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Intra-articular corticosteroid injection for the treatment of idiopathic adhesive capsulitis of the shoulder

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***Abstract*---**Treatment for idiopathic adhesive capsulitis or frozen shoulder of the shoulder is controversial. The hypothesis of the study is that intra-articular corticosteroid injection in the early stages of idiopathic adhesive capsulitis will lead to a rapid resolution of stiffness and symptoms. This is a prosspective cohort study of only patients with stage 1 or stage 2 adhesivecapsulitis. The diagnosis was made by history and physical examination and excluding other causes of shoulder pain and loss of motion. Stage 1 adhesive capsulitis was defined as patients with significant improvement in pain and range normalization of motion following intraarticular injection. Stage 2 included patients who had significant improvement in pain and partial improvement in range of motion following intra articular injection. 7 patients with stage 1 and 23 patients with stage 2 comprised the baseline cohort. The mean age was 59 years (range: 42 to 72); 8 patients were female and 22 patients had diabetes mellitus. All patients completed physical examination and shoulder rating questionnaire for symptoms and disability. Criteria for resolution were defined as forward flexion and external rotation to within 15^0 of the contralateral side and internal rotation to within three spinal levels of

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the contralateral side. Twenty six of the patients out of 30 met the criteria for recovery at a mean of 6.7 months. The mode and median time to recovery was 3 months. The mean score at final follow-up for 41 patients using the shoulder-rating questionnaire of L_Insalata was 90 (range 52–100). The mean time to recovery for the stage 1 patients was 6 weeks (range: 2 weeks to 2 months), and it was 8 months for stage 2 patients (range: 4 weeks to 1 year). Glenohumeral corticosteroid injection for early adhesive capsulitis may have allowed patients to recover motion at a median time of 4 months. Patients with stage 1 disease tended to resolve more rapidly than stage 2 patients. Prompt recognition of stage 1 and stage 2 idiopathic adhesive capsulitis and early injection of corticosteroid with local anesthesia may be therapeutic and diagnostic.

***Keywords*---**corticosteroid injection, idiopathic adhesive capsulitis, shoulder.

Introduction

Adhesive capsulitis is a condition characterized by spontaneous onset of shoulder pain and gradual loss of active and passive shoulder motion. It is a common cause of shoulder pain and disability estimated to affect 2–5% of the general population[1] The aetiology of adhesive capsulitis remains unclear; however, the factors associated with adhesive capsulitis include female, trauma, age older than 40 years, diabetes, prolonged immobility, thyroid disease, stroke, myocardial infarcts and presence of autoimmune disease.[2]

The treatment for idiopathic adhesive capsulitis or frozen shoulder of the shoulder remains controversial. Certain investigators have recommended benign neglect based on the fact that the natural history of this condition has been purported to be self-resolving [3,4].. Treatment options documented in the literature include supervised physical rehabilitation [5, 6, 7, 8], nonsteroidal anti-inflammatory medications [9,10], oral corticosteroid [11], intra-articular corticosteroid injection [6, 13, 14, 15], distension arthrography [16], closed manipulation [15, 17, 18, 19], open surgical release, and arthroscopic capsular release [19, 20,21]. While surgery has been demonstrated to shorten the natural history of this condition [19], the complications associated with surgery and anesthesia are important considerations. The rationale of using corticosteroid injection for glenohumeral joint is to reduce synovial inflammation with capsular fibrosis allowing improvement of motion and decreased time to functional recovery. We hypothesized that the use of intra-articular corticosteroid for stage 1 and 2 idiopathic adhesive capsulitis will lead to resolution of stiffness and symptoms.

Methods

All patients presenting with a preliminary clinical diagnosis of stage 1 or stage 2 Adhesive capsulitis presenting to orthopedic OPD satisfying the inclusion criteria during the study period were identified over a 1-year period. The diagnosis of adhesive capsulitis was made based on history, clinical examination and

confirmed by a non-image guided intra-articular injection (see below). This diagnosis was made when patients presented pain with loss of motion compared to the contralateral shoulder and only when other causes were eliminated [4,22,23, 24].

Rotator cuff tendinopathy was excluded based on physical findings, including normal strength and lack of impingement signs. Glenohumeral arthritis and neoplasm were excluded by radiographs. Pain associated to the acromioclavicular joint or biceps was ruled out on lack of tenderness with palpation of these structures. MRI was not obtained routinely as adhesive capsulitis is a clinical diagnosis. Institutional review board approval was taken and informed consent was obtained for all patients. This injection of corticosteroid and local anesthesia was used both to confirm the diagnosis ,stage the disease and for therapeutic treatment. Following the injection, patients were made to do simple pendulum exercises and reexamined 15 min to evaluate pain, determine passive range of motion (ROM) of shoulder, and to define the stage of adhesive capsulitis. If the patient had significant improvement in pain and normalization of motion within 30 min after the injection, this confirmed the diagnosis of stage 1 adhesive capsulitis. If the patient had a significant improvement in pain with partial improvement in ROM, a diagnosis of stage 2 adhesive capsulitis was made.

Patients were given anti Inflammatory medication and started with physiotherapy. The physical examination included both evaluation of cervical spine and the shoulder. All patients had pain on palpation of the anterior and posterior capsule that was exacerbated by ROM of the arm. Range of motion measurements, including active and passive forward flexion, abduction, internal rotation (by making the patient place the thumb to the highest possible spinous process), and external rotation in neutral abduction, were measured and recorded with the patient standing. On physical examination, all patients had a restriction of motion, including a lack of external rotation compared to the contralateral shoulder in each case.

All patients underwent routine radiographic evaluation including anteroposterior views in internal and external rotation, axillary and outlet views to rule out glenohumeral arthritis, calcific tendinitis, a superiorly migrated humeral head, or other processes. Patients with radiographic abnormalities or a history of preexisting shoulder pathology were excluded. All patients presenting with a preliminary clinical diagnosis of stage 1 or stage 2 adhesive capsulitis based on the criteria described above were treated with an intra-articular injection of local anesthetic and corticosteroid. Under aseptic precautions, parts prepped with 10% povidone iodine and and draped .The glenohumeral joint was injected via a posterior approach using traditional posterior arthroscopic portal landmarks utilizing a 21-gauge spinal needle. The needle was advanced until the capsule was penetrated. The solution injected contained 9ml of 2% bupivacaine and 1ml of methyl prednisolone (40mg). All patients received only one injection.

Seven patients with stage 1 and 23 patients with stage 2 comprised our cohort at baseline. The mean age was 59 years (range: 42 to 72). Eight patients were female and 22 male. Seventeen patients had diabetes mellitus. One patient had a prexisting hypothyroidism. Patients completed a shoulder rating questionnaire to

measure symptoms and disability at final follow-up [25]. Detailed ROM assessments were performed preinjection, postinjection, and at all subsequent visits by the treating surgeon. Range of motion was measured by the treating surgeon . This information was accessed by chart review.

The exact time to recovery of motion is difficult to determine because patient follow-up visits are usually at least 6 weeks apart and motion may be limited in one plane but not another. Therefore, it was determined a priori that patients who had regained motion to within 15 of the contralateral side in both forward flexion and external rotation as well as internal rotation to within three spinal levels of the contralateral side were considered recovered. It was felt that this amount of motion limitation was acceptable following treatment for this condition and that it would not cause functional limitations for the patients.

Results

26 of the 30 patients studied met the criteria for recovery at a mean of 6.7 months. The mode and median time to recovery was 3 months. The mean score at final follow-up for 27 patients using a validated shoulder scale (shoulder rating questionnaire of L_Insalata et al. [25]) was 90 (range: 52 to 100). 3 patients did not complete the follow-up questionnaire because of unavailability. One patient who was stage 1 and two patients who were stage 2 were lost to follow up and had not resolved at 2 weeks and a mean of 3 months following the injection, respectively.

The mean time to recovery for stage 1 patients was 6 weeks (range: 2 weeks to 3 months) and 8 months for stage 2 patients (range: 4 weeks to 1 year). The mean time to recovery for the stage 2 group was affected by two patients who were not documented to have met the criteria for recovery until the 1-year mark (see Figs. 1 and 2). Fifteen patients met the criteria at 2 months or less.

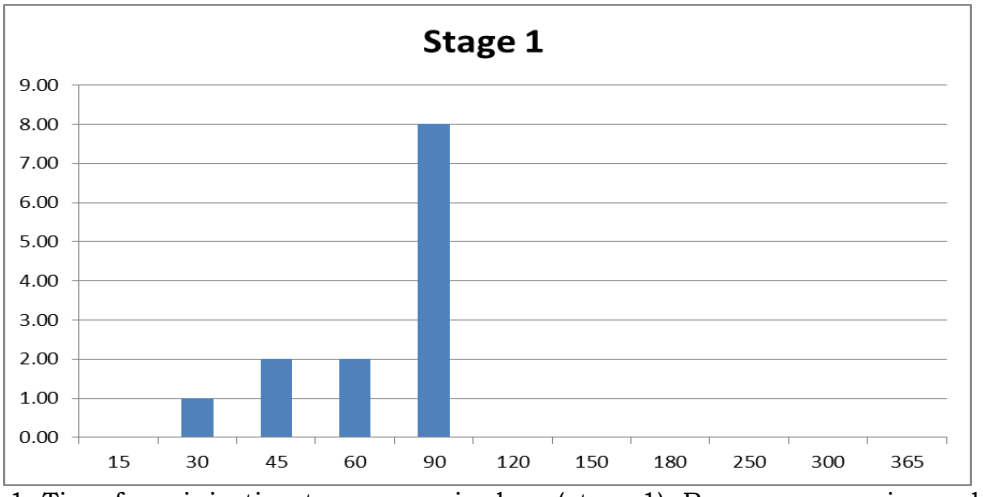

Fig. 1. Time from injection to recovery in days (stage 1). Recovery = maximum loss of 15- in external rotation and forward flexion or a maximum loss of internal rotation of three spinal levels, compared to the contralateral side

The duration of symptoms prior to injection and the time to recovery were found to be related, although this association was not statistically significant (Pearson r=0.26; p=0.34). In the group of patients successfully treated with intra-articular injection, the stage 1 patients recovered more rapidly than the stage 2 patients (mean of 42 days for stage 1 and 238 days for stage 2, p=0.006; Mann–Whitney U test).

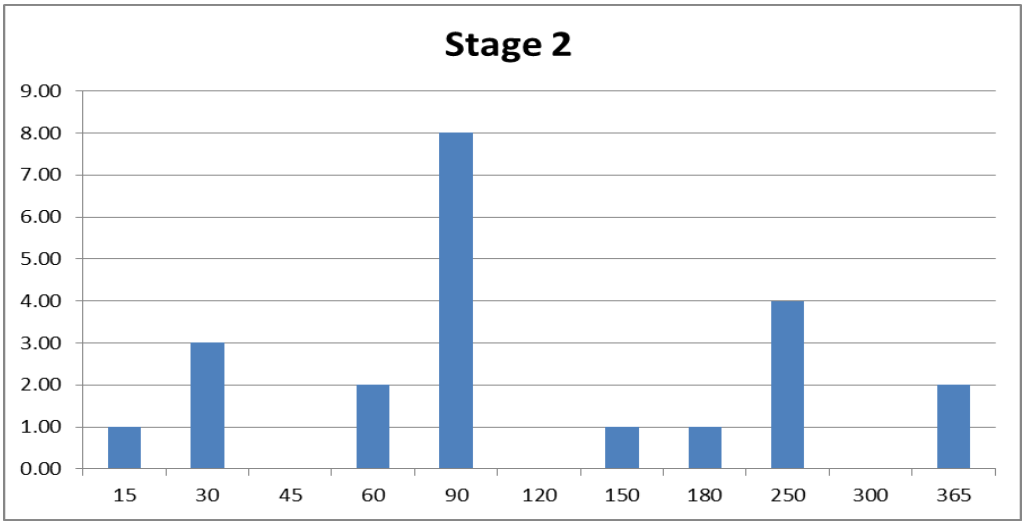

Fig. 2. Time from injection to recovery in days (stage 2). Recovery = maximum loss of 15- in external rotation and forward flexion or a maximum loss of internal rotation of three spinal levels, compared to the contralateral side

One patient in stage 1 was lost to follow-up. Two patients with stage 2 did not return for physical examination to determine whether they had recovered. These patients final physical examination prior to being lost to follow-up was at a mean of 3 months (range 0–4.5 months).

Discussion

Neviaser and Neviaser initially described a staging system for adhesive capsulitis [23]. The four stages ranged from synovial inflammation with limited motion to adhesive synovitis, to more mature adhesions with less synovitis, and finally to mature adhesions with limited motion. Subsequently, Hannafin et al. correlated clinical, arthroscopic, and histological findings to further refine the definition of the first three stages previously described [26]. In stage 1, the patient presents with pain and limited motion. In this first stage, full ROM is obtained on examination under anesthesia. Pathologic analysis reveals an inflammatory synovitis with normal underlying capsule. The second stage involved pain with limited ROM, whichis not restored on exam under anesthesia. The pathology revealed synovial hyperplasia and capsular fibroplasia and fibrosis. The third stage is characterized by mild pain withmarked loss of motion, minimal synovitis, and capsular fibroplasia with dense capsular scar formation. The fourth stage, or "thawing phase," is unchanged from the description of Nevaiser.

To formulate a logical and scientific approach to the treatment of patients with adhesive capsulitis, it is necessary to understand the pathophysiology of this disease. A review of the literature reveals a multitude of strategies for treatment of patients with adhesive capsulitis, with extremely variable results. The lack of consistency in the published literature reflects a lack of understanding of the stages of adhesive capsulitis, which play a significant role both in diagnosis and in formulation of a treatment plan. Conventional orthopedic wisdom is that non operative treatment of this condition will lead to recovery if the patients are followed over a long enough period of time. However, one long-term follow-up study demonstrated thatat a minimum 3-year follow-up, 50% of patients reported pain or stiffness or both [27]. The mean time to recovery in this study was 12 months.

Other investigators have followed patients for a mean of 25 months, with a minimum of 6 months [28]. The investigators found that a statistically significant improvement in a shoulder rating scale (the simple shoulder test), as well as the physical function, role physical and bodily pain subscales of the SF-36. They concluded that the home program leads to improved self-assessed shoulder function. However, only 56% were able to place an 8-lb weight on a shelf, and only 66% were able to carry 20 lb at their side.

Others have studied the effects of arthroscopic debridement and release for this condition. While arthroscopic surgery has been shown to improve symptoms in these patients, the risks of complication and the recovery period associated with surgery make this treatment less desirable[19, 29, 30,31].These data and others present in the literature support the hypothesis that adhesive capsulitis is both an inflammatory and a fibrotic condition [7, 8, 13, 32, 33]. The hypervascular synovitis present in the early stages results in subsequent fibrosis of the subsynovium and capsule.

Cytokines have been implicated in the inflammation and fibrosis described in adhesive capsulitis. Cytokines are also involved in the initiation and termination of repair processes in multiple musculoskeletal tissues, and their sustained production has been shown to result in tissue fibrosis [12]. In a series of 12 patients with inoperable gastric cancer treated with a synthetic matrix metalloproteinase inhibitor, six developed a frozen shoulder or a Dupuytrens like condition [38].

We hypothesized in this study that early treatment with intra-articular corticosteroid provides a chemical ablation of the synovitis, limiting the subsequent development offibrosis and shortening the natural history of the disease. The self-limiting nature of adhesive capsulitis also supports the role of the synovium in initiation and regulation of the fibroticprocess in the capsule. With resolution of the synovitis and termination of capsular scar formation, capsular remodeling and recovery of ROM occurs. This hypothesis is supported bythe orthopedic and rheumatalogic literature [32, 33].

Van der Windt et al. compared glenohumeral injection of corticosteroid to 6 weeks of physical therapy for patients with “painful stiff shoulders”. It is unclear how many of these patients truly had adhesive capsulitis. They found significant

improvements in pain, disability, and motion inthe injection group at 3 and 7 weeks [34]. Response to intra-articular steroid was not related to stage of disease. However, at 26 and 52 weeks there was minimal or nodifference between the two groups.

Gam et al. treated patients with adhesive capsulitis with either steroid injection or steroid injection and distension with 19 cm3 of Lidocane. They found that the distensionwith steroid group (12 patients) used fewer analgesics and had improved motion compared to the steroid-only group (eight patients). However, the visual analog pain scores for the groups were similar [35]. Again, the duration of symptoms and stage of adhesive capsulitis was notcorrelated with response to treatment. Bulgen et al. [12] randomized patients to treatment with steroid, physical therapy, ice, or benign neglect. The initial positive response to treatment was most marked in patients treated with steroid; however, no significant difference in final long-term outcome was reported when treatment groups were compared.

Hazleman [36] summarized numerous studies on the use of intra-articular corticosteroid and reported that success of treatment is dependent on the duration of symptoms. Patients treated within 1 month of onset of symptoms recovered in an average of 1.5 months. Patients treated within 2 to 5 months of onset of symptoms recovered in 8.1 months; patients treated 6 to 12 months after onset of symptoms required an average of 14 months for full recovery. In this prospective cohort study of glenohumeral corticosteroid injection for early adhesive capsulitis, we found that patients motion loss recovered at a median time of 3 months. In many cases, the patients had improved prior to the 3-month mark; however, that was the routine time point for follow-up. Patients with stage 1 disease tended to resolve more rapidly than the stage 2 patients. Literature indicated that, early in the course of adhesive capsulitis,synovitis is present without capsular fibrosis [37]. In this setting, early chemical ablation of the synovitis would result in decreased scar formation in the capsule and potentially improved ROM.

The duration of symptoms prior to injection was related to the time to recovery, although this relationship was not statistically significant. This association would also be supported by the basic science research, as a prolonged symptomatic time period would allow for greater capsular fibrosis, which would then lead to a longer time to recovery.

It is difficult to define recovery for this condition. We elected to use recovery of ROM as our outcome. Range of motion is a continuous variable, with multiple follow-up measures in several planes of motion. For ease of interpretability, we converted recovery of range of motion to a binary variable (i.e., recovery or no recovery). While the recovery criteria were defined a priori based on what was felt to constitute a clinically relevant end-point, there is no standard available to determine recovery

In summary, corticosteroid injection in the early stages of adhesive capsulitis allows the patient to regain motion prior to developing severe fibrosis in many cases. Patients who were treated in stage 1 recovered more rapidly than those in

stage 2. Prompt early recognition of stage 1 and stage 2 idiopathic adhesive capsulitis and early injection of corticosteroid and local anesthesia are both diagnostic and therapeutic.

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