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Efficacy of Ultrasound-Guided Intra-Articular Steroid Injection and Hydrodilatation, Combined with Home Exercises in Patients with Adhesive Capsulitis: A Case Series

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Abstract

Background: Adhesive capsulitis is characterized by an initial painful phase leading to significant stiffness and limited range of motion in the shoulder joint. Early intervention is crucial to prevent long-term functional impairment and chronic discomfort. This case series aims to evaluate the efficacy of ultrasound-guided intra-articular steroid injection and hydrodilatation, combined with home exercises, in managing patients with adhesive capsulitis.

Methods: Six patients with shoulder pain were treated at a tertiary care centre from June 2022 to May 2024. Inclusion criteria included a Shoulder Pain and Disability Index (SPADI) score greater than 30 and a limitation of glenohumeral joint movement more than 25% in at least two directions. All patients received 10 ml of intra-articular steroid with local anaesthetic. Pain relief and range of motion were assessed immediately after intervention and during follow-up at 1, 6, 12, and 18 months.

Results: Immediate post-injection assessments showed dramatic pain relief and improvement in the range of motion of the shoulder joint. Further follow-up revealed that all patients experienced sustained pain relief and improved range of motion, with no reported complications.

Conclusion: Ultrasound-guided intra-articular steroid and local anaesthetic injections combined with home-based exercises are an effective regimen for managing adhesive capsulitis. Early diagnosis and appropriate treatment are essential for improved outcomes.

Keywords: Adhesive Capsulitis; Ultrasound-Guided Intraarticular Injection; Glenohumeral Approach; Methylprednisolone

Abbreviations

ROM: Range of Motion; SPADI: Shoulder Pain and Disability Index; DM: Diabetes Mellitus, IASLA: Intraarticular Steroid with Local Anaesthetic; SSN: Suprascapular Nerve Block; PROMs: Various Patient-Reported Outcome Measures; DASH: Disability of Arm Shoulder and Hand; ASES: American Shoulder and Elbow Surgeon score.

Introduction

Frozen shoulder, or adhesive capsulitis, is a disorder marked by an initial painful phase which leads to stiffness in the shoulder joint; then, the condition progresses into a fibrotic phase that is defined by a severe restriction in range of motion (ROM). Diagnosis is based on the American Academy of Orthopedic Surgeons' definition, which emphasizes the gradual development of global limitation of shoulder motion without significant radiographic findings [1] The incidence of frozen shoulder seems to be on the rise, and it disproportionately affects individuals with diabetes. Frozen shoulder affects approximately 3-5% of the general population [2]. In India, it is observed that the condition is slightly more prevalent among females compared to males, and it typically affects individuals aged between 40 and 70 years. The non-dominant arm is most commonly affected, and about 12-16% of patients with frozen shoulder may develop the condition bilaterally [3,4]. This condition is often associated with prolonged discomfort and functional impairment, making early intervention crucial.

Although the exact cause of adhesive capsulitis remains unclear in majority of cases, prolonged immobilization and inflammation of the shoulder joint are considered as the primary reasons for its development. The identified risk factors for the development of adhesive capsulitis are diabetes, hypothyroidism, dyslipidaemia, autoimmune disorders, and traumatic shoulder injuries such as fractures, rotator cuff tears or dislocations [5].

Although frozen shoulder is a self-limiting condition that resolves within 2 to 3 years for most patients, timely diagnosis and treatment are essential to avoid long-term sequelae and enhance the quality of life. Neglected frozen shoulder might result in chronic discomfort and functional impairment, negatively affecting day-to-day activities and general health [6]. We describe the successful management of six patients who visited our pain clinic with shoulder pain and limited range of motion.

Case Series

A total of six patients visited our newly established pain clinic between June 2022 and May 2024 at a tertiary care center (All India Institute of Medical Sciences, Bibinagar, Hyderabad). The demographic details are mentioned in Tables 1 & 2. There were two female patients and four male patients out of the six. The intervention was planned in patients with a SPADI (Shoulder Pain and Disability Index) score of more than 30/130 and limitation of both active and passive movements of the gleno-humeral joint > 25% in at least two directions (abduction, flexion, internal rotation, external rotation) [7].

Case no	Age (yrs)	Gender	Symptoms Duration (months)	Prior Physiotherapy/ Exercise	Date of Intervention	Affected Side
1	38	Male	3	No	21.06.2022	Left
2	49	Male	6	Yes	05.08.2022	Left
3	56	Male	6	Yes	21.10.2022	Left
4	46	Female	6	No	21.02.2023	Left
5	61	Male	12	Yes	10.10.2023	Right
6	73	Female	5	No	04.05.2024	Left

Table 1: Patient Demographic Details.

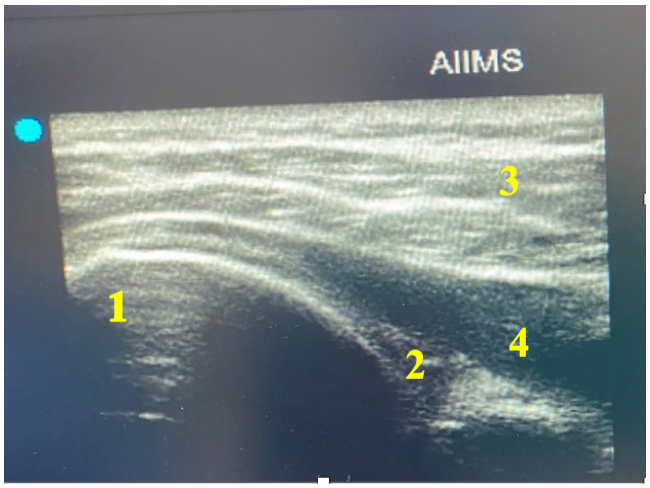
Case no	Age (yrs)	SPADI score	Comorbidities	Intervention	Drugs used for IASLA	Adherence to home exercise program
1	38	47	Nil	IASLA	Particulate Methylprednisolone 80 mg (2ml) + 0.25 % Bupivacaine (5 ml) + Normal saline (3 ml)	Good
2	49	54	DM + Hypothyroidism	IASLA	Particulate Methylprednisolone 80 mg (2ml) + 0.25 % Bupivacaine (8 ml)	Good

3	56	59	DM	IASLA + SSN	Particulate Methylprednisolone 80 mg (2ml) + 0.25 % Bupivacaine (10 ml)	Good
4	46	50	Nil	IASLA	Particulate Methylprednisolone 80 mg (2ml) + 0.25 % Bupivacaine (8 ml)	Good
5	61	60	Nil	IASLA + SSN	Particulate Methylprednisolone 40 mg (2ml) + 0.2 % Ropivacaine (10 ml)	Good
6	73	71	Nil	IASLA + SSN	Dexamethasone 8 mg (2ml) + 0.25 % Bupivacaine (8 ml)	Poor (due to old age)

Source: DM: Diabetes Mellitus, IASLA: Intraarticular Steroid with Local Anaesthetic, SPADI: Shoulder Pain and Disability Index, SSN: Suprascapular Nerve Block.

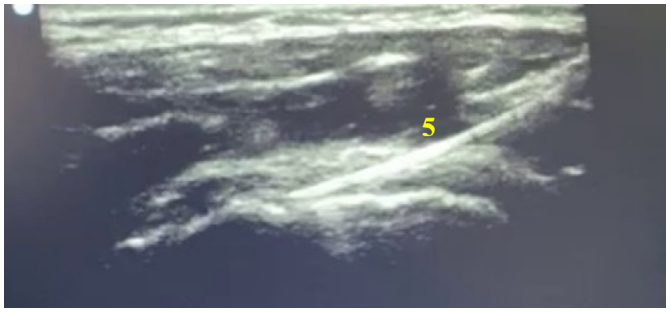
Table 2: Details of Patients' Disease Severity, Comorbidities, SPADI Score and Intervention.

None of our patients reported the use of antiplatelets or anticoagulants. No patient had a history suggestive of a bleeding disorder, stroke and autoimmune disorders. On the day of the procedure, written and informed consent was obtained. IV access was secured. Prophylactic broad-spectrum IV antibiotic coverage was provided at least 30 minutes before the procedure. Adequate control of blood sugar was ensured before the procedure in diabetic patients. Using the posterior glenohumeral approach to the shoulder joint an ultrasound-guided intra-articular shoulder joint injection was performed in all patients with 8 ml of 0.25% bupivacaine and 2 ml of steroid (Figures 1 & 2). Three were supplemented with ultrasound-guided suprascapular nerve block with 5 ml of 0.25% bupivacaine.



Source: 1: Humeral Head, 2: Glenoid Labrum, 3: Infra Spinatus Muscle, 4: Deltoid Muscle.

Figure 1: Ultrasound Image of the Shoulder in a Patient with Adhesive Capsulitis.



Source: 5: Needle Entering the Joint during the Intraarticular Injection.

Figure 2: Ultrasound Image Showing the Accurate Placement of Needle Tip via the Posterior Approach.

10-15 minutes after the injection, passive external rotation, abduction, flexion and internal rotation of the shoulder was done after ensuring adequate analgesia to facilitate adhesiolysis. All patients were advised to take oral analgesics (paracetamol and tramadol) for the needle pain for a week, oral antibiotics for two days and ice packs over the joint thrice a day for a week. All subjects were taught in home exercises that involved shoulder mobility such as abduction against the wall (wall walking/wall climbing exercise, both facing the wall and side to wall) (Figure 3), shoulder stretching exercises and rotations. Patients were assessed for Pain relief and range of motion immediately after the procedure, and at 1, 6, 12, and 18 months post-intervention.

Source: 1: Abduct Arm, 2: Start to Lift with Fingers Crawling on the Wall, 3: Abduct More Than 90 Degrees, 4: Abduction Over Head up to 180 Degrees.

Figure 3: Showing the Steps of Shoulder Joint Abduction against the Wall (wall climbing exercise) for Post Invention Home Exercise.

Results

The details of pain relief and improvement in the range of motion are mentioned in Table 3. The pain relief and range of motion were assessed immediately after intervention and after one month. The pain relief and range of motion were evaluated telephonically at 6 months, 12 months, and 18 months (Table 3). After 10 minutes of intervention, all patients were able to abduct the shoulder overhead on their own. Five patients had pain relief of more than 80% immediately, and the relief continued throughout the follow-up period. None of the patients reported any complications.

Case no	Pain relief following intervention (%)					Range of abduction (%)				
	Post-procedure	1 mon	6 mon	12 mon	18 mon	Post-procedure*	1 mon	6 mon	12 mon	18 mon
1	90	100	100	80	100	Achieved	90	90	100	100
2	10	40	90	90	100	Achieved	80	90	90	90
3	80	80	100	100	100	Achieved	70	70	80	80
4	50	100	100	90	100	Achieved	100	100	100	100
5	50	100	80	80	-	Achieved	60	70	80	-
6	100	100	-	-	-	Achieved	50	-	-	-

Source: *(asterisk): Able to Achieve Overhead Shoulder Abduction after Intervention.
Table 3: Outcomes after Intraarticular Steroid Injection.

Discussion

Frozen shoulder is a self-resolving disorder that typically follows a three-phase course: freezing, frozen, and thawing. Restoring the range of motion, controlling pain and inflammation, and progressively enhancing function are common components of treatment. Early intervention can significantly improve patient outcomes and quality of life. The commonly used therapies include physiotherapy, oral anti-inflammatory drugs, intra-articular steroid injections, hydrodilatation (arthrographic distension) with local anaesthetic, and surgical procedures such as arthroscopic capsular release and manipulation under general anaesthesia.

In most cases, a thorough history and physical examination are adequate for diagnosing adhesive capsulitis. Imaging studies like X-rays, MRI, and ultrasound, is generally not required for the confirmation of the diagnosis. However, X-rays and ultrasound are commonly advised to exclude other pathological conditions such as shoulder arthritis, rotator cuff injuries, bursitis, etc. Although adhesive capsulitis typically affects patients aged 40 to 70 years, in our series, the oldest patient is 73, and the youngest is 38 [8].

Due to it's the availability of limited evidence, no standard recommendations are available to treat this condition. Recent metaanalysis has shown that ultrasound-guided single steroid injection combined with arthrographic distension (hydrodilatation) [9]. The commonly used medications are triamcinolone (20 to 40 mg), and methylprednisolone (40 to 80 mg); however there is not enough data to support superiority [10]. In our series, all patients were treated with 2 ml steroid injections with 8 to 10 ml of local anaesthetic and normal saline to facilitate analgesia and hydrodilatation. Three patients with severe shoulder pain received ultrasound-guided suprascapular nerve block in addition to intraarticular steroid injection for better pain relief. With the exception of one patient, there was [3] 80% improvement in pain and range of motion at 12 months following intervention. The limited improvement in shoulder mobility for this patient may be due to her advanced age (73 years).

Ultrasound-guided injections improve success rates; avoid the use of ionizing radiation (C-arm), less expensive, faster, with reduced complications such as intra-labral and intra-tendinous injections. It allows for real-time visualization of the joint structures and dynamic assessment of the joint and rotator cuff. Furthermore, compared to aggressive physiotherapy and surgical manipulation, intra-articular injections lower the risk of potential complications, such as rotator cuff tears, labral detachment, and fractures [2,11-13].

The incidence of frozen shoulder is higher in individuals with diabetes mellitus. Two of the six patients in our series had diabetes mellitus. Diabetes increases the risk of developing a frozen shoulder for various reasons. Metabolic alterations with diabetes damage collagen and connective tissue, increasing the risk of shoulder inflammation and fibrosis. Poor glycaemic control and hyperlipidaemia can play a role in the onset of frozen shoulder by impairing joint health and raising the risk of inflammation [14]. Additionally, diabetic complications such as diabetic neuropathy and joint stiffness are associated with restricted movement of the shoulder, which can also increase the risk of developing adhesive capsulitis of the shoulder [14].

Various patient-reported outcome measures (PROMs) such as the Shoulder Pain and Disability Index (SPADI), Disability of Arm Shoulder and Hand (DASH), and American Shoulder and Elbow Surgeon score (ASES), etc., were used to assess the severity of diseases and outcomes in patients with shoulder diseases. Among these, SPADI showed the highest quality in the assessment of shoulder pain conditions [15]. It consists of two subscales: pain (5 items) and disability (8 items), with patients rating their experience on a scale from 0 (no pain/disability) to 10 (worst pain/disability). High scores (> 30/130) correlate with the severity of the disease and is often used as a threshold for interventions. We followed

the criteria suggested by the Simon Carette et al, limitation of both active and passive movements of the gleno-humeral joint > 25%, and SPADI (Shoulder Pain and Disability Index) score of more than 30, were used in to give intraarticular injections in our practice [7]. However SPADI not always practical for telephonic follow-up assessments. Hence we did not use SPADI for the post procedure follow-up assessments.

Shoulder immobilization and factors that aggravate inflammation are the primary identified triggers for the development of adhesive capsulitis. Therefore, strict glycaemic and lipid control and maintaining active shoulder mobility are the key preventive measures recommended to prevent its occurrence. Consistent with the literature, the majority of patients (four out of six) in our series had no apparent cause for the development of adhesive capsulitis. This emphasizes the need for further research to identify the etiological factors for the development of adhesive capsulitis.

The main limitation in our study include no standard regimen was followed for all patients and a small sample size.only six patients were analysed. Reducing the local anaesthetic dose and volume to 3 – 4ml and adding saline may be safe, as prolonged use of high concentrations of intraarticular local anaesthetics may result in chondrotoxicity [16]. However, a single injection of low-concentration local anaesthetics appears to be safer and less likely to cause cartilage damage [17].

Conclusion

Patients with diabetes should be particularly concerned about frozen shoulder since it can negatively impact the quality of life and shoulder function. For this illness to be effectively managed, prompt diagnosis and treatment—including intra-articular steroid injections—are crucial. Treatment outcomes can be further optimized by choosing the right type of steroid and using ultrasound guidance.

Conflict of Interest: None

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