REVIEW ARTICLE

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A Comprehensive Update of Adhesive Capsulitis and Minimally Invasive Treatment Options

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ABSTRACT ~ ***Background:*** *Adhesive capsulitis of the shoulder (AC) is characterized by fibrosis and contracture of the glenohumeral joint capsule, resulting in progressive stiffness, pain, and restriction of motion of the shoulder. The prevalence of AC is estimated to be 2–5% of the general population. Patients with AC typically have an insidious onset of pain and can progress to severe limitation of the shoulder leading to significant disability and decreased quality of life.* ***Objectives:*** *The objective of this manuscript is to provide a comprehensive review of AC with a focus on clinical presentation, natural history, pathophysiology, and various treatment modalities.* ***Study Design:*** *A review article.* ***Setting:*** *A review of literature.* ***Methods:*** *A search was made on the Pubmed database using the keywords of adhesive capsulitis, frozen shoulder, shoulder capsulitis, arthrofibrosis, shoulder pain, shoulder stiffness.* ***Results:*** *Our search identified numerous studies in order to provide a comprehensive review of the current understanding of the treatment and management of AC.* ***Limitations:*** *There remains limited evidence in literature about the understanding of AC and optimal treatment.* ***Conclusion:*** *AC is an important cause of chronic pain and disability. There is currently no consensus on treatment. Initial treatment modalities revolve around conservative measures as well as aggressive physical therapy. Further treatment options include intraarticular injections, hydro-dilation, nerve blocks, and for more refractory cases, surgical interventions such as arthroscopic capsulotomy.* Psychopharmacology Bulletin. *2020;50(4, suppl. 1):91–107.*

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Introduction

Adhesive capsulitis (AC) is characterized by fibrosis and contracture of the glenohumeral joint capsule, resulting in progressive stiffness, pain, and restriction of motion of the shoulder. On physical exam, patients display loss of both active and passive motion in multiple planes.[1] The American Shoulder and Elbow Society has further characterized AC to reflect the unremarkable radiographic findings associated with the disease.[2] AC can be divided into primary/idiopathic or secondary due to predisposing factors.[3] While the exact pathophysiologic process of AC is not understood, it is largely characterized by inflammation within the capsule. Cytokines enable fibroblasts proliferation and transformation into myofibroblasts, which results in capsular hyperplasia and fibrosis thus causing contracture and restriction of motion.[4,5]

Epidemiology/Etiology

The prevalence of AC is estimated to be 2–5% of the general population.[6] The most alarming of risk factors is diabetes; in this population, prevalence increases to 20%.[6] Additionally, Milgrom et al. reported a significantly higher prevalence of AC in women with hypothyroidism compared to the age-matched regional population (21.1% versus 7.9%).[7] AC affects women more than men.[8] Several predisposing factors have reportedly been associated with AC: hyperthyroidism, Dupuytren contracture, breast cancer treatments, cerebral vascular disease, myocardial infarction, hyperlipidemia, and autoimmune disease.[7,9–14] Lastly AC was more prevalent in those patients with a prior episode of disease in the contralateral shoulder.[15]

AC is frequently described as progressing through four different phases.[16,17] The first phase is known as the painful phase where patients will develop diffuse, severe, and disabling shoulder pain, that is worse at night. During this initial phase, range of motion (ROM) is preserved and the pain is thought to be caused by synovitis. The next phase of the disease course is characterized by increasing stiffness over the next 2–9 months. The third phase is described as a global and progressive loss of ROM while pain becomes gradually less pronounced. This phase typically lasts 2–4 months. The fourth and final phase is described as a recovery phase with a gradual return of ROM that takes 5–14 months to complete.[18]

Diagnosis

Patients with AC typically endorse insidious onset of worsening pain, with no prior history of trauma.[15] Due to the difficulty with elevation

and rotation of the shoulder, patients experience trouble with daily activities involving raising the arms above the head. Additionally, AC may also cause pain at night, similar to other shoulder pathologies.[19] Although several planes of shoulder motion can be impacted, external rotation and abduction are the most commonly affected, followed by internal rotation.[20] Early in disease progression, the physical exam may show pain only at the end of shoulder movement. As AC progresses, significant loss of motion can be seen, sometimes up to 80% loss of total ROM.[21] Upon inspection of the patient, stiffness of the shoulder and loss of arm swing during gait may be noted. Palpation results in diffuse tenderness both in the anterior and posterior shoulder girdle. Focal tenderness may indicate alternative shoulder pathology such as rotator cuff tear or biceps tendinopathy. Usually patients will have loss of active and passive motion in multiple planes of movement like flexion, abduction, external rotation, and internal rotation. Theoretically, AC does not produce pathology of the musculature and tendons. Therefore, the rotator cuff muscles, biceps tendon, and deltoid muscle should allow patients to have preserved strength. However, resisted motion can produce pain and thus cause cessation of movement, mimicking weakness. Neurologic assessment should also be normal in AC patients.[19]

If physical exam is insufficient to diagnose AC, a lidocaine injection test can be done in the office to tease apart AC and subacromial pathology such as rotator cuff tendinopathy or subacromial bursitis. After injection of anesthetic into the subacromial space AC patients will have persistent pain upon active and passive motion. Those with subacromial pathology will have relief of pain and increased range of motion.[22] Imaging may be unreliable in the diagnosis of AC. In a retrospective review of 350 shoulder X-rays of patients with presumed AC, Roberts et al. found that 342 patients did not have concerning features. Of the 8 patients who did also presented with other pathology (6 with severe osteoarthritis, 1 with fracture, and 1 with lucency), necessitating an X ray.[23] While routine imaging is not necessary, imaging can help distinguish other pathologies such as Pancoast tumor, advanced glenohumeral osteoarthritis, pathologic fracture, avascular necrosis, biceps tendinopathy, and calcific rotator cuff.[19] Magnetic resonance imaging can also aid in identifying soft tissue and bony pathology in patients who do not have classic signs of AC. In patients with AC, MRI shows joint capsule edema and thickening, axillary recess thickening, rotator cuff interval thickening, and proliferative synovitis surrounding the coracohumeral ligament.[24,25] Lee et al. conducted a study comparing 21 patients with AC to 20 patients without AC who underwent MR arthrography. Radiologists measured glenohumeral distance (GHD), width of the axillary recess, and capsular thickness. The AC group had

a shorter mean GHD, a narrower axillary recess, and a thickened capsular thickness.[26] Although this was a rather small study, it showed that GHD could be added to routine radiographic features of AC.

Musculoskeletal ultrasound can also be used to diagnose AC although it is most often used as an imaging modality during therapeutic injection. In a case control study of 30 AC patients, 30 painful shoulder patients, and 30 controls, Tandon et al. found that coracohumeral ligament was most thickened in AC patients with a thickness of 0.7mm thickness being diagnostic for AC. AVS patients also had increased soft tissue in the rotator interval with high sensitivity of 86.2% and specificity of 92.8%. On dynamic ultrasonography, restriction of external rotation had high specificity of 92.8%, but restriction in abduction was nonspecific (6.7%). Therefore as a cheap and faster modality than MR, US can be used in the office with high sensitivity and specificity for AC.[27]

Pathophysiology

AC has a profound effect on the movement of the shoulder, and thus has led to certain pathoanatomical findings. Contracture of the glenohumeral capsule is considered the hallmark finding of AC.[28] This is seen with a thickened coracohumeral ligament (CHL), loss of synovial layer of the capsule, and a fibrotic rotator interval.[29] The pathophysiology of AC is not fully understood. It is thought that the root cause is a primary fibrotic disorder.[30] This has further been endorsed as studies have shown AC patients to have altered levels of matrix metalloproteinases (MMP) which are involved in scar tissue remodeling and collagen regulation. This is thought to lead to excessive collagen formation, creating an inherent imbalance between extracellular matrix degradation, remodeling as well as regeneration. Future therapies for AC may stem from inhibiting this fibrosis and remodeling, and restoring normal regeneration.

The primary driving pathogenesis of AC is debated though it is generally accepted that there is both an inflammatory and fibrotic stage that contribute to the progression of AC. The rotator intervals of AC patients have numerous inflammatory markers, such as interleukins, cytokines, as well as mast cells.[31] It is also know that mast cells regulate fibroblast proliferation, and might serve as a mediator between the inflammatory and fibrosing stages of this condition.[31] In addition a recent 2018 study demonstrated that the pathophysiology of AC may actually vary depending on the location in the shoulder.[32] A comparative proteome analysis took tissue samples from the rotator interval, middle glenohumeral ligament and anterior-inferior ligament and

found different expressions of immune response, phagocytosis as well as basic metabolism. This may point to the need to isolate different treatment options of AC depending on location, however more studies need to be conducted in order to fully determine the true utility.[32]

Treatment

Conservative

The goal of treatment for adhesive capsulitis is to restore the shoulder to a painless and functional joint. As adhesive capsulitis is a self-limited disease, and may remit spontaneously, treatment can vary greatly from watchful waiting to invasive open capsulotomy. Since there is limited evidence to support one single treatment method, there is no universal treatment algorithm.[33] Conservative treatment is usually the first line of treatment as most patients having their symptoms resolve spontaneously within 1–3 year.[34] Conservative management includes non-surgical management such as physical therapy, NSAIDS, and oral glucocorticoids. If symptoms progress or recovery seems to plateau, intra articular glucocorticoid injections can be utilized before progressing to surgery.

Physical Therapy

Physical therapy is often the first line of treatment for patients with early stages of adhesive shoulder capsulitis. Its often combined with other treatment modalities as there is limited evidence to support the use of physical therapy alone.[35] PT remains a mainstay in the treatment of AC and early mobilization with physical therapy is almost universally recommended. There is some controversy over the technique and frequency of therapy. One study showed that only 63% of patients undergoing intensive physical therapy demonstrated improved shoulder function compared to 90% who did less intense, gentle exercises.[36] More recent evidence suggested no difference between gentle and aggressive mobilization techniques.[37]

Recent studies have explored novel mobilization techniques. High-intensity stretch (HIS). HIS utilizes a device that can apply torque to the joint similar to that applied by a physical therapist. These devices are designed to stretch a joint at its end of ROM to permanently elongate scar tissue that formed in the joint. Patients are given HIS devices when they are not meeting treatment milestones and have reached a plateau in their recovery with standard PT. A study which observed patients with postoperative AC who were unable to reach their PT treatment goals during a standard protocol of PT, found that HIS may

be a beneficial addition to their treatment regimen.[38] Angular Joint Mobilization (AJM) has shown some promise in patients with AC and may be an effective intervention for improving shoulder pain, increasing ROM, and decreasing disability. AJM is rotational joint mobilization with joint axis shift. Joint axis shift takes into account that there is more than just the rotational movement of the glenohumeral joint and AJM therapy addresses joint axis shift that could be impaired in AC. In a recent case report a patient with AC reacted positively to AJM.[39] Lastly, continuous passive motion (CPM) is intended to prevent the formation of scar tissue through continuous movement the joint back and forth throughout the entire ROM. The use of CPM in treating AC has had mixed results. A recent randomized controlled trial, diabetic patients with AC seemed to have positive results and benefited from treatment with CPM. Patients had improved ROM and decreased pain when compared to the control group.[40]

Pharmacological Therapy

NSAIDS are often the first medications taken by patients to alleviate pain from AC. Currently there are very few studies evaluating the effectiveness of NSAIDS for the use of AC. Despite this, NSAIDS usually allow for short-term pain relief during the early inflammatory stages of AC, and can be a useful to allow patients to tolerate early PT.[41]

Oral corticosteroids can also be considered to provide a short burst of relief to prepare the patient for physical therapy and mobilization of the shoulder. Buchbinder et al. conducted a systematic review of five small randomized control trials to determine the efficacy of oral corticosteroids. No study contained more than 49 participants. Two trials compared oral steroids to placebo, one study compared oral steroids to no treatment, one compared oral to intraarticular steroids, and one compared manipulation under anesthesia to intraarticular steroids. One study reported improved pain relief with oral steroids and improved shoulder abduction but the relief was not seen after 6 weeks. A second study showed no improvement in either range of motion or pain relief between oral steroids and placebo. The third study showed that oral steroids when compared to no treatment had significant pain relief initially but these results dissipated within 5 months. Considering these results and the fact that oral corticosteroids had minimal adverse effects, it is recommended as a good therapeutic option for short term-less than 6 weeks.[42] Important to note is that none of these studies used the same dosages and intervals for delivery of the steroids.[42] Therefore, there is insufficient evidence to support superiority of any treatment studied.

Corticosteroid Intra-Articular Injection

Intra-articular corticosteroid injection may offer faster and superior improvement in symptoms when compared to PO corticosteroid treatment.[43] Intra-articular steroid injections have been shown to decrease fibromatosis and myofibroblasts in adhesive shoulders.[44] Intra-articular methylprednisolone injections have been shown to provide more rapid improvement in pain and ROM when compared to PT, ice therapy, and no treatment.[45] There seems to be no difference between those three treatment modalities at 6 months follow up. In recent reviews exploring the effectiveness of corticosteroid injections, it was concluded that intra-articular corticosteroid injections were more effective in pain relief in the short term, but this pain relief did not sustain in the long term.[46,47] It was also concluded that intra-articular corticosteroid injections improve ROM both in the long and short terms. In another review of randomized clinical trials it was concluded that there was no difference in outcomes between corticosteroid injection and oral NSAID drugs at 24 week follow up.[48] Recently it was shown that there might be added benefit of image-guided corticosteroid injections but further investigation is needed.[49,50]

Additionally, it was shown that when used in conjunction with other treatment modalities, intra-articular corticosteroid injections can provide additional benefit. In a recent study comparing the efficacy of a single intra-articular corticosteroid injection, a supervised physiotherapy program, a combination of the two, and a placebo in the treatment of adhesive capsulitis showed that a single injection of corticosteroid combined with a simple home exercise program was more effective than just supervised physiotherapy (Table 1).[51]

Sodium Hyaluronate Injection

Sodium hyaluronate is an unbranched polysaccharide and a natural component of connective tissue considered to be chondro-protective.[52] At a physiologic level, hyaluronate may exert metabolic effects on articular cartilage, synovial tissues, and synovial fluid.[52] Furthermore, hyaluronate injection was shown to lower the coefficient of enhancement on dynamic MRI imaging.[53] The coefficient of enhancement is a radiologic marker for inflammation and more specifically is used as a measurement of synovitis. Recent studies have shown that hyaluronate injections have been beneficial and lead improve ROM and pain scores.[54,55] Similar to corticosteroid injections, hyaluronate injections only seem to provide improvement in the short term. In long term follow up hyaluronate injections did not provide any added benefit

TABLE 1

Intra-Articular Injections

AUTHOR (YEAR)	GROUPS STUDIED	INTERVENTION	RESULTS AND CONCLUSIONS
Wang et al. (2017)	Patients with Adhesive Capsulitis	Meta-analysis of Intra-articular corticosteroid injections	Intra-articular corticosteroid injections were more effective in pain relief in the short term, but this pain relief did not sustain in the long term
Koh (2016)	Patients with primary and secondary adhesive capsulitis	Systematic review of randomized controlled studies to assess the efficacy and safety of corticosteroid injections	Dosages of intra-articular triamcinolone 20 mg and 40 mg showed identical outcomes, while subacromial and glenohumeral corticosteroid injections had similar efficacy. The use of corticosteroid injections is also generally safe, with infrequent and minor side effects.
Papalia (2017)	Patients with Adhesive capsulitis	Systematic review of studies comparing clinical outcomes of patients treated with Hyaluronic acid in association with conventional therapy	When compared with cortisone intra-articular injection, HA has equivalent clinical outcomes and ROM.
Lim et al. (2014)	Patients with idiopathic adhesive capsulitis	Prospective study comparing the early clinical results of intra-articular injection of hyaluronate or corticosteroid in patients with idiopathic adhesive capsulitis.	Patients treated with intra-articular injection of hyaluronate and corticosteroid for idiopathic adhesive capsulitis showed significant improvement in early clinical scores and range of motion without significant differences between groups.
Khenioui et al. (2016)	Patients with joint pain	Systemic review looking at the analgesic effect of botulinum toxin in joint pain	The number of randomized trials and sample sizes are too small to provide a satisfactory level of scientific evidence or statistical power

when compared to other conservative treatment options.[56] When compared to corticosteroid injections, hyaluronate injections were shown to have equivalent outcomes with improved ROM and pain scores.[55,57] Additionally, hyaluronate is found to be safe with no reported adverse effects or complications.[55]

Botulinum Toxin Type A

Botulinum toxin is a proven and widely used treatment for numerous conditions characterized by excessive muscular contractions. A number of studies have assessed if botulinum has any effect on joint pain, including randomized controlled trials looking at adhesive capsulitis specifically. Recent review of international literature showed that number of randomized trials and sample sizes are too small to provide a satisfactory level of scientific evidence or statistical power.[58]

SSNB

The suprascapular nerve block (SSNB) is another treatment modality that allows for the treatment for AC. The main goal is to allow for pain relief to facilitate early movement of the affected shoulder joint. The block targets the nerves to the glenohumeral joint as they branch from the suprascapular nerve. The suprascapular nerve provides nearly 70% of the nerve fibers to the shoulder joint.[59] The technique can be performed blind often by targeting the supraspinatus fossa, but is often done today with ultrasound guidance to allow for better visualization of the nerve.[59] The SSNB is a safe and effective modality for treating AC. A recent 2012 study found that injection of 40 mg methylprednisolone acetate and 5 mL 1% lidocaine at the suprascapular nerve caused a significant pain reduction as well as increased mobility of the shoulder in AC patients.[59] A 2015 randomized control trial found that SSNB allowed for more aggressive and earlier PT. The studied compared SSNB to SSNB with PT and found a significant reduction in pain among patients that have SSNB with PT as opposed to just the nerve block alone.[60] A 2016 comparative study measured the effects of SSNB versus intra-articular steroid injections, and found that while both have efficacy, SSNB provided faster pain relief, earlier range of motion improvements and less contraindications/side effects.[61] A recent 2019 study showed that combining both a SSNB as well as an intra-articular steroid injection provided significantly improved pain and functional outcomes.[62] SSNB is considered to be an effective and safe procedure for the treatment of AC and can help patient tolerate more aggressive physical therapy.

Intra-articular Distention

Hydrodilation is a minimally invasive office-based technique which involves injection of fluid into the joint with the goal of distending the glenohumeral joint. The injectate usually contains a mixture of corticosteroids, anesthetics, and saline. Although it is a relatively quick procedure, hydrodilatation is not without adverse events. Notably, it can cause increased pain or joint rupture. Additionally, it is expensive when compared to other noninvasive therapies.[63] Saltychev conducted a systematic review of 12 RCTs and meta-analysis of 7 RCTs to further investigate the effectiveness of hydrodilatation. While the procedure had a significant effect on pain reduction and increase in ROM, it did not have an impact on disability level. Also, the study found the number needed to treat to be relatively high at 12; the authors deemed the clinical significance of the treatment to be low.[63]

Yoon et al. conducted a prospective randomized controlled trial of 86 patients to compare the efficacy of intra-articular injection to subacromial injection and to hydrodilatation in reducing pain and increasing passive range of motion 1 month, 3 months, and 6 months after treatment. All patients also received medical treatment with NSAIDs and a muscle relaxant and a physical therapy exercise program for the duration of the study. While the results for intra-articular injection and subacromial injection were similar, hydrodilatation showed better reduction in pain and increase in range of motion for 1 month and increase in functional scores for 3 months. This benefit was no longer seen at the 6 month mark.[64] Although the study showed positive results for hydrodilatation, several limitations should be noted. All participants went through physical therapy as well as injection therapy. Because there was no control group of placebo injections, it is difficult to say whether the injection therapy was solely responsible for the stated benefits or whether it was a combination of injections and regimented physical therapy. Additionally, hydrodilatation injections contained a combination of steroids and anesthetic; thus, potential benefit could be attributed to combination therapy.

Alternative Therapies

Whole body cryotherapy (WBC) is a technique through which cold air at −110°C to −140°C is delivered to a patient within a chamber.[65] It has been used in a myriad of conditions such as fibromyalgia, rheumatoid arthritis, chronic back pain, osteoarthritis, and inflammatory arthritis like ankylosing spondylitis.[66] WBC is thought to exert benefit through the release of β-endorphins, reduction in afferent

nerve pathways that modulate pain sensation, and anti-inflammatory effects.[67] Ma et al. compared the use of whole-body cryotherapy in conjunction with physical therapy and passive joint mobilization to patients who only received physical therapy and passive joint mobilization. At the 4-week mark, patients who received WBC as well as physical therapy and mobilization showed better scores in pain reduction and ROM. Although the disability from AC can last several months to years, symptoms can spontaneously resolve. Therefore, it is difficult to assess whether or not the patients included in this study who were followed for only 4 weeks saw benefit due to the therapies or whether they experienced natural decrease in symptoms. Moreover there was no control group to compare the interventions to non-therapy but the authors felt that it would be unethical to include such a control, highlighting the difficult in truly analyzing the effectiveness of WBC.[68]

In an RCT of 60 patients, Badalamente et al. studied the effectiveness of collagenase clostridium histolyticum (CCH) injection in lysing the shoulder capsule, reducing pain, and increasing ROM when compared to exercise therapy alone. All patients received either placebo or a single injection of varying concentrations of CCH, however, single injection therapy showed no improvement in symptoms. After failure of the single injection, patients were eligible for up to five high dose CCH injections and were followed up at regular intervals for 60 months.[69]

Jain et al. conducted a study to analyze the effects of yoga therapy in addition to conventional methods (oral analgesics) for patients with AC. Patients were followed for a month; results showed that yoga therapy did not improve symptoms based on Shoulder Pain and Disability Index scores. Adherence to the yoga regimen was self-reported so there was room for misreporting in this study. Additionally, all 72 patients were chosen from Phase 1 of AC, which is notably treatment resistant. Therefore longer follow up or patients in different phases of AC could have altered the results of yoga therapy.[70]

Manipulation Under Anesthesia

Manipulation under anesthesia (MUA) is reserved for patients who are refractory to conservative and minimally invasive treatment options. MUA relies on aggressive manipulation of the shoulder joint, allowing for adhesional tears and release of the inferior capsule. This forced rotation allows for movement beyond a patient's normal pain threshold that would otherwise be unmanageable with normal PT.[71] Many studies have shown notable effectiveness of MUA for AC, though the utility still remains under debate. A recent 2018 study showed that MUA caused significant improvements in pain scores, range of

motion and patient satisfaction at both 3 weeks as well as 3 months.[72] Also a recent 2019 systematic review stated that considerable increases in range of motion and reduction in pain scores leading to an 85% patient satisfaction rate is possible with MUA.[71] Given the lack of a large randomized control trial the argument still cannot be made for or against the use of MUA for adhesive capsulitis.[71] The timing of when patients should receive MUA has also been debated. It was thought that early intervention may lead to over-treatment in a disease that could have a mild progression. It was also thought that early intervention – during the inflammatory stage of the disease would be less effective and cause increased recurrence of symptoms.[73] A retrospective 2015 study showed that 6–9 months after symptom onset may be the ideal time for intervention to prevent long term complication as well as over treatment.[73] A 2017 study demonstrated that patients that have had limited success with MUA, should be offered a repeat MUA. Subsequent MUA led to significant reduction in pain scores as well as an increased range of motion.[74] Although it is regarded as a safe procedure, MUA is not without its inherent risks. There have been incidences of capsular tear, labral detachment, hemarthrosis, glenoid/humeral fracture as well as the risk of anesthesia.[71] Vastamaki et al. reported that MUA in diabetic patients may be less effective than in non-diabetic patients.[73] There have also been various studies that compared the utility of MUA versus other more conservative methods. Jacobs et al. conducted a randomized control trial finding there no difference between MUA and intra-articular steroid injections with regard to reduction in pain or increase in range of motion.[75] In addition, a 2007 randomized control trial showed that when comparing normal physiotherapy exercises to MUA no difference was noted at 3, 6 and 12 months.[76] MUA has demonstrated utility and proven effectiveness for the treatment of AC, however when given the lack of large randomized control trials its use should be limited only when more conservative measures have failed.

Arthroscopic Capsulotomy

Arthroscopic capsular release (ACR) is demonstrated to be a safe and an effective modality in treating AC. When compared to other methods of treatment arthroscopic release may offer distinct advantages. Direct visualization of the affected joint allows for diagnostic confirmation and to rule out additional pathology. The effectiveness of capsular release has been proven in a variety of studies with a dramatic reduction in pain scores, increased range of motion as well as overall

increased shoulder function.[77–81] There is some debate as to which technique and approach provides the most optimal relief for patients. Most authors have published data where the contracted CHL ligament as well as the rotator cuff interval were released.[41] The anterior-inferior capsular release approach has also been done fairly often with good results.[77] The release of the posterior capsule still remains controversial. It is thought that the additional posterior release will allow for more internal rotation of the shoulder. Although this was shown in various studies, when comparing long term follow-up with an anterior release there was no difference in range of motion with patient that has an isolated anterior release.[77,82] In addition, the entire circumferential release of the capsule is associated with a higher risk of axillary nerve damage. Currently there is no consensus regarding the extent of capsular release or which structures should be isolated. ACR is effective in both diabetic and non-diabetic patients. Diabetic patients showed poorer improvement in internal rotation and forward flexion.[83] Although potentially beneficial, ACR carries inherent risk. Postoperative adhesive capsulitis can be a major complication following ACR. There is a fine balance between immobilization after surgery to allow for healing as well as early mobilization to prevent arthrofibrosis. It is currently thought that the best treatment to prevent post-operative adhesive capsulitis is adequate pain control in order to facilitate early mobilization.[84] ACR has been demonstrated to be an effective treatment modality for adhesive capsulitis, and may be considered in patients who have been refractory to more conservative treatments.

Conclusion

Adhesive capsulitis of the shoulder is defined as fibrosis and contracture of the glenohumeral joint capsule, resulting in progressive stiffness, pain, and restriction of motion of the shoulder. The prevalence of ACS is estimated at 2–5% of the general population.[6] The most alarming of risk factors is diabetes in which the prevalence increases to 20%.[6] AC is often diagnosed clinically, in which both passive and active ranges of motion are severely reduced. There is currently no consensus on treatment however, initial treatment modalities revolve around conservative measurement as well as aggressive physical therapy. Further treatment includes intraarticular injections, hydro-dilation, nerve blocks, and surgical interventions such as arthroscopic capsulotomy. AC can have a profound effect on a patient's quality of life, and as such further research needs to be done in order to improve understanding and treatment for this disabling condition. ✤

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