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Mini Review

Management of the Rotator Cuff Tears in Overhead Athletes

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Abstract

Introduction: The rotator cuff is made of 4 muscles that may be commonly be injured in overhead sports. Tears to the rotator cuff are common pathologies that are difficult to treat and to date there are no clinical guidelines or best practices for treating tears in the athletic population. The purpose of this mini review article is to synthesize the best evidence within the last 5 years in the management of rotator cuff tears in the overhead athlete.

Materials and Methods: A literature review was performed using terms to include shoulder injuries, rotator cuff injuries, and overhead athletes in multiple validated databases from the years 2015-2020.

Results: The initial query resulted in 8,852 articles available for analysis. After the initial analysis for duplicates and full text 6,000 articles were left. The search for relevant article that met the inclusion yielded 100 articles to be included into the final review. These articles were instrumental in synthesizing the various treatment and management of rotator cuff tears.

Discussion: In the overhead athlete, the first line of defense should be conservative care for 6-8 weeks to see if patient reported outcomes can be improved. Advanced imaging in the form of MRI should be obtained to assess the degree of damage to the rotator cuff. If the athletes is in season, then orthobiologics may be explored as an option. However, if the athlete does not achieve pre-injury levels of function then arthroscopic surgery may be indicated for optimal performance.

Conclusion: Rotator cuff tears are common in the overhead athletes, and currently there are no guidelines in their treatment and management. This mini review found evidence to support a conservative approach, followed by a possible orthobiologic intervention, and finally arthroscopic surgery if the athlete wishes to return to performance.

Introduction

Rotator cuff injury is common in overhead athletes in both throwing and non-throwing sports [1-3]. In throwing sports, the throwing motion imparts a large amount of stress in the shoulder joint [4,5]. The humeral angular velocities can reach from 7000-8000 degrees/second [6, 7]. The shoulder joint (Glenohumeral joint) is a ball and socket joint that is inherently mobile. The stability of the shoulder can be categorized as static and dynamic. Static stabilizers include the glenohumeral ligaments, joint capsule, and labrum [8-10]. The dynamic stabilizers are made up of the rotator cuff musculature which serve to center the humeral head within the glenoid cavity [11, 12]. The rotator cuff consists of the: supraspinatus, infraspinatus, teres minor, and subscapularis [13, 14]. These muscles serve to resist distraction, horizontal adduction, and internal rotation [15-17]. During the deceleration phase of the throwing phase, the posterior rotator cuff must work eccentrically to slow down the distraction forces produced at the shoulder [18]. In non-throwing sports such as Olympic Weightlifting, the turnover phase of the Clean and Snatch produces large amounts of torque at the shoulder [19]. During the Jerk, the body must pre-load the shoulder through a short dip in the lower extremity before the barbell is lifted overhead [20]. If the transition from the lower body to the upper extremity is not efficient this may cause a concentration of load directly onto the shoulder and rotator cuff [20-22]. It is during these motions that injury can occur. More importantly, due to volume and repetition performed by overhead athletes, rotator cuff injury may more often be chronic or degenerative [23, 24]. These chronic or degenerative injuries may lead to partial thickness or full thickness tears. In a partial thickness tear only part of tendon has torn off the bone while the entire tendon has separated or torn from the bone in a full thickness tear [25-28]. Tears to the rotator cuff have been investigated thoroughly in the literature, however no treatment and management guidelines seem to exist. The purpose of this mini-review is to synthesize the best evidence published in the last 5 years to come up with guidelines for treatment and management of rotator cuff tears in overhead athletes.

Methods

A literature search was performed on PubMed with the terms “rotator cuff tear”, “rotator cuff injury”, “rotator cuff pathology”, “overhead athlete”, and “shoulder injuries” with a publication date from 2015-2020 to capture the most recent data on this topic. Upon the initial review was complete, the author (BS) went through an initial screening of the results using the title to ensure articles were not duplicates and date of publication was in the inclusion criteria. After this initial screen, all articles of interest were reviewed using a combination of the abstract and full text article. If the author (BS) had any doubts or questions about including an article, the corresponding author would try to be reached. For final inclusion into the mini review, the article had to meet all criteria set forth above.

Results

The initial query resulted in 8,852 articles available for analysis. After the initial analysis for duplicates and full text 6,000 articles were left. The search for relevant article that met the inclusion yielded 100 articles to be included into the final review. These articles were instrumental in synthesizing the various treatment and management of rotator cuff tears. Specifically, articles included definitions of partial thickness vs full thickness tears, conservative management, orthobiologics, and arthroscopic surgery.

Discussion

Rotator cuff tears are common in the overhead athletes, with chronic and degenerative tears having a higher incidence rate [29]. The supraspinatus and infraspinatus are the most commonly affected muscles [30, 31]. Rotator cuff tears may include various signs and symptoms which include generalized pain the shoulder, referred pain to the lateral shoulder, pain with sudden movements, loss of range of motion, and loss of strength [32-34]. When performing the physical exam in the overhead athletes it is important rule out the cervical spine as the source of injury. Furthermore, the proximal biceps and labrum are commonly injured within this population. SLAP tears are the most common [35, 36], however because the labrum is a 360 degree structure the clinician must be conscious on injuries to the inferior labrum [37] and posterior labrum [38]. The specific guidelines for treatment will depend on level of play, stage of season, and the amount of limitation the athlete is experiencing. For example, partial thickness tears respond well to conservative treatment in short-term and long-term follow-up. The athlete, clinician, coach, and orthopedic surgeon must all be informed to the progression of the tear into a larger tear in the future.

Diagnosis of a rotator cuff tear can be performed in many ways such as clinically or with imaging. Using diagnostic ultrasound, CT scan, and MRI all provide well validated avenues of advanced imaging. MRI does remain as the gold standard due to its high sensitivity and specificity [39-41]. Diagnostic ultrasound is reliable but is highly dependent on user expertise and familiarity [42]. CT scan presents a quicker way than MRI but the high amounts of radiation and lower sensitivity to soft tissue injuries make it less used [43].

Conservative treatment is the first line of defense once a rotator cuff tear is suspected or diagnosed. Best guidelines for conservative treatment include the athletes as a holistic body using the concept of kinetic chain and regional interdependence. This means that even though the shoulder is injured, the clinician should assess the entire body with emphasis on scapular neuromuscular control, thoracic spine mobility, the hip (femoroacetabular joint), and ankle joint (talocrural joint) [44, 45]. The literature shows that athletes with shoulder injuries have poor neuromuscular control in that the scapula can't achieve retraction, adduction, and posterior tilt [46]. In the thoracic spine, if extension can't be achieved properly, the shoulder must compensate and put more stress on local structures like the rotator cuff and labrum [47]. The hip must have adequate single-leg stability if the athletes is throwing and in general must have adequate internal rotation to achieve motion and avoid stress in the lumbar spine setting of a chain reaction as energy is transferred into the upper extremity [48]. Similarly, the ankle joint must have adequate dorsiflexion for efficient transferring of force into the trunk and upper extremity. Conservative treatment should be attempted consecutively for 6-8 before exploring other options.

Recently, the use of orthobiologics has increased dramatically in sports medicine due to its low morbidity, low levels of invasiveness, and a quicker return to play [49]. Although there are many definitions of what an orthobiologic is, this review will focus on Platelet Rich Plasma (PRP) and Stem Cell Therapy. It is interesting to note that many arthroscopic procedures augment their repair using PRP but this section will only summarize findings using PRP as a standalone intervention. PRP is an autologous platelet concentrate that typically contains more than 1000x103 platelets/ML, representing a three to five fold increase as compared to whole blood. PRP contains more than 1500 bioactive growth factors that promote tendon healing [50, 51]. It is theorized to have a mechanism of action through modulation of the inflammatory pathway which encourages healing of tendon, ligament, muscle, and bone [52-54]. The reader should be aware of the two main variations (leukocyte-rich and leukocyte-poor preparations) of which there is no clear superior option at the time of writing this review. Shams et al. found evidence for PRP injection as a good alternative to corticosteroid injection for patients with partial rotator cuff tears [55]. Conversely, Kesikburns found no difference in pain or functional outcome scores at any time point up to 1 year between PRP and placebo injections [55].

Stem Cell therapy (SCT) consists of mesenchymal stem cells (MSC) which differentiate into different mesodermal tissues and have strong anti-inflammatory, immunoregulatory, and angiogenic potential [56,57]. Thus, SCT is seen as a potentially effective therapy in the healing of rotator cuff tears. SCT has been investigates in the healing of the tendon-bone interface which is crucial in regaining biomechanical strength after injury [58-60]. The most common source for SCT is autologous bone marrow while other less commonly used sources include adipose tissue derived MSC's [61]. The biggest obstacle with STC is the cost which is not covered by insurance and the lack of published studies in humans. To date, there is no consensus statement on the use of SCT, it is an experimental treatment that seems to show promising results.

Surgical management of rotator cuff tears should be viewed as a necessary last resort if the athlete has not achieved their necessary function for optimal performance. Surgically, there are three common procedures performed: open, mini-open, and arthroscopic. Arthroscopic has become the dominant technique in the last 10 years due to its lower level of invasiveness, faster return to play time, and higher patient reported outcomes [62, 63]. Needless to say, the rehabilitation period after arthroscopic is longer as compared to conservative treatment, PRP, or SCT and involves sling use for about 4-6 weeks, active range of motion starting at 8 weeks, strengthening exercises at week 10 [64-66]. The athlete may begin their return to gradual progression starting at Month 4 (20 weeks) depending on their sport. In the throwing athlete, the throwing progression is usually started at month 6 (week 24) [62, 63, and 66].

Conclusion

Rotator cuff tears are common in the overhead athlete population with chronic/degenerative tears being more prevalent compared to acute tears. The general treatment and management will depend on competition level, time of season, and symptom interference in the athlete. The purpose of this mini-review was to synthesize the latest research and synthesize it into recommendations for the clinician working with the overhead population. Upon clinical or imaging diagnosis, conservative treatment should be attempted for 6-8 weeks. If this is not sufficient, a physician should be consulted to explore options of PRP or STC. If this option is explored or bypassed, the last step would be arthroscopic surgery with an orthopedic surgeon, preferably one who is fellowship trained in sports medicine.

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