Case Report

A Case Report of Clear Cell Chondrosarcoma (CCC) Sparing the Epiphysis and Literature Review of CCC

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Keywords

Chondrosarcoma · Clear cell · Epiphysis

Abstract

Clear cell chondrosarcoma (CCC) is a rare subtype of chondrosarcoma with a relatively low malignant potential, mainly diagnosed by its characteristic location in the epiphysis of long bones. We report the case of a 33-year-old gentleman who presented with pain, difficulty in walking and restricted range of motion of the right hip joint, with a lesion located in the proximal femoral metaphysis and completely sparing the epiphysis. Needle biopsy was consistent with CCC, which was extremely unusual considering the location of the tumour. The patient was treated by “en bloc” resection of the tumour along with femoral head and reconstruction with hemiarthroplasty. The final histopathology report confirmed the diagnosis with clear surgical margins. The aim of this case report and literature review was to highlight the unusual location of this rare tumour, as such an isolated case of CCC completely sparing the epiphysis has never been reported.

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Introduction

Clear cell chondrosarcoma (CCC) is a rare variant and constitutes about 2% of all chondrosarcomas [1]. It is usually located at the ends of long bones confined to the epiphysis which may extend into the metaphysis and the diaphysis, commonly occurring around the third to fourth decade of life and more frequently in males [2]. It is characterized by the presence of large clear cytoplasm and small fragments of heavily calcified matrix and multinucleated osteoclast-like giant cells [3]. Since the recurrence rate is high following curettage, “en bloc” resection is the preferred surgical procedure for CCC [4]. Unni et al. [5] first described the condition in 1976 and to date radiological diagnosis of CCC has been a challenge as it has to be differentiated from other benign lesions of the epiphysis such as giant cell tumour and chondroblastoma [6, 7]. We report a case of CCC of the proximal femur where the tumour was located in the metaphysis and completely sparing the epiphysis, which is extremely unusual for a CCC.

Case Presentation

A 33-year-old gentleman was referred to our centre from another hospital following radiological and histological evaluation with complaints of pain over the right hip region and difficulty in bearing weight and walking for the past 3 months. Complaints were insidious in onset and gradually progressing, with no significant past history. On examination the patient had right hip joint point tenderness and restricted and painful range of motion. Plain radiograph of the right hip region showed an osteolytic lesion over the medial aspect of the right femoral neck (Fig. 1). Magnetic resonance imaging (MRI) of the right hip joint revealed an expansile, eccentric, irregular, T2 hyperintense $3.3 \times 1.7 \times 2.9$ cm lesion over the medial aspect of the right proximal femoral metaphysis surrounded by bone marrow oedema with synovial proliferation and a small amount of hip joint effusion (Fig. 2). The lesion was completely sparing the epiphysis and the differential radiological diagnoses were giant cell tumour, chondromyxoid fibroma and less likely, intraosseous haemangioma. PET scan and bone scan showed hypermetabolic activity at the index lesion site with no signs of skip or distant metastasis. CT scan-guided needle biopsy from the lesion was consistent with CCC. The patient underwent resection of femoral head and neck and uncemented bipolar hemiarthroplasty reconstruction. Frozen sections from the surrounding tissue of the resected specimen were all negative for malignant cells and the surgery and postoperative period were uneventful. Diagnosis of CCC was confirmed with histopathological examination of the resected specimen. The size of the lesion was $3.0 \times 1.1 \times 2.1$ cm (Fig. 3); the tumour was confined only to the metaphysis and all surgical margins were free of tumour. On histopathological examination, abundant cells with clear cytoplasm with chondrocytic cellular morphology, mild increased cellularity, absent tumour necrosis, mitotic count of 4/10 high-power fields, and expanding tumour borders were seen (Fig. 4). Immunohistochemistry staining for cytokeratin was negative, CD99 was weakly positive, and S-100 was positive (Fig. 5). At follow-up of 18 months, the patient is comfortable, asymptomatic, and full weight-bearing walking on the operated limb. There is no evidence of local recurrence or distant metastasis.

Discussion

Chondrosarcomas are the third most common malignant bone tumours after osteosarcoma and Ewing's sarcoma [8]. CCC is a rare subtype of chondrosarcoma, with low-grade clinical course and potential for distant metastasis [9]. Though the age of occurrence ranges from 13 to 85 years, 95% of the tumour occurs in the age group of 5–25 years [6]. Males are 1.6–2.6 times more commonly affected than females. The proximal femur (60%) and proximal humerus (15%) are the most common locations for the tumour followed by the distal femur and proximal tibia (15%), and rarely involves other bones like the skull, spine, pelvis, phalanges and foot (10%) [1].

Since the tumour is believed to arise from the chondrocytes in the secondary ossification centre, its predilection to the epiphysis or apophysis of long bones is the general rule. However, extension of the tumour into the metaphysis and even diaphysis is not uncommon [10]. In the radiological review by Collins et al. [2] of 22 long bone CCC (34 in total), 19 patients had epi-metaphyseal (epiphyseal and metaphyseal) involvement and 3 patients had only epiphyseal involvement. Similarly, an institutional review of 16 cases of CCC by Itälä et al. [11] reported involvement of the epiphysis in all 12 patients with CCC of the extremity, and Laporte et al. [12] noted epiphyseal involvement in all 8 cases of proximal femur CCC in their case series of 13 CCC. The largest series of CCC consisting of 47 cases, was published by Björnsson et al. [1] in 1984 and had 32 cases of long bone CCC out of which only 2 patients (1 meta-diaphyseal and 1 diaphyseal) did not have involvement of the epiphysis. Another study by Kaim et al. [6], comparing the radiological features of CCC and chondrosarcoma, had 2 cases of meta-diaphyseal CCC without involvement of the epiphysis. Apart from the above-mentioned 4 cases there are no other reported cases of CCC sparing the epiphysis, as per the combined knowledge of the authors.

Most CCC behave as low-grade malignant tumours and sometimes can de-differentiate into high-grade malignancy [13]. The cortex usually remains intact and in aggressive tumours, mainly of the proximal femur, cortical destruction and soft tissue extension is seen [14]. Poor tumour differentiation on histopathology with widespread positive MMP-2 staining and proximal humerus lesions have been found to have correlation with the aggressive nature of the tumour [15]. CCC are considered to be resistant to both radiotherapy and chemotherapy, and surgery remains the mainstay of management [16]. Because of its relative rarity, location, and indolent behaviour, CCC is sometimes misdiagnosed as a benign tumour, especially chondroblastoma, and is mistreated by curettage, which results in unacceptably high rates of recurrence of about 83–86% with mortality of 26–50% [17]. Hence “en bloc” resection is the preferred surgery, which yields good prognosis [12].

Histologically, CCC is characterized by the presence of sheets of round to ovoid large and clear neoplastic cells with slightly eosinophilic cytoplasm. Areas of circumscribed heavily calcified matrix called “short bone trabeculae”, tumour-induced osteoid formation, and osteoclastic giant cells are also often seen. The classical chondromyxoid matrix seen in conventional chondrosarcoma and also in enchondroma is less prevalent in CCC and may be seen in about 50% of cases [3]. The clearness imparted to the neoplastic cells can be attributed to the abundant intracytoplasmic glycogen, which can be confirmed by PAS (with and without diastase digestion) staining and they have been seen to express osteonectin, S-100 protein, type II collagen, vimentin, and concanavalin [18]. Metastasis from renal clear cell carcinoma can also have similar histological features, but the cytoplasm would be rich in glycogen and fat, in contrast to the cytoplasm of CCC, which is rich only in glycogen [10].

Serum alkaline phosphatase, though not very specific to CCC, can be used as a marker in diagnosis and more efficiently during the follow-up period for the early detection of local recurrence and metastasis [19]. Local recurrence even after 2 decades following surgery has been reported and hence a very long-term follow-up is advocated for patients following surgery considering the tendency of the tumour to slowly progress with time [4, 20]

Conclusion

CCC is a rare subtype of chondrosarcoma with a relatively low-grade malignant potential. A combination of clinical, radiological, serological, and pathological approaches has to be used for appropriate diagnosis considering the wide spectrum of possible differential diagnoses. This case was reported as the tumour was localized to the metaphysis and completely sparing the epiphysis, which is extremely unusual. “En bloc” resection of the tumour must be performed followed by appropriate reconstruction to prevent local recurrence.

Statement of Ethics

It was clearly explained to the patient in his own language that the data concerning the case would be submitted for publication. The patient consented to same.

Disclosure Statement

The authors have no conflicts of interest to declare.

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Author Contributions

S.H. analysed the patient details and wrote the manuscript. Y.S.K. was involved in the peri-operative care of the patient, and the collection and assessment of radiological and pathological data and images. H.-S.K. was involved in the planning and execution of the surgery. I.H. was involved in the correction of the manuscript.

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Fig. 1. Plain radiograph of the pelvis reveals an osteolytic lesion with cortical thinning and poor line of demarcation over the medial aspect of the right femoral neck.

Fig. 2. Contrast-enhanced T1 MRI of the right hip with a non-expansile chondroid lesion confined to the medial aspect of the proximal femoral metaphysis, without soft tissue extension.

Fig. 3. Gross sectional image of the resected specimen with the lesion just inferior to the fused physal plate region, sparing the epiphysis.

Fig. 4. Haematoxylin and eosin-stained microscopic histopathology image (without decalcification) consisting of sheets of neoplastic cells with clear cytoplasm and scanty mitotic figures. Magnification, $\times 200$.

Fig. 5. Immunohistochemistry image staining positively with S-100. Magnification, $\times 100$.