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Functional Outcome of Ultrasound Guided vs Blind Steroid Injection in Adhesive Capsulitis: A Prospective Study

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ABSTRACT
Adhesive capsulitis is a self-limiting disorder that is commonly managed non-operatively. But it could take two or three years for the symptoms to completely go away. Only a minor but substantial percentage of people need surgery. For primary adhesive capsulitis, glenohumeral joint hydrodilatation with corticosteroids has been suggested as an efficacious subsequent treatment approach. According to some research, intra-articular injections with ultrasound guidance, or US-guided injections, are more precise and successful than injections done blindly. To compare efficacy and accuracy of US-guided injections versus blind injections of steroid in the glenohumeral joint in patients with adhesive capsulitis. The present study is a prospective study conducted for a period of 18 months. A total of 40 cases diagnosed with shoulder adhesive capsulitis were included. Patients were divided into 2 groups with 20 patients in each group randomly and underwent intra-articular injection either blind or under guidance of ultrasound by a specialist. Demographic characteristics, their functional status, the severity of pain and the Range of motion (ROM) were gathered and compared between the two groups. Results were analyzed using SPSS 20.0 version and the association was tested using Chi square test. Participants in the two groups were almost equal in terms of their average age, gender distribution, as well as dominant/non-dominant side ratio. During the first and fourth weeks following injection, the US-guided injection group experienced a significantly higher improvement in pain intensity and range of motion (flexion, extension and external rotation) compared to the blind injection group ($p<0.05$). Prompt diagnosis of stage 1 and stage 2 idiopathic adhesive capsulitis, as well as early corticosteroid injection under local anesthetic, may be both diagnostic and therapeutic. During the initial weeks of treatment, US-guided intra-articular injections may provide a therapeutic advantage over a blind method for the treatment of adhesive capsulitis. Patients are able to regain range of motion more quickly. The findings suggest that better treatment for adhesive capsulitis may arise from enhanced targeting to the intra-articular area with the aid of US-guidance.

INTRODUCTION

Adhesive capsulitis, commonly known as frozen shoulder or periarthritis, is an unpleasant debilitating shoulder illness that affects about 3% of the population in the United States. Adhesive capsulitis is defined by the American Shoulder and Elbow Surgeons (ASES) as "a condition of unknown aetiology characterized by considerable limitation of both active as well as passive shoulder movement that occurs in the absence of a diagnosed intrinsic shoulder pathology[1]. Duplay was the one who first introduced it in 1896. It is characterized mostly by sudden chronic shoulder pain and progressive loss of shoulder motion, including all active as well as passive movements[1,2].

There are two categories for the disease: primary and secondary. Primary AC frequently presents as idiopathic with normal radiography findings and has a subtle onset. Hemiparesis, diabetes mellitus, rotator cuff tears and cardiovascular disorders are examples of the secondary kind of causes[3]. Three stages are often associated with adhesive capsulitis: Stage 1 (freezing stage) lasts for 2-9 months and is characterized by growing pain and stiffness., Stage 2 (frozen stage) lasts for 4-12 months and is characterized by persistent stiffness; and Stage 3 (thawing stage) lasts for 12-42 months and is characterized by spontaneous recovery[4].

Adhesive capsulitis can be distinguished from other common shoulder pathologies (such as rotator cuff tears, glenohumeral or acromioclavicular joint arthritis and impingement syndrome and) by its painful presentation, which is accompanied by a gradual reduction of both active as well as passive ROM (abduction along with internal/external rotation) in the absence of arthritis and calcific deposition. Although not diagnostic, patients frequently report increased discomfort at night and pain when sleeping[5].

The therapy goals are to reduce discomfort, restore movement and restore shoulder function. Nonsteroidal anti-inflammatory medicines (NSAIDs), corticosteroid injections and physical therapy are common therapeutic choices, with more invasive procedures such as capsular distension, manipulation under anaesthesia and arthroscopic capsular release considered when conservative treatments fail[6]. The majority of patients can be handled in primary care with non-operative treatment. Because of its cost-effectiveness and patient acceptance, intra-articular corticosteroids are frequently used as a conservative therapy for adhesive capsulitis[7].

Previous research has found that the success rate of intraarticular injections in the shoulder joint ranges from 10% to 46%. Soft tissue damage, tendons weakening, and skin depigmentation can all result with extra-articular injections[8]. Although few studies have identified no significant relationship between response to treatment and injection accuracy, a majority of research on the subject have found that correct injections are more effective than faulty ones. As a result, the purpose of the study was to compare the effectiveness of blind injections with ultrasound-guided injections in order to achieve a consensus on the use of imaging techniques as assistance for intra-articular injection among individuals with frozen shoulder.

MATERIALS AND METHODS

The present study was a prospective study conducted in the department of Orthopaedics, Sree Mookambika Institute of Medical Sciences, Kulasekharam for a period of 18 months from July 2022-December 2023. Convenience sampling was used to identify 40 individuals with stage 1 or stage 2 idiopathic adhesive capsulitis based on their physical and medical histories. Following intra-articular injection, considerable reduction in discomfort and normalization of motion was characterized as stage 1 adhesive capsulitis. Patients in stage 2 received great pain relief and substantial improvement in movement following injection.

Exclusion criteria included previous shoulder fractures, a history of joint inflammatory diseases or bone disorders, a history of surgical treatment in the affected shoulder, a history of shoulder physical treatment or injections in the affected shoulder in the previous 3 months, hypersensitivity reactions to steroids, and disease recurrence.

The patients were separated into two groups of equal size. There were 20 patients in the blind group and 20 in the USG guided group. Data on demographic parameters of the patients, such as age, gender, height, weight and a history of diabetes, hypertension, hypothyroidism and coronary artery disease (CAD), were collected using a questionnaire. The remaining data for the study was gathered in three stages: before the injection, one week after the injection and four weeks after the injection. The data included the severity of pain as measured by the visual analogue scale (VAS)[9], the functional status of patient as measured by the Oxford questionnaire[10] and ROM measurements documented in the patient charts in five planes: flexion, extension, abduction, internal rotation, as well as external rotation in neutral abduction as measured by a goniometer. A single treating physician performed all ROM measurements prior to injection and at all subsequent post-injection visits.

The posterior technique was used in the blind group, and the 25-gage needle was inserted 2.5 cm lower than the posterolateral portion of the acromion. Initially, 1 cm3 of 1% lidocaine was injected, followed by 3 cm3 of water soluble un-ionized contrast and 1 cm3 of distilled water. Lastly, 1 cm3 of 40 mg/cm3 triamcinolone was injected together with 1 cm3 of 1% lidocaine. With the patient seated and the injured hand resting on his or

her thigh, the same consultant administered injections to the ultrasound-guided group using an Alpinion E-cube 7 ultrasound instrument with a linear 3-to 12-MHz probe. Using the posterior short axis method, the needle was inserted medial to the posterior portion of the humerus and in plane with respect to the ultrasound probe.

Data were entered into an Excel sheet. The SPSS 20.0 version was used to analyze the results. Quantitative variables were documented as the mean±standard deviation. The independent Student's t-test was used to evaluate the quantitative factors that differed between the two groups. A $p<0.05$ was considered statistically significant.

RESULTS AND DISCUSSIONS

There were forty participants in the study. The average age of the patients in the ultrasound-guided group was 51.36±9.02 years, while it was 53.65±8.75 years in the blind group. Male patients made up the bulk of both categories. There were 13 (65%) men and 7 (35%) women in the blind group. Ultrasound-guided group contained 15(75%) males and 5(25%) females. Adhesive capsulitis of the dominant extremity affected most individuals. In the blind group, 16 patients (80%) had dominant side adhesive capsulitis. Of the patients in the ultrasound-guided group, 14 (70%) developed adhesive capsulitis on their dominant side. The Blind group had a mean disease duration of 12.65±1.26 months, which was greater than the Ultrasound-guided group's mean disease duration of 11.24±1.98 months. Among the patients in Blind group 3(15%) patients had coronary artery disease, 2(10%) had diabetes as comorbidities and in Ultrasound-guided group 5(25%) patients had diabetes, 2(10%) had hypertension and 1(5%) patients had hypothyroidism.

The quantitative variables were measured before injection and after 1 and 4 weeks and were compared between the two groups (Table 1). The mean values for VAS score, Oxford score and ROM were higher in USG guided group than the blind group. On comparison, VAS score and ROM (Flexion, Extension and external rotation) showed statistically significant difference among both groups.

Adhesive capsulitis is characterized by gradually increasing discomfort and restriction of ROM in the afflicted shoulder. Patients frequently have significant restrictions with their shoulder's external rotation and abduction. In most situations, frozen shoulder is a self-limiting condition, however in other people, it may not go away entirely. There is no conventional approach available for these patients. Treatment options for this condition include particular exercise sessions, intra-articular injections, joint manipulation under general anesthesia, arthrographic capsular distention and surgical treatments, which are chosen uniquely for each patient based on their condition[5,8].

Table 1: Comparison of mean values for VAS score, Oxford score and ROM in both groups

Variable	Mean values	Blind group	Ultrasound-guided group	p-value
VAS score	After 1 week	3.7	4.1	0.012
	After 4 weeks	1.5	1.34	
Oxford score	After 1 week	6.98	7.14	0.761
	After 4 weeks	13.45	14.25	
Flexion	After 1 week	11.25	13.17	0.042
	After 4 weeks	23.56	29.68	
Extension	After 1 week	2.01	9.25	0.035
	After 4 weeks	2.78	12.56	
Abduction	After 1 week	17.24	19.28	0.57
	After 4 weeks	30.72	32.56	
Internal rotation	After 1 week	3.12	8.63	0.31
	After 4 weeks	6.82	11.21	
External rotation	After 1 week	6.12	14.26	0.025
	After 4 weeks	13.35	23.54	

Since adhesive capsulitis is thought to be an inflammatory and fibrotic condition, early intra-articular corticosteroid injection therapy may lessen synovitis, prevent capsular fibrosis from developing and change the course of the condition. Steroid injections into the glenohumeral joint have been shown to reduce inflammation, one of the pathologic processes contributing to this condition[8].

The current study included 40 patients with frozen shoulder and compared the two intra-articular injection procedures of blind and US-guided injections, taking into account improvements in discomfort of patient, function and ROM. Participants in the two groups were almost equal in terms of their average age, gender distribution, and dominant/non-dominant side ratio. Although the improvements were found to be more pronounced in the US-guided group, the variations among both groups were not statistically significant, with the exception of changes in shoulder flexion, extension and external rotation, which were significantly higher in the ultrasound group.

Raeissadat[11] in their study found that improvement in pain, ROM and functional score after 1 and 4 weeks was greater in the US-guided group, but the differences were not statistically significant, except for changes in extension, which were significantly higher in the US-guided group ($p=0.01$). Injection accuracy was similarly higher in the US-guided group (90% vs. 76.19%), although the differences were not significant ($p = 0.24$). This was similar to the current study.

Studies by Cho[12] and Balazs[13] found that during the follow-up period until 12 weeks following injection, both groups significantly improved in terms of VAS score, American Shoulder and Elbow Surgeons (ASES) Shoulder score, forward flexion, abduction, external rotation, and internal rotation ($p<0.001$). There was no significant difference in VAS score, ASES score, or ROM between the two groups ($p>0.05$).

Shang[14] included 8 RCTs and one quasi-RCT in their meta-analysis. With a PEDro score of 5, all studies had a minimal risk of bias and were of medium-high

quality. With the exception of VAS at 2-3 weeks (p=0.02) and ROM of internal rotation at 8-12 weeks (p=0.02), the pooled effect revealed no significant difference in the major outcomes between IA and SA corticosteroid injections. Subgroup studies revealed that the variations in VAS as well as ROM of the internal rotation did not persist for more than 2-3 weeks. Furthermore, SA injection offered the advantage of avoiding unfavorable corticosteroid effects, particularly a substantial change in serum blood glucose levels.

Verma[15] conducted a study to compare the efficacy of ultrasoundguided supra scapular nerve block (USNB) with intraarticular steroid injection (IASI) in the AC of the shoulder in terms of pain alleviation, functional improvement and disability reduction. The study discovered that both dimensions of SPADI (pain and disability score) and passive shoulder ROM improved considerably ($p<0.05$) within both groups at 1week, 3week, and 6week follow up as compared to baseline. But no statistically significant variations between the two groups were identified at baseline or follow up ($p > 0.05$).

Donati[16] observed that US-guided infiltration along with early rehabilitation treatment improved active joint ROM in 16 patients with post-COVID-19 syndrome after 10 weeks, particularly in shoulder elevation and abduction movements. Prior to therapy, the mean VAS score was 6.9±1.66. The VAS score after 10 weeks of treatment was 1±0.63. The study also found that US-guided hydrodistension combined with guided exercise was useful for individuals with post-COVID-19 syndrome adhesive capsulitis (phase 1) in terms of joint mobility recovery and pain reduction.

CONCLUSION

Overall, the results obtained suggest that US-guided injections for adhesive capsulitis patients may provide more improvement in pain relief, shoulder ROM and function. There is, however, no statistically significant relationship between the alleviation of symptoms in the patients. Given the minor advantages associated with US-guided injections, this approach may be a preferable option for individuals with adhesive capsulitis. The limited sample size in this study is one of its drawbacks. It is proposed that bigger sample sizes be used in future studies to reduce the second type error.

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