[Sports Physical Therapy]

CEU

The Mature Athlete's Shoulder

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Context: The mature athlete's shoulder remains a challenging clinical condition to manage. A normal natural history of the shoulder includes stiffness, rotator cuff tears, and osteoarthritis, all of which can become increasingly more symptomatic as an athlete ages.

Evidence Acquisition: PubMed (1978-2013).

Study Design: Clinical review.

Level of Evidence: Level 3-4.

Results: Rotator cuff pathology increases with age and activity level. Partial tears rarely heal, and debridement of significant partial tears results in poorer outcomes than those of repair. Repair of partial-thickness tears can be accomplished with completion and subsequent repair or in situ repair. The most successful result for treatment of osteoarthritis in the shoulder remains total shoulder arthroplasty, with more than 80% survival at 20 years and high rates of return to sport. Caution should be taken in patients younger than 60 years, as they show much worse results with this treatment. Adhesive capsulitis of the shoulder can be successfully treated with nonoperative management in 90% of cases.

Conclusion: Mature athletes tend to have rotator cuff pathology, osteoarthritis, and stiffness, which may limit their participation in athletic events. Age is a significant consideration, even within the "mature athlete" population, as patients younger than 50 years should be approached differently than those older than 65 years with regard to treatment regimens and postoperative restriction.

Keywords: rotator cuff; glenohumeral arthritis; aging shoulder; adhesive capsulitis; aging athlete

The natural history of the aging shoulder presents a particular challenge to the mature athlete. The normal shoulder joint is the most mobile joint in the human body,[30] and this mobility is leveraged in many athletic events, including swimming, tennis, and throwing sports. Unfortunately, this motion declines not only with age but with long-term sports participation.[17] Furthermore, as a minimally constrained joint, the shoulder is uniquely dependent on balanced muscular forces to optimize strength and function, particularly in athletics. Aging itself leads to an increased tear rate in rotator cuff muscles,[42] which presents a significant challenge to continued athletic performance. While osteoarthritis of the shoulder is not as common as it is in the knee and hip, it is not uncommon and can be debilitating if added to the myriad of pain generators in the biceps, acromioclavicular joint, and subacromial space. The aging shoulder in a mature athlete represents a challenging condition for even the most experienced clinician.

ROTATOR CUFF PATHOLOGY

Rotator cuff dysfunction ranges from tendinitis to massive tear and is perhaps the signature pathology in the aging athlete's shoulder. Aging has been associated with increasing tear rates,[39,49] and while not all are symptomatic, patient-based measures of shoulder function and range of motion are worse with tears.[50]

Partial-thickness tears are quite common in the aging athlete, and their natural history remains controversial. Yamanaka and Matsumoto[51] noted that 80% of partial-thickness rotator cuff tears may enlarge to full-thickness tears over 2 years. In contrast, only 8% of partial-thickness rotator cuff tears increased in size at 20 months.[36] In the symptomatic patient with a partial-thickness tear, debridement may be effective in lesser grade tears,[23] while more advanced tears (Ellman grade 3[10]) have had less encouraging results. Rotator cuff tears treated

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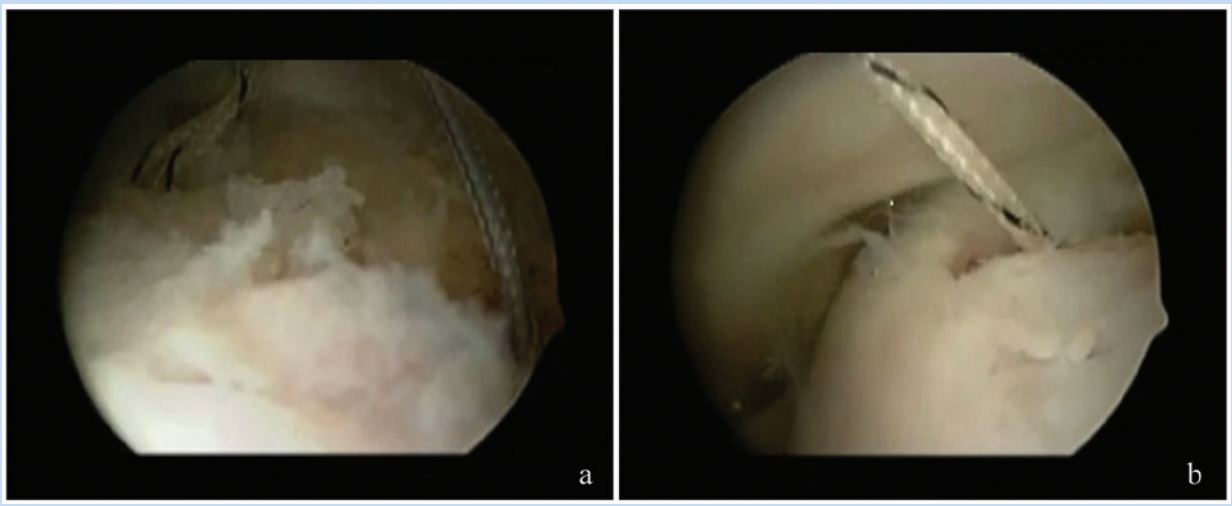

Figure 1. Intra-articular view of a partial-thickness supraspinatus tear in a 42-year-old recreational softball player. (a) Dual anchors placed in the footprint; (b) after repair, the leading edge is advanced to the medial footprint.

with debridement do not heal.[5,15,47] Understandably, repair has become increasingly popular. Weber's[47] original study noted good or excellent results in 31 of 33 partial-thickness tears treated with repair. Similarly, 98% patient satisfaction was obtained in 41 patients treated with repair of a partial-thickness supraspinatus tear.[12] The optimal method of repair is a topic of increasing discussion. Several studies have shown excellent results with completion of the tear and either open[47] or arthroscopic[8,16] repair, but others have made the case for an in situ repair[22] (Figure 1). Ide et al[14] were the first to report results after an in situ repair technique and noted that 16 of 17 patients had a good or excellent result.[22] An additional study on 54 patients treated similarly had 98% good or excellent results.[9] A 12% retear rate occurred with completion of the tear and repair.[25] As of yet, retear rates for the in situ technique are not known. In matched cadavers, the in situ transtendon repair had less gapping and higher mean ultimate failure strength than did the converted full-thickness tear with double-row repair.[7] These results should be interpreted with caution in the elite throwing athlete, however. Several studies show good results with debridement of rotator cuff tear in this challenging population,[1,22,33] while repairs have not been as successful.[26,43] Strategies to improve healing can be classified as mechanical or biological. On the mechanical front, double-row repairs are popular, with a larger footprint and better biomechanical performance, in comparison with traditional single-row techniques.[46] In a meta-analysis of 15 biomechanical studies comparing the 2 approaches, Wall et al[46] noted that double-row repair constructs were superior in terms of strength, failure, gap formation, and anatomic footprint restoration. From a clinical standpoint, however, the results have been less convincing. In 4 separate meta-analyses/systematic reviews,[31,32,44,45] double-row repair showed no advantage in clinical outcome. The meta-analysis by Prasathaporn et al[32] did demonstrate better healing rates in the double-row group.

A second major mechanical emphasis in rotator cuff repair optimization is augmentation. An acellularized natural extracellular matrix scaffold can act as a biological stimulus to recruit host cells to deposit a tendonlike matrix and improve tendon healing.[2] Tissue types include autograft, allograft, xenograft, and synthetic materials, which have had disappointing clinical results.[13,25] More recently, however, acellular human dermal allograft has shown promise as a graft.[2] In 45 patients with massive rotator cuff tears treated with augmentation and replacement of the cuff with a dermal allograft, there were improvements in 3 validated outcomes scores. In a prospective randomized study of augmentation with a patch versus control repairs, outcomes scores were 4 times as high in the nonaugmented group.[2]

Biological augmentation of cuff repair with platelet-rich plasma or mesenchymal stem cells relies on growth factors enhancing healing tissues. Human platelets and stem cells contain high concentrations of platelet-derived growth factor and vascular endothelial growth factor and have a dramatic effect in vitro.[5] There is great difficulty in evaluating this technology, and the ideal concentration and delivery method to stimulate healing is not yet known. Five controlled comparative trials evaluated platelet-rich plasma in rotator cuff healing and found no difference in retear rates or any measure of functional outcome score.[10] Stem cell or gene therapy is still in the preclinical phase.

Treatment of full-thickness rotator cuff tears in the athlete has mixed results. It is important to differentiate among the age, level, and sport to understand the outcomes studies. In the elite baseball thrower, repair of the full-thickness rotator cuff tear usually has poor results. A 32% return to prior competitive levels after rotator cuff repair was found in professional

Figure 2. Radiograph of a total shoulder arthroplasty in a 53-year-old golfer. The patient had a failed lateral meniscal allograft resurfacing, which was revised after 10 months. The patient returned to golf and lowered his handicap after surgery.

pitchers,[43] while results of miniopen rotator cuff repair in professional pitchers found that only 1 of 12 (8%) was able to return to competitive baseball.[26]

In a series of older recreational pitchers with rotator cuff repair (mean age, 59 years), all returned to their previous level of throwing and, on average, rated themselves at 92% of their original function.[32] Furthermore, the sport should be considered. Of 51 middle-aged tennis players with rotator cuff surgery, 42 were able to return to tennis at an average of 9.8 months, with activity scores averaging 27 of 30.[40]

OSTEOARTHRITIS

Osteoarthritis of the shoulder can be a debilitating condition for the aging athlete. For the older recreational patient who is able to limit activity, total shoulder arthroplasty provides excellent long-term survival rates in excess of 85% at 20 years (Figure 2).[7] Return to sport after arthroplasty is high.[15,27,37] Of 75 patients with an mean age of 66 years, 53 improved their ability to play, and 50% increased their frequency of participation postoperatively. Type of sport was predictive of return, with mean time to full return at 5.8 months.

Jensen and Rockwood[15] reported that 96% of patients returned to recreational golf after shoulder replacement surgery and improved their performance by approximately 5 strokes. In contrast, for the younger, more active patient, results of shoulder arthroplasty have been less reliable. In 62 shoulder arthroplasties in patients 50 years old and younger, nearly 50% had an unsatisfactory clinical result.[41] Similar results in young patients treated with total shoulder arthroplasty noted that the 10-year survival rate was only 62.5%.[6]

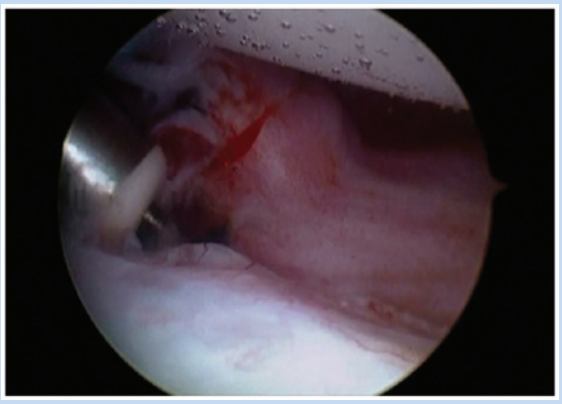

Figure 3. Arthroscopic picture of an inferior capsular release performed on an active-duty 42-year-old infantry officer. This patient could not do pushups required for the fitness test. Postoperatively, the patient returned to full duty.

In light of these issues, less invasive treatments such as debridement have been employed. Adjunctive treatments such as microfracture[28] and capsular release have improved pain and range of motion.[4]

Biological resurfacing represents a potential solution in the young aggressive athlete or active-duty military member. Glenoid resurfacing options include Achilles tendon allograft,[19] lateral meniscal allograft,[48] and dermal allografts.[3] In 36 shoulders treated with Achilles allograft, 86% had a satisfactory result at 84 months.[18] In 23 patients who underwent glenoid resurfacing with a biological graft, there was a 75% satisfaction rate at greater than 3 years.[36] Conversely, in 10 of 13 patients with resurfacing and hemiarthroplasty, revision surgery was indicated for pain and limitation of range of motion.[8] Similarly, high complication rates have been reported with meniscal allograft resurfacing.[20]

Thus, a definitive solution to osteoarthritis in the mature athlete's shoulder is significantly affected by age. In older, more sedentary patients, arthroplasty remains an excellent option that reliably allows return to most sports. In younger mature athletes, the ultimate solution remains elusive.

ADHESIVE CAPSULITIS

Adhesive capsulitis, also known as frozen shoulder, is a common disorder characterized by loss of both active and passive motion.[12] It can be primary (idiopathic) or secondary to another pathologic process; it can also be associated with diabetes or thyroid disease; and it is more common in patients older than 40 years.[38] Both synovial hyperplasia and capsular fibrosis occur with a deposition of type 1 and type 3 collagen.[29,35]

Treatment of adhesive capsulitis relies on identifying and treating the underlying condition. More often, the process is primary without a correctable cause. Conservative management

is a reasonable, evidence-based approach.[11] Formal physical therapy with a steroid injection was significantly better than that without at 3-month follow-up, but both groups were similar at 1 year.[8] Seventy-five consecutive patients treated nonoperatively reported 90% good and excellent results, with decreases in pain and increases in outcomes scores and range of motion.[18] Motion was not restored to normal, however, with patients lacking up to 30° in each plane with nonoperative treatment of adhesive capsulitis. Ninety percent of patients responded in an average time of 3.8 months.

Because of the high rate of success with nonoperative management in adhesive capsulitis, it should be the first-line treatment in these patients. Risk factors for failure include diabetes and younger age.[21,34] In recalcitrant adhesive capsulitis, operative management can be an effective treatment tool (Figure 3).[24] Outcomes scores improved roughly 50 points on a 100-point scale, and range of motion improved significantly. Complications are few, but several cases of rotator cuff and labral injury[24] have been documented after manipulation under anesthesia.

CONCLUSION

The symptomatic shoulder in the mature athlete remains a challenging clinical condition to manage. Older athletes tend to have more advanced disease processes than their younger counterparts but also may have less performance requirements. Age is a significant consideration, even within the "mature athlete" population. Patients younger than 50 years should be approached differently than those older than 65 years with regard to treatment regimens and postoperative restrictions.

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