Topics in Sports Medicine

Shoulder Internal Derangement and Osteoarthritis in a 25-Year-Old Female Softball Athlete

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Abstract

Objective: The purpose of this report is to describe osteoarthritis and internal derangement of the shoulder in a collegiate softball player.

Clinical Features: A 25-year-old female softball athlete presented with a history of chronic right shoulder pain. A thorough clinical examination and multiple imaging studies were performed. Osteoarthritis was demonstrated on radiographs, and ligamentous and rotator cuff tendon tears were displayed on magnetic resonance imaging. The patient's treatment plan included full spine manipulation, cold laser therapy, kinesiotaping, stretching, and neuromuscular reeducation of the right shoulder.

Interventions and Outcomes: The patient reported a decrease in symptoms after 1 month, although treatment was sporadic because of poor patient compliance.

Conclusion: Osteoarthritis and internal derangement may occur in overhead-throwing athletes, and correct imaging is needed for timely and accurate diagnoses. Following a timely diagnosis, the young patient in this case had a good recovery with multimodal chiropractic care.

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Introduction

Internal derangement (eg, rotator cuff tears, tendinopathy, and labral tears) and osteoarthritis (OA) are not pathologies typically associated with a young healthy athlete, but the occurrence of shoulder injuries or

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instability in overhead-throwing sports, such as baseball, softball, volleyball, tennis, or football, is increasingly prevalent.¹⁻⁶ The rotator cuff and other muscles are dynamic stabilizers, whereas the glenoid labrum, glenohumeral ligaments, joint capsule, and osseous structures are the static stabilizers of the glenohumeral joint.⁷ Diagnosis of rotator, labral, or osseous pathologies of the shoulder can be obtained with a variety of imaging modalities, but which structures are best seen, by which modality, has been a topic of ongoing controversy.⁸⁻¹⁴ To our knowledge, there have been no case reports demonstrating OA and internal derangement to this severity in a young female softball athlete. Therefore, the purpose of this report is to describe chiropractic management and the diagnostic imaging findings of OA and internal derangement of the shoulder in a collegiate softball player.

Case Report

A 25-year-old woman presented at her initial visit with a variety of complaints including chronic right shoulder pain. Her shoulder pain began in high school insidiously related to softball and working out. She played short stop on her high school and college softball teams. In 2005, she had a labrum reattachment on her right shoulder. Following surgery, she underwent 9 months of physical therapy. In 2009, she reinjured her labrum but did not have reparative surgery. She had 5 intraarticular cortisone injections in the right shoulder, the last in 2012. She stated that these helped relieve the pain but temporarily. She had pain involving the entire right shoulder and rated the pain at a 3 of 10 on numeric pain scale, with 10 being the worst pain ever. Pain was elicited at the end ranges of external rotation, internal rotation, and 90° of abduction. All remaining right shoulder ranges of motion were within normal limits and absent of pain. Speed's test and Yergason test results on the right shoulder were positive. The patient also elicited a positive result in supraspinatus press test, empty can test, shoulder impingement sign, and posterior drawer test on the right shoulder. Allen test, Adson test, Wrights test, and Roos test results on the right shoulder were negative. She stated that sometimes the pain was achy and throbbing, and other times, she described it as sharp and stabbing. The pain was usually worst in the morning or after physical activity. Occasionally, her right arm, forearm, and hand went numb. She has played competitive softball prior to adolescence and maintained a healthy diet with daily exercise. Her workouts often included lifting heavy weights. At the

time of the initial examination, she was undergoing physical therapy for her right shoulder as prescribed by her medical physician. The remainder of the physical examination was unremarkable. Initial working diagnosis of her right shoulder was bicipital tenosynovitis and supraspinatus tendinosis complicated by repetitive injury to the shoulder, and outside imaging was obtained.

Imaging studies included a radiographic examination (internal/external rotation and glenohumeral joint views) and magnetic resonance imaging (MRI) with intraarticular contrast injection examination of the right shoulder. The findings consisted of small subchondral cystic changes with cortical irregularity on the greater tubercle as well as cortical irregularity and an inferior osteophyte on the humeral head (Fig 1) indicating mild OA using the classification outlined by Reineck et al.³ Pertinent findings on the MRI included a subacromial/subdeltoid bursal fluid collection inferior to the acromion process, articular surface partial-thickness tearing of the supraspinatus/infraspinatus junction (Fig 2) extending posteriorly to the bursal surface of the infraspinatus tendon, tendinosis of the supraspinatus and subscapularis tendons, a labral tear at the 12 o'clock position including the anchor of the long head of the biceps tendon, and extravasation of the imaging contrast agent into the adjacent soft tissues with no evidence of the posterior band of the inferior glenohumeral ligament (Fig 3). This injury to the inferior glenohumeral ligament, the most important

Fig 1. Anteroposterior radiograph of the right shoulder demonstrating cortical irregularity, sclerosis, and a large inferior osteophyte (arrow) of the humeral head.

Fig 2. Sagittal T1-weighted fat-suppressed (a) and sagittal T2-weighted fat-suppressed (b) MRA images demonstrating an increase in signal within the supraspinatus and infraspinatus tendons (long arrows) and a small subchondral cyst (short arrow).

static stabilizer, has been related to anteroinferior instability and dislocation of the shoulder.¹⁵

Treatment was planned with a frequency of twice a week for 1 month. It included cold laser therapy on the right anterior and posterior shoulder and kinesiotaping of the right shoulder. After completion of physical therapy treatment, the patient received full spine manipulation, to

any levels of restriction within the cervical, thoracic, lumbar, and sacroiliac regions, using diversified technique. Scapular mobilization was performed bilaterally, and the patient was given pendulum and wall angel exercises. The patient was also asked to discontinue any activities that caused pain but was noncompliant. A neuromuscular reeducation plan was implemented after

Fig 3. Abduction and external rotation view: T2-weighted fat-suppressed (a) and sagittal T1-weighted fat-suppressed (b) MRA images demonstrating contrast extravasation (white arrows) due to the inferior glenohumeral ligament (posterior band) tear.

imaging was obtained, including upper body stabilization in a half push-up position on a vibration plate to increase strength and stability of the rotator cuff muscles. This was performed for 1 minute, 3 times, with 30-second rest periods between intervals. After 1 month of treatments with sporadic compliance, the patient reported that her right shoulder pain had decreased since she transitioned from traditional weight-lifting exercise to CrossFit exercise. Surgical consultation was discussed, but this patient chose not to undergo surgery. A signed patient consent was obtained to publish her anonymized health care information.

Discussion

Shoulder injury and instability are common in the overhead-throwing athlete because of chronic and repetitive overuse. These injuries are usually seen in baseball and softball players instead of impact trauma-related injury seen in football players.⁶ Most research has been conducted evaluating shoulder injury patterns and biomechanics of baseball pitchers.^{2,4} The biomechanics of throwing is divided into 6 stages: the windup, stride phase, cocking phase, acceleration, deceleration, and follow-through. Lintner et al² found that most shoulder injuries occur during the cocking and acceleration phases, the highest forces occurring from late cocking to early acceleration, because of the transition from extreme external rotation to internal rotation in the abducted position. Hibberd et al⁵ argue that the baseball and softball position players employ unique biomechanics. They found, when comparing baseball and softball position players, that there was a significant difference between the physical adaptations and potential injury mechanisms in total range of motion, glenohumeral internal rotation deficit, and external rotation gain during throwing. They postulated that this was due to the softball size and weight, smaller field size in softball compared with baseball, and the smaller female height and body and muscle mass. Regardless of the mechanism, the injuries sustained by the static and dynamic stabilizers of the throwing athlete do cause shoulder instability which can increase the risk of developing OA at a younger age^{1,3,4}. In our opinion, our patient starting high-level softball at a young age increased her risk of injury and led to the current degenerative processes involving her right shoulder.

Diagnosis of internal derangement and OA of the shoulder is not only a clinical but a radiologic diagnosis. Osteoarthritis is typically diagnosed by radiographic findings demonstrating joint space loss, juxta-articular

sclerosis, subchondral cystic changes, and osteophyte formation of varying degrees of severity,³ some of which are demonstrated on our patient's radiographs (Fig 1). Moor et al⁸ suggested a new radiologic measurement called the *critical shoulder angle* (CSA) to determine if the anatomy of the scapula was associated with the development of rotator cuff tears or OA of the glenohumeral joint (Fig 4). They found that shoulders with CSAs larger than 35° had a higher prevalence of rotator cuff tears, whereas shoulders with CSAs less than 30° had a higher prevalence of OA.⁸ Three-dimensional computed tomography was also found to be helpful in assessing glenoid bone loss due to degeneration, particularly the posterior glenoid⁹.

Internal derangement displays substantial complexity regarding its imaging diagnosis and can be identified by using one or multiple modalities such as MRI, magnetic resonance arthrography (MRA), musculoskeletal ultrasonography (US), and positron emission tomography with computed tomography.^{10–14} Most studies found that MRI, MRA, and US are frequently used when making an internal derangement diagnosis. Schreinemachers et al^{10,11} found that MRA particularly in the abduction and external rotation position had comparable sensitivity and specificity to conventional MRI in detecting ante-

Fig 4. Anteroposterior radiograph of the right shoulder demonstrating the CSA. The angle is performed by drawing a line from the superior aspect to the inferior aspect of the bony glenoid and then drawing a line from the inferior aspect of the glenoid to the most lateral aspect of the acromion process. The patient's measurement fell into the increased risk of rotator cuff tear group.

roinferior labral and supraspinatus tears. MRA was most helpful in demonstrating the patient's rotator cuff, labral, and glenohumeral ligament injuries by highlighting the joint and localizing extravasation of the contrast material, particularly in the abduction and external rotation position (Fig 3).

One study comparing MRI to US found that both modalities were equally sensitive and specific in diagnosing partial-thickness rotator cuff tears¹²; however, another study found that US was better at detecting partial- and full-thickness tears, whereas MRI was better at detecting bony glenoid or humeral lesions and MRA was best for labral tears¹³.

Limitations

As this report is a single case, it cannot be generalized in terms of diagnosis or treatment outcomes. Future research pertaining to the long-term effects of overhead-throwing sports in young athletes is necessary for saliency of the manifestations in this particular early-onset condition specifically regarding the degenerative joint processes that can occur later in life.

Conclusion

Shoulder internal derangement and OA may occur in young overhead-throwing athletes. Clinicians need to be cognizant of the comparable sensitivities and specificities of the imaging modalities used for making these diagnoses, specifically MRI, MRA, and musculoskeletal US. Following a timely diagnosis, the young patient in this case had a good recovery with multimodal chiropractic care.

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No funding sources or conflicts of interest were reported for this study.

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