CASE REPORT

Parosteal Osteosarcoma Arising from a Rib: Imaging Features with an Emphasis on Magnetic Resonance Imaging

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ABSTRACT

Parosteal osteosarcomas are uncommon neoplasms that typically affect the long bones. Primary involvement of a rib is very rare. The imaging features of a parosteal osteosarcoma involving a rib are described, including the magnetic resonance imaging features, which have not been previously been reported in the literature.

Key Words: Computed tomography, Diagnostic imaging, Magnetic resonance imaging, Osteosarcoma

INTRODUCTION

Parosteal osteosarcoma is an uncommon neoplasm. It usually involves the long bones such as the distal femur, proximal tibia and proximal humerus. Occasionally the tumour may arise in a flat bone. Rib involvement is very rare. In a large retrospective review of 226 patients from the Mayo Clinic,1 there were no instances of parosteal osteosarcoma arising from a rib. To our knowledge, there have been only a handful of cases in the literature describing parosteal osteosarcoma arising from a rib.2-5 None of these cases reported have described the magnetic resonance imaging (MRI) features of this rare lesion. We present a case of parosteal osteosarcoma arising from a rib, with emphasis on the MRI features of this mass.

CASE REPORT

A 44-year-old Caucasian woman presented with a mass in her left thoracic wall. The patient had first noticed the mass six months previously and had decided to seek medical attention due to its recent growth in size. She reported a dull, aching sensation in her chest, extending into the left arm. On physical examination, a firm, fixed, minimally tender mass was palpable on the anterior chest wall, in the region of the left second rib. A chest radiograph (Figure 1) showed a 7.0 cm x 7.0 cm, densely calcified mass, projecting over the left second rib anteriorly. No expansion or destruction of the underlying rib or adjacent ribs was detected.

The differential diagnosis included osteosarcoma, paraosteal osteosarcoma, or a chondrosarcoma arising...
from a large osteochondroma. Computed tomography (CT) of the thorax revealed the mass to be encircling the second rib, with a large component protruding posteriorly into the left hemithorax, and impressing the adjacent pleura and lung (Figure 2). The lesion also extended anteriorly into the soft tissue of the chest wall, displacing the pectoralis musculature. The majority of the mass was an oval, densely mineralised structure, with lobulated margins. A crescent-shaped peripheral component, situated at the interface with the pleura, demonstrated soft tissue attenuation. No pulmonary involvement or pleural effusion were detected. Based on these findings, parosteal osteosarcoma was considered the more likely diagnosis.

On MRI, most of the lesion, with the exception of the peripheral, crescent-shaped, deep soft tissue component identified on CT, was of low signal intensity on both T1-weighted and T2-weighted sequences (Figures 3a and 3b). The crescent-shaped peripheral component was isointense to skeletal muscle on T1-weighted sequences, and intermediate to high signal intensity on T2-weighted sequences (Figure 3b). Extensive contact between the mass and the cortex of the second rib was noted. No cleavage plane could be detected. A short tau inversion recovery (STIR) sequence (not shown) showed similar signal change in the mass to that seen on T2-weighted sequences.

A complete excision of the mass was performed. The surgical resection included the mass, most of the second and third ribs, and adjacent soft tissue (Figure 4). An intact layer of pleura was present on the internal aspect of the specimen. The tumour measured 7.0 x 7.0 x 6.0 cm³, and had a lobulated external surface. Approximately 30% of the tumour on the deep aspect of the
specimen was pale tan, non-mineralised and cut easily with a knife. This corresponded to the peripheral non-ossified component identified on CT and MRI. The ossified component of the tumour was firmly attached to the cortical surface of the second rib. Microscopically, the tumour was composed predominantly of irregular intersecting spicules of woven bone, between which there was a moderately cellular, collagen-rich spindle cell infiltrate (Figure 5). The histological features were consistent with a parosteal osteosarcoma of the rib.

Five months following removal of the rib tumour, a tumour nodule (5.0 mm) was identified within the apical posterior segment of the upper lobe of the left lung. Resection of the nodule confirmed the presence of metastasis. Currently, the patient is 9 months post surgery for removal of the rib tumour. She has been treated with adjuvant chemotherapy and no additional metastases have been detected.

**DISCUSSION**

Parosteal osteosarcoma is a low-grade malignant bone tumour that arises from the surface of the metaphysis of long bones, commonly the distal femur. The lesions are usually histologically well-differentiated, with well-formed osteoid within a spindle-cell stroma. Medullary involvement occurs in less than 25 per cent of cases. Dedifferentiation is said to occur in about 16 per cent of the patients and when it occurs is associated with a poor prognosis. The peak incidence for parosteal osteosarcoma is in the third decade. In general, the prognosis is markedly better than for conventional osteosarcoma. Unlike conventional osteosarcoma, these tumours are commonly painless, leading to delay in presentation and large tumour size at diagnosis.

Radiologically, parosteal osteosarcomas appear as dense calcified masses on CT and plain radiographs. A cleavage plane or cleft can often be identified. Large lesions may encircle the shaft of long bones, and are more intimately related to underlying cortex than smaller lesions. In such cases, the plain radiograph may be misleading and CT should be employed to allow better visualisation of the lesion. Medullary extension into the bone is visualised in some cases.

Parosteal osteosarcomas occur rarely in flat bones and primary rib lesions are extremely rare, with few case reports existing in the literature. Several features in the case described are in keeping with other cases in the literature. Most patients described have similarly been middle aged, for example, and at the time of diagnosis, all have had large tumours. This latter feature probable reflects the fact that most of these tumours are initially painless and therefore present late. The current case differs from other reported cases of rib-related parosteal osteosarcoma, in that MRI evaluation of the mass was completed in addition to plain radiographs and CT scans. The mass was found to be predominantly of low signal on both T1-weighted and T2-weighted sequences. This is comparable to MRI findings of parosteal osteosarcomas in other locations.
The presence of a higher signal crescentic component is useful information in differentiating the mass from other calcified lesions, such as exuberant callous or myositis ossificans, which do not usually have a peripheral soft tissue component. Identification of a soft tissue component is also useful in directing a biopsy. In this case, a biopsy was not performed. While it could be argued that plain radiography and CT in this case might have given sufficient diagnostic information, it is nevertheless important that the MRI features of such tumours be specified. As MRI is becoming more commonly used, it is not uncommon for a tumour to be evaluated initially by MRI. Knowledge of tumour patterns on MRI is therefore essential to aid in making a correct diagnosis. MRI is also invaluable in aiding the local staging of bone and soft tissue tumours, allowing for accurate evaluation of tumour extent, as well as relationship to adjacent structures.

Treatment of parosteal osteosarcomas generally consists of local excision with wide margins. Adjuvant chemotherapy or radiotherapy may also be utilised. Parosteal osteosarcoma is usually well differentiated, and displays a low propensity for metastases. When present, resection of lung metastases may still be curative unless widespread.

CONCLUSION

While parosteal osteosarcoma of the rib is very rare, it should be included in the differential diagnosis of a large, extensively mineralised mass that encircles a rib. Plain radiographs and CT scanning form the cornerstone of imaging evaluation of such a mass. It is important given the widespread use of MRI, however, to also be aware and able to recognise the MRI features of these tumours.

REFERENCES