



Chondrosarcoma Requiring En Bloc Resection of the Right Anterior Chest Wall

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Introduction

Malignant tumors of bone primary account for less than 1% of bone disease in the United States and approximately 0.2% of all malignancies.^{1,2} Chondrosarcomas produce a malignant collagen matrix and occur less frequently than bone producing osteosarcomas.¹ They are subclassified based on histologic appearance and anatomic location within the bone which includes an intermedullary conventional type, dedifferentiated, mesenchymal and clear cell variant.³ Chondrosarcomas comprise a genetic heterogeneous group of malignancies with some association of the conventional variant to EXT, IDH1, IDH2 gene mutations and CDKN2A silencing.⁴ In the absence of genetic etiology, they generally arise from sites of previous trauma or exposure to increased ionizing radiation.⁴ Men are twice as likely to develop this malignancy with a median age of 59 years and preferential presentation in the femur and pelvis.^{1,4,5}

Chondrosarcomas comprise one-third of all chest wall tumors, however, they are the most common primary malignancy of the chest wall.^{5,6} Treatment and prognosis depend on the origin and subclassification of chondrosarcoma. Computed Tomography (CT) scans and guided core needle biopsies are the preferred methods for diagnosing primary malignancies of bone origin and immunohistochemistry may be used to distinguish conventional and dedifferentiated variants using S100 and P53 markers.^{3,7} Detection of dedifferentiated variants indicates poor prognosis which can be attributed to hematogenous metastasis to the lungs, seen in 90% of cases months after receiving a diagnosis.⁸

The survival rate of chondrosarcomas varies based on the presence of metastasis at the time of diagnosis, location of tumor, positive margins at resection and the ratio of dedifferentiated component.⁹ This malignancy has demonstrated resistance to both chemo and radiation therapy. Recent studies have determined the average survival after resection with neoadjuvant therapy is approximately 8 months with a five-year disease-free survival of 7.1%, indicating no significant improvement.¹⁰ Contributing factors include insufficient number of dividing cells, poor vascularity and extensive extracellular matrix, making complete resection with clear margins the preferred treatment option for anything classified above a grade 1.¹¹

Patient Case

A 65-year-old female presents with a painless right anterior chest mass noticed 5 weeks prior to a negative mammogram study. A CT Scan with contrast revealed a 7cm centrally necrotic mass that appeared to involve the anterior aspect of the third rib. Irregularities were also noted on the left aspect of T8 vertebral body as well as the right ilium. CT guided core needle biopsies were performed on the primary chest wall mass which demonstrated lobulated, cellular cartilaginous tissue with moderate cytologic atypia resulting in the diagnosis of chondrosarcoma, grade 2. The iliac irregularity was then biopsied and designated as metastatic chondrosarcoma possessing similar features of the primary mass suggesting metastasis to the iliac bone as well as the spine. The patient opted to receive aggressive chemotherapy as well as proton radiation therapy preceding cryoablation resection of the primary mass.

Materials & Methods

Conventional subtypes have demonstrated the tendency to act as precursor lesions for dedifferentiated variants.^{1,4} It is important for the Pathologists' Assistant (PA) to consider unique features that differentiate histologic variants of chondrosarcomas to ensure they submit all suspicious aspects of the specimen. In this case, the PA submitted representative sections of heterogeneous features to determine histologic subvariant, demonstrated viability of the margins and determine depth of invasion.

The following sections were submitted for histologic evaluation and classification:

- Anterior soft tissue margin, FS
- Superior and inferior soft tissue margins, En fac
- Mass to anterior and posterior resection margin
- Mass to underlying bone, x2. DECAL

Results

Gross Findings

The surgical pathology laboratory received the thoracotomy specimen measuring 13x10x6cm; medial-lateral, superior-inferior, and anterior-posterior, respectively. The specimen included ribs 2-4, as identified by the surgical staff, as well as adjacent sternum (Figure 1). The primary mass, measuring 7x6.5x6cm, was located 1cm to the closest margin (medial), and appeared encapsulated with 80% homogenous gelatinous material and 20% firm cut surfaces. The gross dissection identified focal areas of hemorrhage which indicates possible progression to a dedifferentiated variant.⁴ Representative sections of the mass, underlying bone, and margins, were submitted for histologic evaluation.

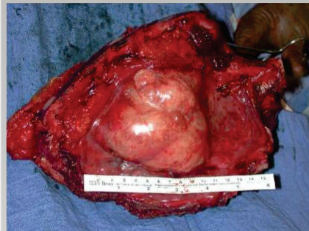


Figure 1. Wide en bloc resection of rib chondrosarcoma. Although this specimen is pT2, greater than 8cm, there was similarly no involvement of the underlying lung or adjacent structures of this primary chest mass.⁸

Microscopic Findings

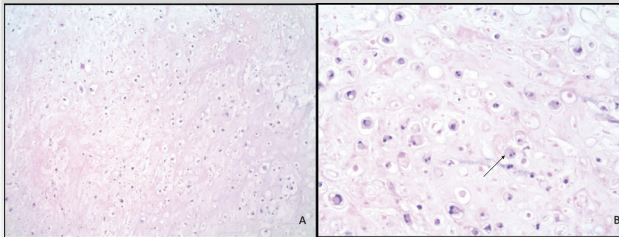


Figure 2. Chondrosarcoma of the 3rd rib. After decalcification and H&E staining. **A.** 40x objective lens. Abnormal chondrocytes in the medullary cavity producing hyaline cartilage. No uninvolved bony tissue can be identified. **B.** 100x objective lens. Moderate cytologic atypia with binucleated chondrocytes (arrow).

Staging

The histologic type according to the World Health Organization (WHO) was chondrosarcoma with a histologic grade 2, indicating moderate differentiation. Many cells showed cytologic atypia and binucleation (Figure 2). The largest diameter of the mass was less than 8cm which classifies it as a pT1. There were no lymph nodes clinically evident or submitted for review resulting in a pNX designation. The presence of metastasis to the left ilium with pathologic confirmation on bone biopsy indicates pM1b. Based on the pTNM classification, the chondrosarcoma is considered a stage IVB.¹⁷ The stage IVB prognosis at 48 months following resection is approximately 30% although many factors may affect its variability.

Discussion

The factors influencing the prognosis of this case included the patients advanced age, the presence of metastasis at the time of diagnosis and the amount of cytologic atypia identified.⁴ Factors improving the survival rate are the negative margins after en bloc resection, no family history of possible genetic precursors, and the use of proton radiation therapy. Since primary and secondary chondrosarcomas are difficult to differentiate histologically, sarcoma grading based on AJCC standards provides the best expectation of clinical course.¹² Local recurrence is common in grade 2 and 3 lesions with aggressive wide resection being the recommended treatment.⁸ Consistent with the literature, the primary mass showed no pathologic evidence of treatment effect, despite the use of proton radiation therapy.⁴

When a chondrosarcoma is diagnosed via CT guided core needle biopsy, the Pathologists' Assistant should assess the resection specimen for characteristic features that confirm or contradict the original diagnosis.¹³ Chondrosarcoma subvariants display similar qualities on radiographic imaging.¹⁴ Biopsies only yield an accurate final diagnoses in 88% of primary bone tumors.¹⁵ Therefore, a thorough gross evaluation of the resected specimen is necessary to achieve accurate subvariant diagnosis. In this case, the PA noted focal hemorrhage on cut surfaces of the mass, however, there was no histologic evidence of necrosis. This constitutes a significant differentiating factor between conventional and dedifferentiated variants.⁵ A dedifferentiated mass would have demonstrated a clear distinction between the centrally located cartilage producing matrix and the dedifferentiated cells exhibiting signs of necrosis and cystic change in a destructive soft tissue mass.³

Providing precise detail regarding location, size, depth of invasion, and viability of the margins will generate the pathologic staging criteria necessary for diagnosis.¹⁶ Noting the anatomical site, in addition to ancillary studies, may provide characteristics of the pathology not readily seen histologically.¹⁷ Staging criteria such as size cut offs, discontinuity, and invasion demonstrate the importance of accurate measuring and reporting of the gross examination.¹³

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