right-sided ribs. The patient reported that the symptoms had been gradually progressive over several months. There was no history of preceding trauma, fever, or constitutional symptoms such as weight loss or night sweats. His past medical history was unremarkable, with no known history of malignancy or chronic illnesses.

On clinical examination, a firm, non-tender, palpable swelling was noted over the right lateral chest wall, corresponding to the region of the 8th rib. The overlying skin appeared normal with no evidence of erythema or ulceration. Respiratory examination was unremarkable, with clear breath sounds bilaterally. Routine laboratory investigations, including complete blood count and inflammatory markers, were within normal limits.

To further evaluate the bony swelling, a contrast-enhanced computed tomography (CT) of the chest was performed. The CT images revealed an expansile, lytic lesion involving the 8th rib on the right side (**Figure 1**). The lesion demonstrated a Type III pattern of bone destruction according to the Lodwick classification, characterized by a wide zone of transition and aggressive features (7). A soft tissue component was noted adjacent to the lesion, extending beyond the confines of the rib cortex.

The matrix of the lesion showed characteristic chondromatous calcifications, predominantly in the form of arc and ring patterns, along with linear calcifications (**Figure 1**). Similar calcifications were also identified within the adjacent soft tissue component of the mass (**Figure 2**). No fat density was identified within the matrix, and no evidence of invasion into adjacent structures such as the pleura or lung parenchyma was observed. No other osseous or pulmonary lesions were detected.

Based on the classic imaging findings of an expansile lytic lesion with arc and ring chondromatous calcifications and an associated soft tissue component, a diagnosis of chondrosarcoma of the rib was strongly suggested. The patient subsequently underwent surgical resection of the involved rib, and histopathological examination of the specimen confirmed the diagnosis of primary chondrosarcoma of the rib, correlating with the imaging findings.

3. Discussion

Chondrosarcoma of the rib is a rare but important entity in the differential diagnosis of chest wall tumors. This case illustrates the characteristic imaging features that enable accurate diagnosis and differentiation from other benign and malignant lesions. The patient's age, the location of the tumor, and the presence of a painful, expansile rib lesion were all clinical features consistent with a primary malignant bone tumor.

Imaging Characteristics

The diagnosis of chondrosarcoma relies heavily on imaging, with CT being the modality of choice for characterizing the tumor matrix and assessing cortical destruction. The hallmark of cartilaginous neoplasms is the presence of chondromatous calcifications, which appear as arc, ring, stippled, or popcorn-like densities on CT (8). These calcifications represent mineralized cartilaginous matrix and are pathognomonic for a cartilaginous origin. In our case, the arc and ring calcifications were prominently visualized within both the intraosseous and extraosseous components of the mass, strongly supporting the diagnosis of chondrosarcoma.

The expansile nature of the lesion and the Type III pattern of bone destruction (wide zone of transition) are indicative of an aggressive, malignant process (7). The Lodwick classification system categorizes bone lesions based on the pattern of bone destruction, with Type III lesions showing a wide zone of transition, cortical destruction, and soft tissue extension—all features that favor malignancy (9). The presence of a soft tissue component, as seen in this case, further supports the diagnosis of a high-grade chondrosarcoma.

Differential Diagnosis

The differential diagnosis for an expansile, calcified rib lesion includes several entities. Enchondroma is a benign cartilaginous tumor that may present with similar matrix calcifications but typically lacks aggressive features such as cortical destruction, wide zone of transition, and soft tissue extension (10). Osteochondroma is another benign lesion that may arise from the rib, but it is characterized by continuity with the underlying medullary cavity and cortical bone, often with a cartilaginous cap that may calcify. However, osteochondromas are usually asymptomatic and lack the aggressive features seen in our case.

Other malignant lesions that may involve the rib include metastasis (most commonly from lung, breast, or renal primary tumors), multiple myeloma,

and Ewing's sarcoma. Metastatic lesions typically do not exhibit chondromatous calcifications and are often multiple rather than solitary. Multiple myeloma presents as lytic "punched-out" lesions without matrix mineralization. Ewing's sarcoma is more common in younger patients and typically presents with aggressive periosteal reaction and soft tissue extension but lacks cartilaginous matrix calcifications (4). The presence of arc and ring calcifications is highly specific for a chondroid matrix and effectively narrows the differential diagnosis to a cartilaginous neoplasm.

Management and Prognosis

The standard of care for primary chondrosarcoma of the rib is wide surgical resection with negative margins (3). Unlike osteosarcoma and Ewing's sarcoma, chondrosarcoma is generally resistant to chemotherapy and radiation, making complete surgical excision the cornerstone of treatment (1). The prognosis depends on several factors, including tumor grade, size, location, and the adequacy of surgical margins. Low-grade chondrosarcomas have an excellent prognosis with 5-year survival rates exceeding 90%, while high-grade tumors have a significantly worse prognosis, with higher rates of local recurrence and distant metastasis, most commonly to the lungs (2).

In this case, the patient was referred for surgical resection, and histopathological examination confirmed the diagnosis. Postoperative follow-up with imaging surveillance is essential to monitor for local recurrence or metastatic disease.

4. Conclusion

Chondrosarcoma of the rib is a rare primary malignant bone tumor that presents with nonspecific symptoms of pain and swelling. CT imaging plays a critical role in diagnosis by demonstrating characteristic features including an expansile lytic lesion with a wide zone of transition, cortical destruction, soft tissue extension, and most importantly, arc and ring chondromatous calcifications. These imaging hallmarks allow for accurate differentiation from other benign and malignant rib lesions. This case highlights the importance of recognizing these classic CT findings to guide appropriate surgical management and improve patient outcomes.

Figure Legends

- **Figure 1:** Axial CT image of the chest (bone window) showing an expansile lytic lesion involving the 8th rib on the right side (asterisk). The matrix demonstrates characteristic chondromatous calcifications in arc, ring, and linear patterns (arrows), which are pathognomonic for a cartilaginous neoplasm.
- **Figure 2:** Axial CT image of the chest (soft tissue window) demonstrating the soft tissue component of the mass adjacent to the involved rib (asterisk). Chondromatous calcifications (arrows) are also identified within the soft tissue component, a feature suggestive of a high-grade cartilaginous tumor.

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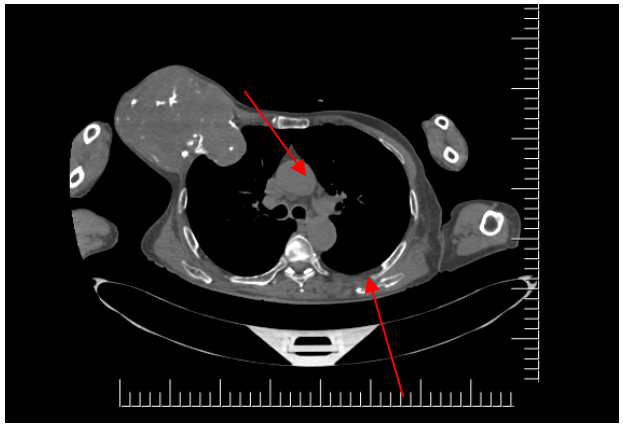

Figure 1

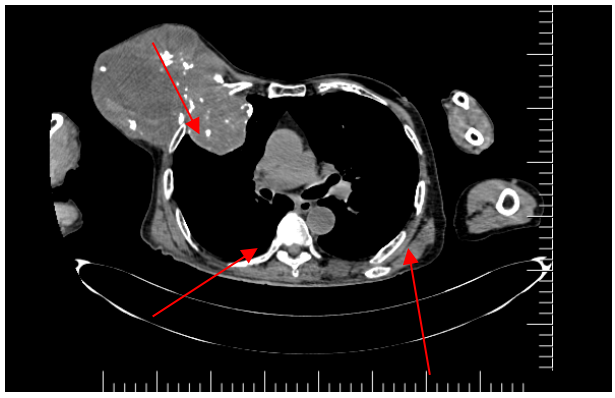

Figure 2: