Review Article

Rotator Cuff Disease, Adhesive Capsulitis, and Osteoarthritis. A Review of Literature

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Abstract

Shoulder pain may occur as a secondary symptom to a wide range of conditions, including rotator cuff disorders, glenohumeral osteoarthritis, or adhesive capsulitis. One common factor linking these diseases is inflammation. Understanding the role of inflammation in shoulder disorders can help physicians to manage and treat these common problems. Here, I document a perspective of a review of literature on these pathologies of shoulder.

Key words: Shoulder; Pain; Inflammation; Pathologies; Conservative treatment

Introduction

Shoulder pain is a common orthopedic problem accounting for more than six million out-patient visits to orthopedic surgeons each year. Multiple pathologies exist that can be the inciting factor, including degenerative and inflammatory arthritis, rotator cuff pathology (ranging from impingement and bursitis to cuff tear arthropathy), and adhesive capsulitis. One common factor linking these diseases is inflammation. The physiologic process of inflammation is a necessity for an appropriate healing and immune response in the human body. However, the etiology of many pathological processes in the body such as coronary artery disease (CAD), certain types of cancer, and Alzheimer's disease (AD) is a direct result of inflammation. Understanding the role of inflammation in shoulder disorders can help physicians to manage and treat these common problems.

Pathophysiology

The human shoulder has a unique design that depends on the enveloping soft tissues for motion and stability. The tendons of the rotator cuff pass are inferior to the relatively rigid coracoacromial arch, which is composed of the acromion, acromioclavicular (AC) joint, and the coracoacromial ligament. Normally, the subacromial bursae promotes smooth gliding between the two surfaces. Disruption of this mechanism, in the form of bursitis, tendonitis, and tendon tear, is extremely common and can lead to shoulder pain and disability [1-5]. The estimated incidence of rotator cuff tear is greater than 56% within the population [5-7].

Recently, the link between rotator cuff disease and glenohumeral joint pathology has been investigated. Aside from the fact that impingement and rotator cuff disease are traditionally considered extra-articular diseases, investigators have identified inflammatory mediators in both the glenohumeral joint and the subacromial space, which have been implicated in the etiology of cytokine-induced tendonitis [8-12]. Glenohumeral joint arthropathy associated with rotator cuff disease may represent a continuum of intraarticular pathology that occurs in association with rotator cuff disease. Bursal interleukin (IL)-1, tumour necrosis factor (TNF)- 〈, transforming

growth factor (TGF)- ® , and basic fibroblast growth factor (bFGF) have been identified in the subacromial space of patients with rotator cuff disease when compared with patients with instability [13]. The expression of IL-1 and IL-8, both pro-inflammatory cytokines, have been found to correlate with symptomatic impingement [14, 15]. Glenohumeral arthritis is a well-documented clinical problem, with total shoulder replacement being the third most frequent joint replacement procedure performed in the US. Inflammatory arthritis and degenerative arthritis both comprise this subset of pathologic shoulder pain. Chronic inflammation is the hallmark of all inflammatory arthritis. The presentation of cartilage auto-antigen (types II, IX, and XI collagen, aggrecan, and link protein), in conjunction with a major histocompatibility class II receptor by the antigen-presenting cell, is believed to initiate the inflammatory cascade. This is followed by a complex interplay of multiple inflammatory cells that lead to synovial hypertrophy and the destruction of articular cartilage. The most important cytokines identified in the etiology of inflammatory arthritis have been TNF-⟨ and IL-1. Animal models have demonstrated that the inhibition of these cytokines abolishes the process of erosive arthritis that occurs with their presence [16, 17].

Non-inflammatory arthritis has a distinctly different pathology and is less well understood. There is a cascade of cellular and biochemical events that occurs leading to the breakdown of articular cartilage, which is followed by insufficient cartilage repair. The biochemical events associated with osteoarthritis include a loss of collagen matrix, resulting in an increase in water content, alterations in proteoglycan composition, and an increase in proteolytic enzymes and cytokines (IL and TNF). The increase in cartilage degradation and repair processes results in an increase in cartilage breakdown products, as well as an increase in the synthesis of cartilage proteoglycans [16, 17]. Adhesive capsulitis (or frozen shoulder) has an uncertain etiology characterized by the restriction of active and passive motion, usually accompanied by severe pain. Both primary and secondary adhesive capsulitis exist, with the onset of the former often being slow and insidious after minimal or no trauma. Secondary frozen shoulder has been linked to disorders, such as impingement, but can also be associated with systemic disease such as thyroid disease or diabetes.

There is disagreement in the literature as to whether the underlying pathologic process is inflammatory in

nature or a fibrotic condition [8, 18-20]. A comparison of tissue biopsies of shoulder capsule and synovium in patients with adhesive capsulitis compared with those with synovitis demonstrated an increased expression of TGF- ® , platelet-derived growth factor (PDGF), and hepatocyte growth factor. Staining for the growth factors and the receptor isolated preferentially to the synovial tissue rather than the capsule. A predominance of fibroblasts and synovial cells were identified. The elevated presence of the inflammatory mediators suggest that adhesive capsulitis is likely to be a continuum of synovial inflammation that precedes the capsular fibrosis [8].

Non-pharmacologic Treatment

Options for the Painful Shoulder

Physical therapy is generally considered to be the first step when treating patients with persistent shoulder pain. The specific approach to therapy is dictated by the diagnosis at presentation.

Impingement and Rotator Cuff Disorders

Physical therapy is the initial treatment of the patient with impingement and rotator cuff disorders. Investigation has led to a greater understanding of the specific muscle groups involved and has brought attention to the entire arm as a kinetic chain [21], which has subsequently led to more targeted therapy on scapular stabilizers [22]. Both supervised physiotherapy and self-guided training programs have shown to significantly improve range of motion and decrease pain [23]. The goals of physical therapy are to recover and maintain a passive range of motion and to strengthen the rotator cuff once acute symptoms have abated [24]. The first step in physical therapy is to strengthen the cuff in a non-impingement range of motion, below the horizontal plane. An individualized stretching program should be carried out several times a day. Passive arcs in all positions should reach at least 80% that of normal, prior to initiation of strengthening exercises that place the arm in a provocative position for impingement. Once pain-free range of motion is achieved, strength should be restored through a rotator cuff and scapular stabilization program [25]. Multiple studies have demonstrated the benefits of physical therapy for impingement and rotator cuff disorders. Results from these studies have shown that initial management with a program of continuous passive motion significantly improved the range of motion [26, 27]. Findings from a 12-month study of 90 consecutive patients with rotator cuff disease and a positive impingement sign also indicated that exercises aimed at strengthening the stabilizers and decompressors of the shoulder are effective in improving mean constant scores over one year of follow-up [28]. The American Academy of Orthopedic Surgery (AAOS) guidelines indicate that a majority of patients presenting with rotator cuff disorders will respond favourably to an effectively designed physical therapy program within several weeks. If a favourable response does not occur, the diagnosis should be revisited and the possibility of structural damage requiring alternative therapy should be considered [24].

Osteoarthritis of the Glenohumeral Joint

Physical therapy to maintain motion and strength (although not so aggressive as to aggravate the patient's condition) is recommended for patients with glenohumeral osteoarthritis [24]. Unlike patients with adhesive capsulitis, they should not be encouraged to 'push' through the pain as structural changes associated with arthritis often cause a mechanical block to motion. Pre-operative physical therapy for patients with glenohumeral arthritis should be focused on increasing range of motion within these mechanical limits and improving rotator cuff and scapulothoracic muscle strength [29].

Adhesive Capsulitis

Physical therapy is also recommended for patients with adhesive capsulitis. The treatment program for these patients should initially focus on regaining range of motion and, once this is achieved, improving strength [24]. Multiple controlled clinical trials have documented the effectiveness of physical therapy for patients with adhesive capsulitis in improving range of motion [30-32]. Vigorous exercises are contraindicated in the patient with adhesive capsulitis because of the pain associated with rupture of

adhesions. In addition, more aggressive and painful rehabilitation regimens have been associated with poor patient compliance [33].

Oral Pharmacotherapy

Non-Steroidal Anti - Inflammatory

Drugs and Cyclo-oxygenase-2

Oral non-steroidal anti-inflammatory drugs (NSAIDs) are considered to be first-line systemic pharmacotherapy for patients with shoulder pain [24, 34]. Both conventional NSAIDs and more recently developed cyclo-oxygenase-2 (COX-2) selective inhibitors have demonstrated efficacy in patients with shoulder pain in a small number of controlled clinical trials [35-37]. Unfortunately, there is concern about the use of these agents due to the high risk of gastrointestinal (GI) side effects (conventional NSAIDs) and the potential for increased cardiovascular (CV) risk (conventional NSAIDs and COX-2) [38-41]. NSAIDs also have renal, haematological, dermatological, and neurological side effects that may limit their use [43]. Elderly patients may be at a particular risk; NSAIDs should therefore be used with caution [43]. NSAIDs may blunt the effects of diuretics, ⬚-blockers, angiotensin converting enzyme (ACE) inhibitors, and angiotensin type- receptor antagonists, which can lead to loss of blood pressure control in patients with hypertension. NSAIDs can also interfere with digoxin levels, potentiate anticoagulants, and interact with platelet inhibitors, thus leading to a higher bleeding risk in patients taking these drugs [42, 44]. A short course of NSAID therapy is generally recommended for patients with shoulder pain [45]. The increased CV effects of NSAIDs and COX-2 inhibitors have been shown only with long-term therapy (more than two to three months).To decrease adverse GI side effects associated with conventional NSAID therapy, a proton pump inhibitor can be co-administered. This pump has been shown to heal ulcers and decrease the risk of recurrence in clinical trials [46, 47].

Acetaminophen

Acetaminophen can be considered a reasonable alternative to NSAIDs for pain relief, but it can also increase the risk of CV disease (CVD). Results from two prospective cohort studies among older women (51 to 77 years of age) from the Nurses' Health Study I and younger women (34 to 53 years of age) indicate that both older and younger women who took a dose of more than 500mg/day of acetaminophen were at significantly greater risk from the development of hypertension compared with controls [48]. The benefit of acetaminophen is decreased GI risk when compared with traditional NSAIDs.

Opioids

Opioid analgesics may be used for the treatment of patients with shoulder pain. Opioids are often delivered in fixed-dose combinations with either an NSAID or acetaminophen. These combinations are generally recommended for the treatment of patients with moderate to severe pain [49]. Safety concerns for opioid analgesics vary somewhat from one product to another, but these drugs are generally contraindicated in patients with significant respiratory depression. Opioids also have significant liability for abuse.

Local Therapy Corticosteroid Injection

Corticosteroid injections are commonly used for the treatment of shoulder pain. Current AAOS guidelines recommend subacromial injection with a mixture of a local aesthetic and a short-acting corticosteroid in patients with rotator cuff disorders that do not respond to physical therapy and oral anti-inflammatory medications.

However, current guidelines do not specifically recommend such injections for patients with either adhesive capsulitis or glenohumeral osteoarthritis [24]. Nevertheless, corticosteroid injections are used widely in clinical practice for patients with shoulder pain of all etiologies and are occasionally employed in conjunction with physical therapy as an initial treatment for patients with shoulder pain. The response to injection is generally rapid and pain relief may enhance the benefits achieved with physical therapy [33]. Results indicate that injection of a corticosteroid is significantly superior to a local injectable aesthetic in providing long-term pain relief and improving range of motion in patients with subacromial impingement [50, 51]. In contrast, Alvarez et al. found no significant benefit of a subacromial injection in patients with tendinosis or a partial rotator cuff tear with symptoms for longer than six months who had failed physical therapy and a trial of NSAIDs [52]. Two studies have demonstrated the efficacy of corticosteroid injection alone or in combination with physical therapy in the treatment of adhesive capsulitis [53, 54]. There is still considerable variability in the results of subacromial corticosteroid injection. It is hypothesized that this may be due to the degree of inflammation involved in the patient's acute pathology. Steroid injections may be most beneficial in patients with inflammatory disease and less effective in those with long-term pain, such as osteoarthritis. Other variables affecting the outcome may be needle placement, anatomical site of inflammation, frequency and dose of injection, and type of corticosteroid delivered [55].

Hyaluronate Injection

There is a growing body of evidence supporting the use of intra-articular injections of sodium hyaluronate preparations in patients with shoulder pain. Hyaluronans are large polysaccharide molecules found naturally in the synovial fluid, which help to create a viscous environment cushioning joints and preserving normal function [56]. Hyaluronans are used extensively in the management of osteoarthritis of the knee and clinical trial results have documented their effectiveness for this indication [57, 3]. Results also suggest that the highest molecular-weight hyaluronic acid may be more effective than lower molecular-weight hyaluronic acid in treating osteoarthritis [58]. Hyaluronic acid injections have also been evaluated in small-scale studies of patients with rotator cuff tears [59], extra-articular arthritis of the shoulder [60, 61], adhesive capsulitis [62], and shoulder osteoarthritis [63]. Results from all these studies indicate the significant benefits of active treatment over placebo in relieving pain, improving range of motion, and decreasing the use of oral analgesics. The first large-scale randomized controlled study evaluating sodium hyaluronate

injections in patients with shoulder pain provided support for the efficacy of this therapy. This trial included 602 patients with diagnoses such as osteoarthritis, rotator cuff tear, and/or adhesive capsulitis. All patients enrolled in the study had a limited range of motion and had failed conventional non-operative modalities. Patients without arthritis experienced no benefit compared with a placebo injection, while patients with osteoarthritis who received the series of injections experienced statistically significant pain relief [64]. While the range of patients that may benefit from non-surgical intervention with sodium hyaluronate injection therapy is not yet clear, it is reasonable to suggest that these injections may be most effective in individuals with persistent pain compared with those experiencing acute inflammation. The relative lack of side effects and concern over CV risk and other systemic adverse effects may make this an attractive option for treatment.

Conclusion

Shoulder pain may occur as a secondary symptom to a wide range of conditions, including rotator cuff disorders, glenohumeral osteoarthritis, or adhesive capsulitis [34]. Despite the variable etiology, a similar stepwise approach to care appears to be appropriate for most patients who do not exhibit evidence of structural damage that would mandate immediate surgical intervention. The first step in treatment is physical therapy focused on improving range of motion and strength. Oral medications to decrease pain and inflammation is often administered to patients with shoulder pain, although the risk of potential side effects must be examined for each patient. Injection therapy with corticosteroids has demonstrated benefits for patients with rotator cuff disorders, adhesive capsulitis, and inflammatory disease. Recently, several studies have suggested that the injection of sodium hyaluronate is also effective for the treatment of shoulder pain, particularly those with glenohumeral osteoarthritis. Additional well-controlled trials are needed to better define which treatment modalities are likely to be the most effective in different subsets of patients with

shoulder pain.

Acknowledgement

Conflict of Interest

No Conflict of Interest.

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