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An Abnormal Bone Lesion of the Scapula in a Collegiate Basketball Player: A Case Report

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Objective: To present the case of a bone lesion of the scapula in a collegiate basketball player.

Background: A 19-year-old National Collegiate Athletic Association Division I male basketball player presented with pain in the posterior region of the right shoulder. During practice, he was performing a layup when his arm was forced into hyperflexion by a defender. Evaluation revealed a bone lesion involving the scapular spine and base of the acromion.

Differential Diagnosis: Acromioclavicular joint sprain, subacromial bursitis, subscapular bursitis, humeral head contusion, acromial fracture.

Treatment: The patient was treated for 2 months with therapeutic modalities and rehabilitation exercises. Because of persistent pain and the risk of a pathologic fracture, open surgical biopsy and bone grafting were then undertaken.

Uniqueness: Most simple bone cysts affect the proximal humerus and femur, whereas our patient's lesion was in the acromial complex.

Conclusions: Athletic trainers should be alert to the unusual possibility of bone cysts, which are usually identified incidentally when radiographs are obtained for other reasons. Most simple bone cysts are asymptomatic, but a pathologic fracture can occur with trauma.

Key Words: bone cysts, chondromyxoid fibromas, upper extremity, shoulder

Simple bone cysts make up 3% of all bone lesions[1] and occur twice as often in males as in females.[2,3] Several simple bone cysts of the scapula have been described. However, the reported sites included the glenoid and neck, coracoid process, and body of the scapula.[4–7] We present the case of a collegiate athlete with a bone lesion of the scapular spine and acromial base.

CASE REPORT

A 19-year-old male National Collegiate Athletic Association Division I collegiate basketball athlete presented to the athletic training clinic with pain in the posterior region of his right shoulder. During practice, the athlete was performing a layup when his arm was forced into overhead hyperflexion by a defender. The patient reported pain in his posterior shoulder and described an immediate "crunch" but was able to finish the practice session. He had a history of a left shoulder subluxation that was surgically repaired the previous summer. Before this injury, the patient also experienced symptoms of minor impingement and possible subacromial bursitis of his right shoulder with resistance training during the summer.

Physical examination revealed point tenderness over the right posterior distal acromion, right acromioclavicular joint, and right posterior superior humeral head. The right shoulder appeared inferiorly depressed compared with the left shoulder. The patient experienced pain with all ranges of motion away from neutral shoulder position, especially with overhead movements. Gross active range of motion for flexion and abduction was 20° to 30° less than shoulder height. The patient demonstrated full range of motion and reported no pain with internal and external rotation at 0° of shoulder abduction. Passive range of motion demonstrated findings similar to active range of motion. All neurologic screening was normal, and no special tests were performed because of pain and limited range of motion.

DIFFERENTIAL DIAGNOSIS

After physical examination, the differential diagnoses included right acromioclavicular joint sprain, subacromial bursitis, subscapular bursitis, humeral head contusion, or acromion fracture. Radiologic examination of the right scapula was performed using scapular and anterior-posterior images (Figure 1) and demonstrated an acromial cyst when compared with the normal left scapula (Figure 2). Further diagnostic studies were then obtained: computed tomography without contrast and magnetic resonance imaging with and without contrast. The computed tomography scan revealed a slightly lytic and slightly expansible bone lesion involving the scapular spine and base of the acromion measuring $3.1 \times 1.9 \times 2.1$ cm (Figure 3A and B). No pathologic fracture or periostitis was noted. The magnetic resonance imaging scan demonstrated that the remaining bony structures were normal in appearance except for a mild congenital anterolateral downsloping of the acromion, which was thought to be the source of the mild subacromial impingement. A borderline glenohumeral joint effusion was present without infiltration into the surrounding rotator cuff muscles.

After radiographic evaluation, the differential diagnosis included simple bone cyst, aneurysmal bone cyst, chondroblastoma, chondromyxoid fibroma (CMF), osteoblastoma, fibrous dysplasia, or eosinophilic granuloma. The well-defined thin cortical rim and the benign cartilaginous

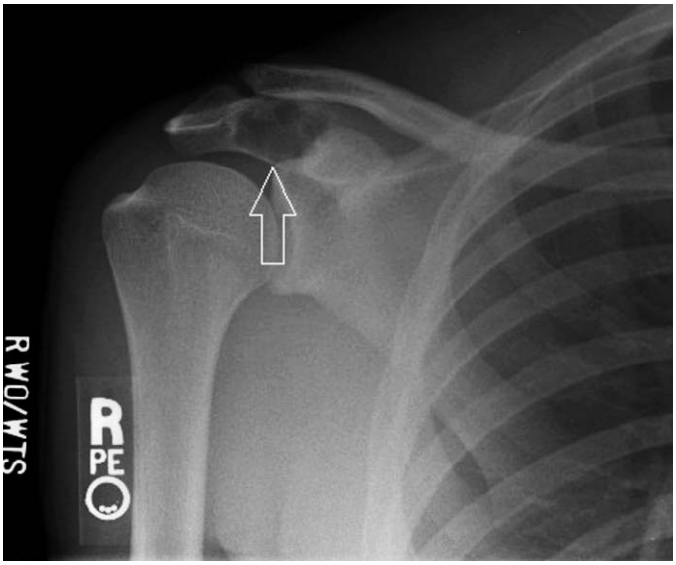

Figure 1. Radiograph of bone lesion in acromial complex.

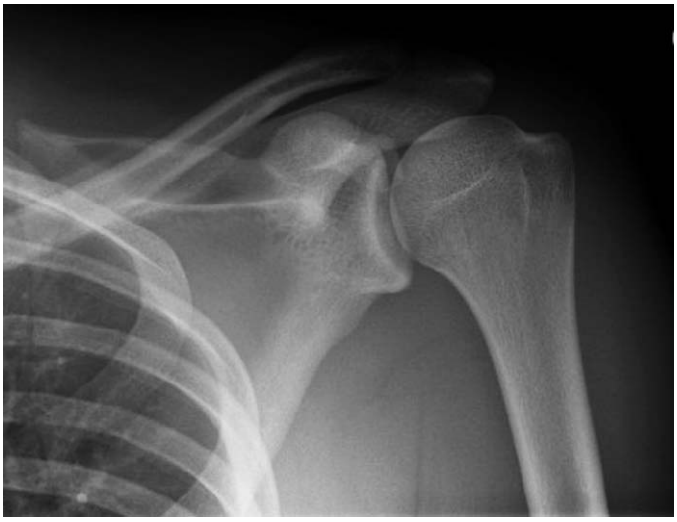

Figure 2. Radiograph of unaffected scapula.

appearance of the lesion indicated that a simple bone cyst, an aneurysmal bone cyst, a chondroblastoma, or a CMF was the probable diagnosis.

TREATMENT

After the initial examination, the patient was placed in a standard shoulder sling for daily activities for 1 week. He was instructed to rest and treat the shoulder with an ice pack and compression for 20 minutes every other hour. Upon reevaluation the next morning, swelling in the patient's shoulder had slightly increased. An 8-week rotator cuff strengthening rehabilitation protocol was initiated on the second day postinjury and consisted of the following exercises: subscapular retraction with Thera-Band resistance bands (The Hygenic Corporation, Akron, OH), standing internal and external rotation with Thera-Band, abduction using a Physioball (Core Performance, Phoenix, AZ) and cuff weight, standing abduction and flexion using full-can positioning with dumbbells, standing rows (low, mid, and high positions) using Thera-Band, standing punches with Thera-Band, prone abduction and scaption exercises using a cuff weight, standing side abduction using a cuff weight, prone retraction and protraction using a cuff weight, and bicep curl with pronation and supination using dumbbells. At 6 days postinjury, the patient had regained the majority of shoulder flexion and was able to abduct his arm to shoulder height without pain. A 20-minute variable shortwave diathermy (Megapulse II; Accelerated Care Plus, Reno, NV) treatment was added to the rehabilitation protocol 2 weeks after the injury to promote bone and soft tissue healing. After 9 days of cryotherapy, shortwave diathermy, and rehabilitation exercises, the team physician released the patient to gradually return to noncontact basketball drills as long as the patient remained symptom free. Noncontact drills included ball handling and shooting exercises. After 16 days of this treatment regimen, the patient was able to fully participate in team conditioning sessions including skill development and aerobic conditioning. However, during resistance-training activities, the patient was restricted to activity below the plane of the right shoulder (90°). The rationale for this restriction was to

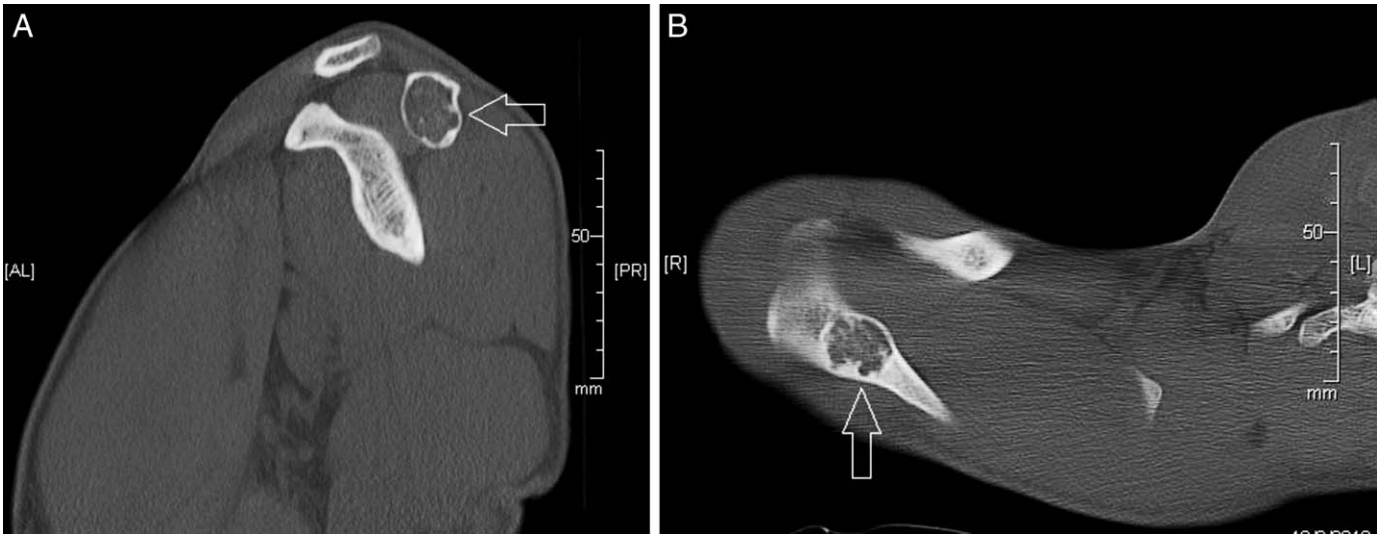

Figure 3. Computed tomography image of bone lesion in acromial complex. A, Coronal view. B, Axial view.

prevent glenohumeral compression within the subacromial space, which could exacerbate his symptoms, while allowing him to maintain cardiovascular and activity-specific fitness levels. The patient was able to return to full-contact basketball drills after 19 days of treatment.

Initially, the decision was made to not perform surgical biopsy and surgical removal because of the patient's approaching season. Radiologic monitoring was performed every 6 weeks to monitor the lesion. Although the selected treatment plan was successful in managing general pain and maintaining shoulder strength, he continued to have point tenderness over the acromion. Considering the patient's persistent local discomfort and risk for pathologic nonunion fracture, consultation with an orthopaedic oncologist was obtained. At this point, the decision was made to proceed with open surgical biopsy and arthroscopic evaluation for definite diagnosis and a subsequent treatment approach based upon the biopsy results.[8,9] Although no established guidelines exist, this approach coincides with contemporary management practices.

On pathologic evaluation, the biopsy specimen displayed no clear cartilaginous neoplasm or malignant neoplasm; a simple bone cyst was diagnosed. The lesion was thoroughly irrigated, and EquivaBone (ETEX Corporation, Cambridge, MA), a bone graft cement substitute, was placed within the lesion and allowed to fully harden.

After surgery, the patient's shoulder was placed in a sling for 2 weeks. At week 3, the patient performed pain-free range-of-motion and strengthening exercises, similar to the exercises performed before surgery. Within 6 weeks, he was able to perform all ranges of motion without pain and was allowed to return to resistance-training activities, although weighted movements above the plane of the shoulder were restricted to prevent excessive subacromial compressive forces. The patient continued the initial shoulder maintenance program, and at 9 weeks, he was allowed to begin noncontact basketball drills. At 10 weeks, he was allowed to return to limited contact practice, contingent upon pain-free motion and continuation of the shoulder maintenance program. The team orthopaedist and team physician reexamined the lesion with radiographs at 16 weeks postsurgery. Healing at the lesion site was complete, and no further complications, including recurrence, were expected.

UNIQUENESS

A total of 94% of all simple bone cysts occur in the proximal humerus and proximal femur,[3] whereas the remaining 6% occur in other bones, including the metatarsals, calcaneus, talus, tibia, fibula, ilium, ischium, pubic rami, sacrum, vertebral bodies, radius, ulna, and craniofacial bones.[1] We located several cases of simple bone cysts in the glenoid, neck, coracoid process, and body of the scapula[2–6]; our patient's lesion occupied the acromial complex, illustrating the unique nature of this case. Cysts have been reported in the acromial complex and scapular blade region, but these have included elastofibromas and CMFs, which are histologically different from simple bone cysts.[7]

Before biopsy, the lesion presented in this case was initially diagnosed as a likely aneurysmal bone cyst or CMF. Aneurysmal bone cysts and CMFs of the scapula are very rare. Aneurysmal bone cysts account for only 6% of all tumorlike lesions and usually occur in the tibia, femur, and humerus.[10] A CMF constitutes only 2% of benign bone lesions and less than 1% of all bone tumors.[11–13] The tibia is the most affected long bone, followed by the femur.[7,13] A CMF tumor in the upper extremity is rare, but it has been described in the scapula,[14–16] rib,[17] sternum,[18] pelvis,[19] mandible,[20] and occiput.[21] A CMF of the scapula occurs in only 0.8% to 3% of all CMF cases.[14,22]

A possibly related condition reported as "snapping scapula" results from a space-occupying lesion, typically on the ventral surface of the scapular fossa and proximal to the serratus anterior muscle,[23] although it has been observed in the elbow, pelvic ischial tuberosity, deltoid muscle, foot, ocular orbit, stomach, and inguinal region.[24] Patients usually report a painful "snapping" or "clunking" sensation resembling impingement or subluxation when abducting and rotating the shoulder.[25] Several authors[23–26] have described this lesion as an elastofibroma, a pseudotumor consisting of an unequal (ie, nonhomogeneous) composition of collagenous fibers and an overproduction of immature elastic tissue. These benign tumors have generally been reported in the elderly and female patients. The prognosis after resection is positive, with a low recurrence rate.[26]

DISCUSSION

The incidence of simple cysts is unknown.[2,8] The widely accepted theory, described by Cohen,[27] of cyst development is that an intermedullary venous bed outflow obstructs bone metabolism, which results in an elevated intraosseous pressure. The increased pressure leads to osteoclastic activation, the reabsorption of bone, and abscess formation, most likely from the elevated cytokines released by the endothelial cells lining the cyst wall.[1] It is rare for a cyst to progress after closure of the growth plates; therefore, simple bone cysts are most active in children younger than 10 years old.[1] As presented in this case, simple bone cysts can be difficult to distinguish from aneurysmal bone cysts and CMFs on plain films,[28] as the lesions have very similar radiologic and histologic appearances.[29,30] Surgical biopsy is usually needed to distinguish the difference between the lesions.[31] Surgical biopsy of an aneurysmal bone cyst usually demonstrates a blood-filled cavity, with macrophages, giant cells, and islands of bone lining the cyst wall.[31,32] Treatment for an aneurysmal bone cyst is surgical curettage, intraoperative adjuvant therapy (eg, corticosteroid injection, decompression using hollow screws), and bone grafting of the lesion. The recurrence rate is 10% to 20%.[3] Surgical biopsy of CMFs usually reveals a myxoid matrix, surrounded by polygonal, stellate, spindle, and round cells.[14–17] The tumor is usually resected or curetted and packed with cancellous bone taken from the iliac crest.[31] This treatment is generally successful, and recurrence is uncommon.[28]

Periodically monitoring any bone lesion is an important part of the treatment regimen to identify any increased abnormal growth that might indicate a malignancy. When the diagnosis of a simple bone cyst is being considered, the differential diagnosis should include aneurysmal bone cyst, CMF, giant cell tumor, chondroblastoma, osteochondroma, and chondrosarcoma (a malignant tumor).[33] Many simple

bone cysts are found incidentally, when radiographs of an involved bone are obtained for other reasons.[1] Pathologic fracture of the cyst resulting from trauma is also a common clinical presentation.[1] Most often, simple bone cysts are asymptomatic.[1–3]

According to Baig and Eady,[1] the only reliable predictor of treatment success is the age of the patient: those older than 10 years of age heal at a rate of 90%, whereas those less than 10 years of age heal at a rate of 60%, regardless of which treatment regimen is used. Campanacci et al[34] advised that 90% of simple bone cysts can be treated nonoperatively; if plain radiographs demonstrate a stable, thick cortical wall, then biopsy, injection, or surgical treatment is not advised.[1] The management for unfractured cysts is trepanation and injection of bone-stimulating materials into the defect.[1] However, if the patient is at risk for a pathologic fracture of the cyst, surgical treatment is appropriate,[3,9] as demonstrated in this case. Our patient's lesion was in an unfortunate location with respect to the physical demands of basketball. Basketball requires a great amount of shoulder flexion, abduction, extension, and internal and external rotation. All of these motions place excessive pressure on the scapular spine and acromion process. As a result, the patient was thought to be at high risk for a fracture of the lesion within the acromion complex. If a fracture was to occur, the supraspinatus, infraspinatus, subscapularis, and suprascapular nerves might all be affected, resulting in extensive muscular and neurologic damage. Therefore, surgical biopsy and allograft bone grafting were performed to minimize the patient's risk. The primary management goal for these lesions is the formation of a bone that can withstand the stresses of use by the patient, not necessarily a normal-appearing radiograph.[1]

Although space-occupying tumors such as simple bone cysts, CMFs, and elastofibromas are believed to occur rarely,[35] cases may go unreported because of the asymptomatic nature of the lesion in the absence of trauma. In this case, as with the single case reported by Mankin et al,[28] the physical activity of a sport or manual labor occupation could predispose patients to exacerbating the condition. Further research, including review of archival and surgical surveillance records, should be conducted to determine the actual rate of incidence and ascertain the essential aspects of diagnosis and treatment.

This unique case presentation reminds clinicians involved in athletic health care to thoroughly evaluate all injuries, keeping in mind that a rare condition can underlie a common complaint of musculoskeletal pain. A systematic evaluation will ensure that no condition is overlooked.

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