Chondroblastoma: A Rare Cause of Femoral Neck Fracture in a Teenager

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Abstract

Chondroblastomas usually present in the epiphyseal region of bones in skeletally immature patients. These uncommon, benign tumors are usually treated with curettage and use of a bone-void filler.

Here we report a case of a hip fracture secondary to an underlying chondroblastoma in a 19-year-old woman. Open biopsy with intraoperative frozen section pointed toward a diagnosis of chondroblastoma. Extended curettage was performed, followed by cryotherapy with a liquid nitrogen gun and filling of the defect with calcium phosphate bone substitute. The femoral neck fracture was stabilized with a sliding hip screw construct. The patient progressed well and continued to regain functional status. A final pathology report confirmed the lesion to be a chondroblastoma.

Clinicians should have heightened awareness of a pathologic lesion in a young person presenting with a femoral neck fracture and should consider the uncommon differential diagnosis that the lesion is located in the greater trochanter apophysis.

Chondroblastomas are uncommon, benign tumors of bone, usually affecting the epiphyseal region of bones in skeletally immature patients. The most common presentation is a protracted course of pain in the region of the lesion or the adjacent joint, and the recommended treatment is curettage and supplementation with a bone-void filler. There have been no reports of a pathologic fracture as the initial presentation of this lesion.

Here we report the case of a 19-year-old woman with a hip fracture secondary to an underlying chondroblastoma originating in the greater trochanter apophysis, review the literature, and present learning points for this diagnosis and treatment. The patient provided written informed consent for print and electronic publication of this case report.

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Am J Orthop. 2011;40(9):E177-E181.

Case Report

The patient was an otherwise healthy 19-year-old white woman who presented to the emergency department with the chief report of right hip pain, and inability to ambulate after slipping on ice and falling on her left side from standing height. She stated she had a 3-year history of intermittent right hip pain before this incident. At that time, her primary care physician had worked up her initial symptoms with radiographs, which were reported as negative. The patient was diagnosed with a muscle strain and was referred to a chiropractor for massage therapy of the groin and abductor musculature. The symptoms improved, and the patient returned to her normal activity, which included dancing, running, and physical labor. While training for a marathon 1 year later, she experienced an exacerbation of right hip pain. She again visited a chiropractor, who performed massage therapy for a hip flexor strain. The hip pain never fully improved, but the patient modified her activity to avoid it. She stated that, before presenting to our emergency department, she had been limping for 6 weeks with progressive pain in the hip.

The patient denied any past medical or surgical history, and her family history was noncontributory for bone, muscle, or connective tissue disorders, lesions, or tumors.

On physical examination, the patient was alert and oriented. She refused to bear weight, secondary to pain. Examination of the right hip and lower extremity revealed no erythema, edema, or ecchymosis. The skin was intact. The right lower extremity was visibly shorter and more internally rotated than the left. Sensation was intact throughout the lower extremity in the appropriate dermatomes, and motor function was preserved. Pulses and capillary refill were attainable and within normal parameters. The knee had a small effusion, but no ligamentous laxity was present. In the fall, she sustained no injuries other than the right hip pain.

The emergency department workup consisted of plain radiography (Figure 1). Radiographs showed a displaced basicervical femoral neck fracture. There

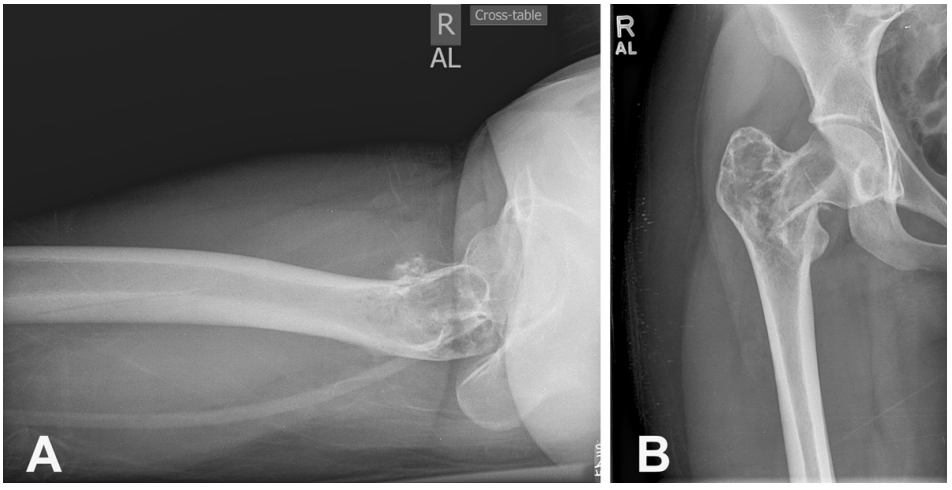

Figure 1. Lateral (A) and anteroposterior (B) radiographs show displaced basicervical femoral neck fracture. Lytic lucency is evident at greater trochanter and extends inferomedially into femoral neck.

was an area of lytic lucency beginning at the greater trochanter and extending inferomedially into the femoral neck, with thinning of the cortical bone. The fracture line clearly bisected the lesion and led us to a diagnosis of pathologic basicervical hip fracture.

Diagnosis and Treatment

Given her age and fracture type, the patient was admitted to the hospital and scheduled for emergent biopsy and fracture stabilization. The working diagnosis was a pathologic fracture through an underlying bone lesion. The differential diagnosis was giant cell tumor, osteomyelitis, osteonecrosis, chondroblastoma, osteosarcoma, clear cell chondrosarcoma, aneurysmal bone cyst, and unicameral bone cyst. Open biopsy with intraoperative frozen section was performed, and frozen section pointed toward a diagnosis of chondroblastoma (Figure 2). Therefore, extended curettage was performed, followed by cryotherapy with a liquid nitrogen gun and filling of the defect with a resorbable calcium phosphate bone cement. The basicervical femoral neck fracture was then stabilized with a sliding hip screw construct (Figure 3). The patient's postoperative hospital course included pain control, deep vein thrombosis prophylaxis, and physical therapy. The final pathology report confirmed the lesion to be a chondroblastoma. At last follow-up, the patient was 6 months out from surgery and was weight-bearing as tolerated. There has been no evidence of disease recurrence.

Discussion

Chondroblastomas are rare benign bone tumors, representing less than 1% of all bone neoplasms. The lesion was originally described, by Codman in 1931, as an "epiphyseal chondromatous giant cell tumor."[1] Jaffe and Lichtenstein[2] renamed it chondroblastoma in 1942. The tumor most often presents in the adolescent population during the period of active growth and seems to arise from secondary ossification centers. Males are more commonly affected than females, and pain is the most common presenting symptom.[3]

The pathologic cell is the chondroblast, which is thought to arise as a remnant from the epiphyseal plate. Although this is the most widely held belief, a few authors have disputed this with descriptions of a diaphyseal-based lesion.[1,4] These authors have proposed that pluripotential mesenchymal cells stimulated toward chondrocytic differentiation are chondroblast precursors.

Regardless of the origin of the cell, histologically, chondroblastomas are characterized by well-defined chondroblasts with benign-appearing nuclei, scattered giant cells, and a pattern of calcification that surrounds the cells, producing a characteristic chicken-wire or cobblestoned appearance.[5] The chondrocyte has distinguishing morphologic features, including cytoplasmic blunted microvillous processes, large and multilobular nuclei, and a continuous band around the inner nuclear membrane.[3]

Radiographic and imaging studies of chondroblastomas show a radiolucent destructive lesion with expansion of the underlying bone. There is often the punctuate calcification in the matrix suggestive of a cartilage neoplasm. The lesion is most commonly located in the epiphysis or apophysis of skeletally immature patients, though diaphyseal loca-

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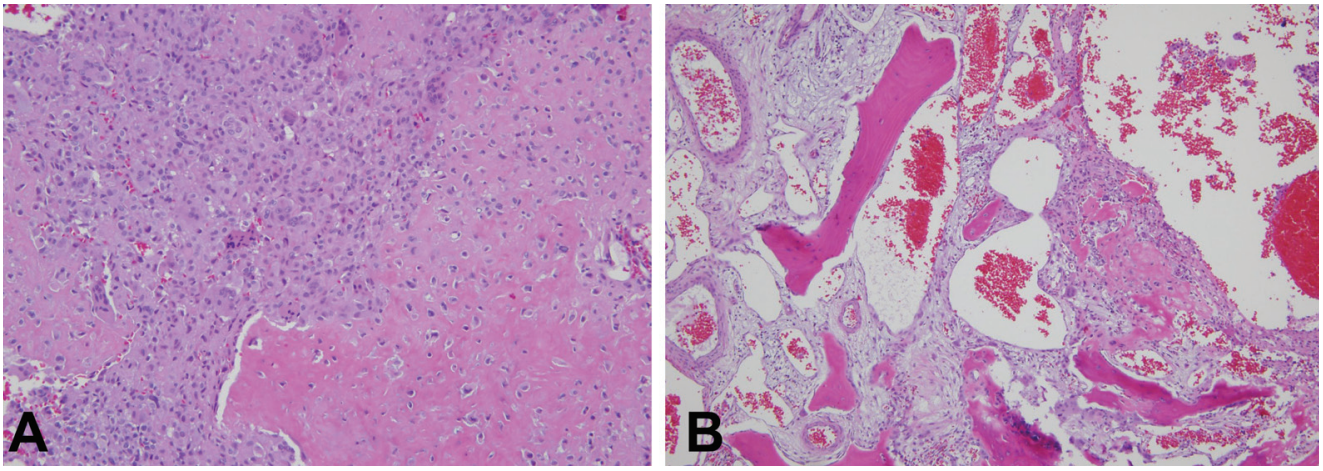

Figure 2. **(A)** Solid population of monotonous rounded cells contains scattered multinucleated giant cells, and eosinophilic chondro-osseous matrix is present (hematoxylin-eosin, original magnification ×100). **(B)** Secondary aneurysmal bone cyst formation is characterized by dilated, blood-filled vascular spaces surrounding fragments of trabecular bone (hematoxylin-eosin, original magnification ×100).

tions have been described.[1] Lesions originating in purely metaphyseal and diaphyseal regions are rare.[6] Ninety-eight percent of chondroblastomas originate in the epiphysis, and therefore, this radiographic finding is strongly suggestive of the diagnosis.[7]

The recommended treatment of chondroblastoma consists primarily of curettage. Several adjuvant treatment options exist, and are all aimed at lowering the local recurrence rate by extending the surgical margin. Options include cryotherapy, use of phenol, use of argon laser, and cementation of the bony defect.[8] There is no consensus in the literature as to which is the most effective. Reported recurrence rates vary from 10% to 35% and most likely correlate with adequacy of the curettage. A strong predictor of recurrence, regardless of treatment, is presence of an aneurysmal bone cyst component within the lesion, leading to recurrence rates of almost 100%.[3,5] Some authors have described tumor location (proximal femur and pelvis) and young age as risk factors associated with recurrence.[3,5,9,10]

Although benign, chondroblastomas can display aggressive or malignant behavior, and metastasis has been reported. Factors associated with a more aggressive course include younger age at presentation, recurrence after curettage, pelvic location, and biological aggressiveness of the tumor. There is no consensus regarding the criteria for aggressive or malignant chondroblastoma. It is recommended that any patient who presents with an aggressive-appearing lesion or a local recurrence after curettage be evaluated with chest imaging for potential metastatic disease. However, malignant transformation is rare.

In a case report, Rajaram and colleagues[6] described an 18-year-old man with a 6-month history of hip pain diagnosed and confirmed with imaging and histology to be chondroblastoma of the proximal femur, including the femoral head and neck. The lesion was treated with curettage, grafting, and prophylactic fixation with a sliding screw construct. Three months after surgery the patient was pain free and fully weight-bearing. In another case report, Fechner and Wilde[11] described a chondroblastoma of the femoral neck in a 13-year-old girl. The initial presenting symptom was knee pain that progressed in duration and severity over an 8-month period. The patient was treated with curettage and was reported "well" after 2 years. For the 7 other cases of metaphyseal chondroblastoma discussed in the report, treatment was curettage only. The authors concluded that these lesions likely present with a long duration of symptoms, heal by curettage, and are most likely to recur within 2 years after initial treatment.

A crucial step in the treatment of impending or pathologic fractures is biopsy of the lesion with meticulous technique and review by a musculoskeletal pathologist.

Our patient's case brings up several learning points for the orthopedic surgeon. First, presentation with a femoral neck fracture is unusual for this lesion. Chondroblastomas most often present with a long history of pain rather than fracture. The pain is thought to be the result of the inflammatory response produced by the lesion, not the result of a stress fracture. One must have a heightened awareness of pathologic lesion in a young person presenting with a femoral neck fracture.

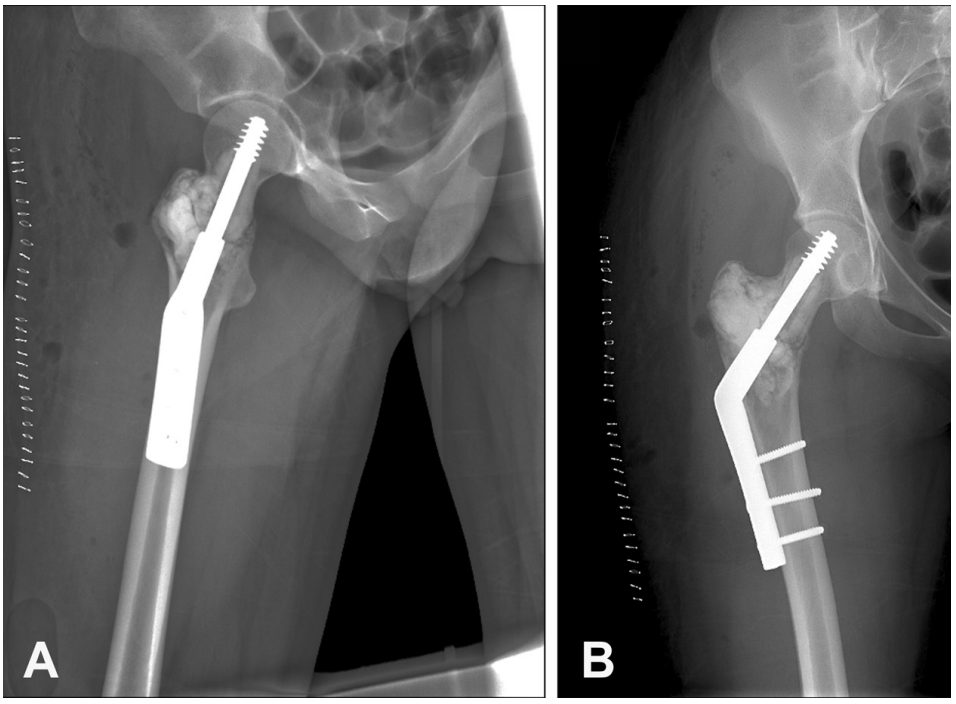

Figure 3. Postoperative lateral (A) and anteroposterior (B) radiographs show sliding hip screw construct used to stabilize fracture.

Second, the location of this lesion is uncommon. Most chondroblastomas occur in the epiphyseal or apophyseal region of bone. Although rare, a chondroblastoma in this location must be considered to correctly include this lesion in the differential diagnosis and fracture management algorithm.

A third learning point is revealed when considering treatment options for this injury and this lesion. The recommended treatment for benign lesions, including chondroblastomas, of the proximal femur is curettage, grafting, and prophylactic internal fixation to prevent fracture or fracture displacement.[5] A crucial step in the treatment of impending or pathologic fractures is biopsy of the lesion with meticulous technique and review by a musculoskeletal pathologist. The surgeon must also be prepared to abort the case and obtain further studies should the initial frozen section be interpreted as malignant or indeterminate. Proceeding under the assumption that the lesion is benign can have drastic consequences. Should this lesion be diagnosed as malignant or indeterminate, the surgeon must adhere to strict technique, including meticulous hemostasis, to prevent local spread of disease. If a lesion, such as the one documented here, were malignant, confined local control could reduce the margins of the definitive procedure, which should be done by an orthopedic oncologist. If there are any doubts as to the nature of the lesion or current treatment protocol, transfer of the patient to the center where definitive surgery will be performed will yield better patient outcomes.[12]

A final important point of discussion is the type of fixation used in proximal femoral fractures, impending or pathologic. Cephalomedullary nails are becoming an increasingly popular option for this fracture pattern in both normal and neoplastic bone.[13,14] One must not use this type of fixation until the final pathologic diagnosis is confirmed because, if the lesion is malignant, a cephalomedullary nail would seed the entire length of the femur, leading to increased morbidity and devastating consequences, likely an amputation for local control. Therefore, the surgeon should give careful consideration to biopsy, curettage, grafting, and prophylactic fixation of a benign lesion in this anatomical location.

Conclusion

Chondroblastomas are uncommon, benign neoplasms that commonly occur in the epiphyses of long bones. Failure to identify these lesions on fracture radiographs can lead to suboptimal consequences. If the lesion is assumed to be benign, or worse, is not recognized at all, improper surgical technique could lead to contamination of multiple compartments with malignant tumor. If the lesion is not identified, fixation can be compromised because of inadequate bone stock for support. Although this lesion is rare, it should be considered as a possible diagnosis, and proper surgical technique and principles for tumors must be followed for optimal outcomes.

Authors' Disclosure Statement

The authors report no actual or potential conflict of interest in relation to this article.

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