

Original Research Article

Single intra-articular steroid injection of the glenohumeral joint in management of adhesive capsulitis: a comparison between approaches

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ABSTRACT

Background: Adhesive capsulitis is a common, painful musculoskeletal condition of the shoulder associated with loss of range of motion in the glenohumeral joint resulting from contraction of the glenohumeral joint capsule and adherence to the humeral head. Earlier stages of adhesive capsulitis can be treated by intra-articular steroid injections into the glenohumeral joint. This study was designed to study the role of long acting intra-articular corticosteroid injections in combination with simple therapeutic exercises while comparing the outcome of blinded anterior and posterior injection approaches in the management of adhesive capsulitis.

Methods: The study comprised of 60 subjects aged 18 years and above who were diagnosed with primary adhesive capsulitis. They were randomly divided into 2 groups i.e., Group A who received blind intra-articular steroid injections via standard anterior approach and group B who received blind intra-articular steroid injection via standard posterior approach. Both groups followed up with a simple home based exercise program. Outcome measures assessed were visual analog scale (VAS) score, shoulder pain assessment disability index (SPADI) and passive shoulder range of motion (ROM).

Results: At last follow up, both groups showed statistically significant improvements in all outcome measures i.e., VAS score, SPADI, shoulder ROM. However, comparison between groups did not reveal any statistically significant differences between the two groups.

Conclusions: Intra-articular steroid injections into the glenohumeral joint in conjunction with simple physiotherapy are effective in improving pain, function and shoulder ROM in adhesive capsulitis. Both the anterior and posterior injection approaches provide good results.

Keywords: Adhesive capsulitis, Corticosteroids, Glenohumeral joint

INTRODUCTION

The shoulder is a special anatomical structure with an extraordinary range of motion (ROM), wherein significant morbidity can and does occur, with loss of mobility at the glenohumeral joint.¹

Adhesive capsulitis is a common, painful musculoskeletal condition of the shoulder that is associated with loss of range of motion in the glenohumeral joint resulting from contraction of the glenohumeral joint capsule and adherence to the humeral head.² The term 'Frozen Shoulder' is commonly used to describe this condition and it is known by several other names too. However, the

term 'adhesive capsulitis', coined in 1987 by Neviaser and Neviaser appears to be the preferred terminology.^{1,2}

The incidence of adhesive capsulitis is approximately 2-5% in the general population according to the literature published.¹⁻³ It is rare in children and peaks between 40 and 70 years of age. Women are known to be affected more commonly than men, it is usually unilateral, and there is no known genetic or racial predilection.² A higher incidence of upto 20% is seen in diabetics.¹

Adhesive capsulitis can be classified as primary (idiopathic) or secondary (resulting from a pre-existing underlying condition). Although adhesive capsulitis is self-limiting and often resolves spontaneously, it can persist for several years without complete resolution in several affected individuals.

The disease presents with shoulder pain and limited range of motion of the shoulder joint. Pain may often become severe and debilitating in nature when it persists over the years. Treatment options include conservative (non surgical) and surgical interventions. Conservative therapy is often the preferred first line of treatment which includes non-steroidal anti-inflammatory drugs (NSAIDs), oral corticosteroids, intra-articular steroid injections, sodium hyaluronate intra-articular injections, suprascapular nerve block, hydrodilatation, physiotherapy and rehabilitation programs. Surgical modalities are used when conservative options fail and include mobilization under anaesthesia (MUA), arthroscopy and open release.^{3,4}

Buchbinder et al in an extensive Cochrane review examined the evidence for efficacy and safety of corticosteroid injections for the treatment of adults with shoulder pain and found that corticosteroid injections are a commonly used modality to treat shoulder pain irrespective of underlying aetiology.⁵ Corticosteroids are known to be effective in adhesive capsulitis when injected in the intra-articular space although studies regarding the same are widely varied. They may be injected into the glenohumeral joint via an anterior or posterior approach, into the subacromial space, tendon sheaths of specific tendons, or locally into trigger or tender points.⁵

The basis for the use of intra-articular steroid injection is to reduce synovial inflammation and capsular fibrosis to allow improvement of range of motion (ROM) resulting in a consequent decreased time to functional recovery.⁶

This study was designed to study the role of long acting intra-articular corticosteroid injections through blinded anterior and posterior injection approaches in the management of adhesive capsulitis. An assessment was also made to ascertain if either of the two injection approaches was better than the other. Simple home based exercise program (physiotherapy) was also combined with the injections to study the effects in tandem.

METHODS

The study subjects constituted outpatients visiting the Department of Orthopaedics, Karnataka Institute of Medical Sciences (KIMS), Hubballi, Karnataka, India. The duration of the study was for a period of 12 months (September 2014 to September 2015) during which sixty subjects of either gender satisfying the inclusion and exclusion criteria and those willing to participate in the study were screened for the study. The subjects included were healthy adult male and non-pregnant females aged 18 years and above, those with painful shoulder in the 5th cervical dermatomal distribution of more than 4 weeks duration, limited ROM of the shoulder and radiographically normal shoulder joint justifying a diagnosis of primary adhesive capsulitis. Those excluded from the study were subjects with fracture/ trauma of the affected shoulder girdle, post immobilization shoulder, shoulder girdle motor control deficits (neurological disorders), history of shoulder surgeries, previous manipulation of shoulder under anaesthesia, recent dislocation of the shoulder, pain of less than 4 weeks duration, evidence of glenohumeral osteoarthritis on plain x-ray, patients with complete rotator cuff tear (positive drop off sign) or weakened rotator cuff muscles and patients with multiple joint pains. A written informed consent was obtained from all individuals.

The study subjects were randomly assigned to 2 groups by using simple randomisation by lottery method as follows

1. *Group A:* Comprised of 30 patients in whom Intra-articular steroid (single dose) i.e., methylprednisolone (Depo-Medrol), 40 mg/ml was injected via the anterior approach. Physical therapy by simple home based exercises was advised.
2. *Group B:* Comprised of 30 patients in whom Intra-articular steroid (single dose) i.e., methylprednisolone (Depo-Medrol), 40 mg/ml was injected via the posterior approach. Physical therapy by simple home based exercises was advised.

Intervention

Both groups were given intra-articular steroid injections via blinded intra-articular approach. Group A received the injection through the anterior approach and group B received the injection through the posterior approach. The injection protocol for each approach was as follows

Anterior approach

Patient was positioned in the sitting position with the patient's arm resting comfortably at the side, and the shoulder externally rotated. Essential landmarks were palpated i.e., head of the humerus, the coracoid process, and the acromion. Sterile technique was followed and a 5 ml syringe fitted with a 25 gauge needle was used. The needle tip was inserted a finger breadth lateral to and just

below the tip of coracoid process, directing the needle posteriorly and slightly superiorly and laterally. After negative aspiration, 2 ml of the solution was injected with consistent pressure.⁷

Posterior approach

Patient was positioned in the sitting position with the patient's arm resting comfortably at the side, and the shoulder externally rotated. Essential landmarks palpated were the head of the humerus, the coracoid process, and the acromion. Sterile technique was followed and a 5 ml syringe fitted with a 25 gauge needle was used. Needle was inserted two finger breadths inferior and medial to the posterolateral corner of acromion and directed anteriorly towards the coracoid process. After negative aspiration, 2 ml of the solution was injected with consistent pressure.⁷

Physiotherapeutic intervention

Patients were demonstrated the following home based stretching exercise and a chart of the same was provided to each patient. Four stretches recommended according to the university of Washington protocol were taught as follows

1. Overhead stretch
2. External rotation
3. Internal rotation
4. Cross body reach

Follow up for all patients was scheduled at two weeks (first follow-up) post injection and physiotherapy was initiated. Patients were then recalled for consecutive

follow-up at 4 weeks, 8 weeks and 12 weeks (last follow up).

Outcome measures were assessed using

1. Visual analogue scale (VAS) for pain
2. Shoulder pain and disability index (SPADI)
3. Passive range of motion of affected shoulder using goniometer

Statistical analysis

Categorical variables were summarized as frequency, percentage and numerical variables were summarized as mean, standard deviation, median and interquartile range. Analysis of pre and post treatment data for both the groups was done using paired t test. Comparison between groups was done via the unpaired t test and significance of post treatment improvements throughout the different stages of the disease was assessed by one way ANOVA test. Analysis was done using SPSS version 19. A p value less than or equal to 0.005 was considered statistically significant.

RESULTS

The total study subjects consisted of 60 subjects of either gender aged 18 years and above who were randomly assigned to two groups. Group A consisted of 30 subjects and group B consisted of 30 subjects. Of the 60 subjects, 33 (55%) were female and 27 (45%) were male. Amongst the subjects, 12 (20%) were below 40 years of age, 18 (30%) were between 40 and 59 years and 30 (50%) patients were above 60 years.

Table 1: Comparison of pre and post treatment values of outcome measures in Group A at 12 weeks.

Outcome measures		N	Mean	SD	Paired differences		Paired t test	
					Mean	SD	t	P value
Pain (VAS)	Pre	30	55.67	27.22	55.67	27.22	11.20	<0.005 (Sig)
	Post	30	0.00	0.00				
SPADI	Pre	30	67.93	14.72	62.70	20.62	16.66	<0.005 (Sig)
	Post	30	5.23	8.77				
External rotation	Pre	30	53.50	25.02	-33.00	20.15	-8.97	<0.005 (Sig)
	Post	30	86.50	24.32				
Internal rotation	Pre	30	55.67	15.01	-10.33	11.29	-5.01	<0.005 (Sig)
	Post	30	66.00	8.94				
Abduction	Pre	30	105.00	47.40	-45.67	37.85	-6.61	<0.005 (Sig)
	Post	30	150.67	47.34				
Flexion	Pre	30	105.67	42.89	-40.67	34.43	-6.47	<0.005 (Sig)
	Post	30	146.33	37.64				

^aVAS: Visual analog scale; ^bSPADI: Shoulder pain and disability index.

Left side (non-dominant side) was affected in 34 (56.75%) patients and the right side in 26 (43.4%) patients. Both groups showed improvements in all outcome measures during the first follow up. However,

this was not significant statistically. At last follow up, statistically significant ($p < 0.005$) improvements were seen in all outcome measures in both the groups (Table 1 and 2).

Table 2: Comparison of pre and post treatment values of outcome measures in Group B at 12 weeks.

Outcome measures		N	Mean	SD	Paired differences		Paired t test	
					Mean	SD	t	P value
Pain (VAS)	Pre	30	54.50	13.79	49.50	14.10	19.23	<0.005 (Sig)
	Post	30	5.00	5.57				
SPADI	Pre	30	65.30	9.75	56.23	13.82	22.28	<0.005 (Sig)
	Post	30	9.07	7.10				
External rotation	Pre	30	44.67	19.78	-28.33	17.24	-9.00	<0.005 (Sig)
	Post	30	73.00	19.85				
Internal rotation	Pre	30	50.33	14.50	-13.00	10.88	-6.55	<0.005 (Sig)
	Post	30	63.33	10.61				
Abduction	Pre	30	92.67	39.39	-44.33	33.19	-7.32	<0.005 (Sig)
	Post	30	137.00	42.28				
Flexion	Pre	30	102.33	37.57	-37.67	26.22	-7.87	<0.005 (Sig)
	Post	30	140.00	38.77				

^aVAS: Visual Analog Scale; ^bSPADI: Shoulder pain and disability index.

Table 3: Comparison of post treatment outcome measures in Group A (anterior approach) and Group B (posterior approach).

Outcome measures	Groups	N	Mean	SD	Mean difference	Unpaired t test	
						t	P value
Pain (VAS)	Group A	30	55.67	27.22	6.17	1.102	0.275
	Group B	30	49.50	14.10			
SPADI	Group A	30	62.70	20.62	6.47	1.427	0.159
	Group B	30	56.23	13.82			
External rotation	Group A	30	33.00	20.15	4.67	0.964	0.339
	Group B	30	28.33	17.24			
Internal rotation	Group A	30	10.33	11.29	-2.67	-0.932	0.355
	Group B	30	13.00	10.88			
Abduction	Group A	30	45.67	37.85	1.33	0.145	0.885
	Group B	30	44.33	33.19			
Flexion	Group A	30	40.67	34.43	3.00	0.38	0.706
	Group B	30	37.67	26.22			

^aVAS: Visual Analog Scale; ^bSPADI: Shoulder pain and disability index.

Table 4: Comparison of post treatment outcome measures in different stages of adhesive capsulitis.

Outcome Measures	Stages of adhesive capsulitis	Number (N)	Mean	SD	One way ANOVA	
					F	P value
Pain (VAS)	Stage 1	31	64.35 ^a	15.32	26.122	<0.005 (Sig)
	Stage 2	21	47.62 ^b	14.11		
	Stage 3	8	20.00 ^c	22.36		
SPADI	Stage 1	31	68.06 ^a	12.53	33.845	<0.005 (Sig)
	Stage 2	21	58.62 ^a	10.15		
	Stage 3	8	28.38 ^b	15.50		
External rotation	Stage 1	31	30.16 ^a	14.75	9.749	<0.005 (Sig)
	Stage 2	21	39.52 ^a	21.09		
	Stage 3	8	09.38 ^b	1.77		
Internal rotation	Stage 1	31	10.32 ^a	9.83	0.904	0.411
	Stage 2	21	14.29 ^a	13.99		
	Stage 3	8	10.00 ^a	5.35		
Abduction	Stage 1	31	37.74 ^a	22.61	18.13	<0.005 (Sig)
	Stage 2	21	70.95 ^b	38.33		
	Stage 3	8	05.00 ^c	5.35		
Flexion	Stage 1	31	29.03 ^a	21.81	21.115	<0.005 (Sig)
	Stage 2	21	64.76 ^b	29.09		
	Stage 3	8	11.25 ^a	3.54		

¹VAS: Visual Analog Scale; ²SPADI: Shoulder pain and disability index. Different superscripts for stages within each parameter suggest significant difference. Similar superscripts for stages within each parameter suggest no significant difference.

Improvement in outcomes namely VAS, SPADI, shoulder ROM (abduction, flexion, internal rotation, external rotation) were more marked in group A when compared with group B, but these differences were found to be insignificant statistically ($p < 0.05$) (Table 3). Physiotherapeutic compliance was good with 90% completing all sessions within the study period.

Patients in the study were seen during different stages of adhesive capsulitis. In group A, 15 (50%) patients, making up half the subjects, were at stage-1 (50%), 11 (36.7%) in stage 2 and 4 (13.3%) in stage 3. Group B constituted of 16 (53.3%) subjects in stage 1, again making up the majority. Ten (33.3%) subjects were in stage 2 and 4 (13.3%) in stage 3. Statistically significant improvement was seen in outcome measures for pain, shoulder function (SPADI) and shoulder ROM (except for internal rotation) in different stages of adhesive capsulitis. These differences were more marked in the earlier stages i.e., stage 1 and 2 than stage 3 (Table 4).

DISCUSSION

Management of primary adhesive capsulitis with non-surgical treatment such as intra-articular corticosteroid injections has shown positive results and remains the primary choice in early stages when pain is the predominant symptom.^{6,8-10} Intra-articular corticosteroid injections are known to be a superior alternative when used as such or in combination with physiotherapy as compared to physiotherapy alone.^{8,9}

This study was undertaken to determine which of the two approaches i.e., anterior or posterior was more effective on injecting intra-articular corticosteroids as well as to determine their efficacy in combination with physiotherapy. Of the total study subjects that were enrolled for this study, majority were female. The age group affected most was also in patients above 60 years of age. These findings were consistent with epidemiological data stating that primary adhesive capsulitis affects females more commonly and also peaks in individuals between 40-70 years.²

Our study showed improvement in overall pain (VAS), SPADI and shoulder ROM in both groups at first follow up at 2 weeks and then at 4 weeks, though these improvements at the first and second follow up were statistically insignificant. The outcome measure pain showed similar improvement for both groups at 12 weeks which was statistically significant. The mean values for SPADI and all shoulder ROM were also significantly improved at the 12th week follow up in both the groups indicating the efficacy of intra-articular corticosteroid injections in treating adhesive capsulitis irrespective of the approach of injection used.

Carette et al conducted a randomized clinical trial to compare the efficacy of a single intra-articular corticosteroid injection, a supervised physiotherapy

program, a combination of the two, and placebo in the treatment of adhesive capsulitis of the shoulder of less than 1 year duration in 93 patients. Patients were divided into 4 groups: group 1, corticosteroid injection (triamcinolone hexacetonide 40 mg) performed under fluoroscopic guidance followed by 12 sessions of supervised physiotherapy; group 2, corticosteroid injection alone; group 3, saline injection followed by supervised physiotherapy; and group 4, saline injection alone (placebo group). All subjects were taught a simple home exercise program and the primary outcome measure was improvement in the shoulder pain and disability index (SPADI) score.⁸

At 6 weeks, groups 1 and 2 showed significantly improved SPADI scores compared with groups 3 and 4 as well as significantly greater improvement in the total range of active and passive motion in group 1 as compared to the other 3 groups. They concluded that patients with adhesive capsulitis suffering from shoulder pain and disability can be greatly benefitted from a single intra-articular injection of corticosteroid administered under fluoroscopy combined with a simple home exercise program. Physiotherapy when used singularly offers limited assistance in the management of adhesive capsulitis.⁸

Musa et al studied the role of intra-articular steroid injection in 60 patients with idiopathic adhesive capsulitis. They were treated with intra-articular corticosteroid injection via the posterior approach. At final follow-up 34 (56.67%) patients were completely pain free, 35 (58.33%) had ROM comparable to contralateral side and 15 (25%) patients regained ROM within 15 degrees of contra-lateral side at final follow-up. They found that local intra-articular steroid injection improved range of motion and provided adequate pain relief in patients with idiopathic adhesive capsulitis.¹¹

Lorbach et al in a prospective randomized evaluation, treated 40 patients with idiopathic adhesive capsulitis with a regimen of either oral glucocorticoids or intra-articular steroid injections. They summarized that intra-articular glucocorticoid injections were superior to a short course of oral glucocorticoids and showed superior results in objective shoulder scores, range of motion and patient satisfaction.¹²

Comparison for improvement in the outcome measures (pain, SPADI and shoulder ROM) between group A and group B did not yield statistically significant differences indicating that both approaches were efficacious in administering intra-articular corticosteroids and that neither was superior to the other. Literature is divided over the accuracy achieved via the anterior and posterior approaches for delivering intra-articular corticosteroids to the glenohumeral joint.¹³⁻¹⁶

Esenyel et al studied 50 shoulders in 25 cadavers through intra-articular glenohumeral injection via the anterior

approach without radiographic assistance and found a high accuracy rate of 96%.¹³ Kraeutler et al injected saline without radiographic assistance into the glenohumeral joint of 75 patients via the anterior approach who were undergoing routine shoulder arthroscopy for a variety of disorders. The precision of the injection was later confirmed arthroscopically. They concluded that anterior injection into the glenohumeral joint can be accurately placed without radiographic assistance using standard landmarks by experienced arthroscopists. They also suggested that orthopedic surgeons could learn and practice the same technique in office settings by paying close attention to standard anterior rotator interval portal (which is similar to anterior steroid injection technique) during shoulder arthroscopy.¹⁴

Sidon et al examined the accuracy of anterior shoulder injection in awake patients under conditions similar to the office setting. One hundred and sixty six patients were injected by experienced radiologists without radiographic assistance and successful injection was verified by magnetic resonance imaging (MRI). Injections were found to be highly accurate (98.2%).¹⁵

Daley et al in an extensive review of literature found that there is a statistically higher accuracy rate with the posterior approach when compared with the anterior approach (85% vs. 45%) in the glenohumeral joint. However, this criterion (injection site selection) did not affect accuracy for the subacromial space, acromioclavicular joint, elbow, or knee.¹⁶

Although the literature cited above is conflicting with regards to favouring the anterior or posterior injection approach, we found that blind accurate injections were possible in office settings by following simple anatomic landmarks and by continually practicing the technique over the years. Moreover, the study was conducted in a government hospital in India with average infrastructure facilities and most of the treatment being rendered free of cost as patients were from poor socioeconomic backgrounds. These conditions made concurrent use of imaging techniques while giving injections highly impractical and costly.

Studies comparing the outcomes of anterior and posterior approaches of intra-articular corticosteroid injections in the management of adhesive capsulitis are few.^{17,18} Sonachand found the blind anterior approach intra-articular steroid injection to be more effective than posterior approach in improving shoulder rotation and abduction range of movements, reducing shoulder pain and disability in patients having less than 3 months duration primary adhesive capsulitis of shoulder.¹⁷ Their results could be influenced from the fact that probably the accuracy rate of posterior injections could be lesser than the anterior approach.

Do-Young et al in a randomized clinical trial of 50 patients compared the anterior and posterior approaches for ultrasound-guided glenohumeral steroid injection in primary adhesive capsulitis. Outcome measures used in this study were visual analog scale (VAS) for pain, range of motion (ROM), patient's satisfaction (SAT), the American Shoulder and Elbow Surgeons (ASES) shoulder score, and the Constant score. The authors found satisfactory outcomes using both the anterior or posterior approach. Although the posterior approach provided more significant improvements in the mean VAS, ASES, and Constant scores, the injection time, total time, and accuracy were not different between the 2 approaches except for the mean positioning time which was shorter for the anterior approach.¹⁸ The authors state that anterior approach is more traumatic to patients psychologically as they could see the injection being given and this could be one of the reasons for improved scores in the posterior approach group wherein patients were less traumatized psychologically and hence followed up with more aggressive approach to rehabilitative physiotherapeutic exercises that were begun 3 weeks later.

The visualization of needle penetration causing psychological trauma was not a factor in our study as all patients were asked to turn towards the contralateral side during the injection procedure.

Stage 1 and stage 2 adhesive capsulitis patients in our study displayed significant improvement in all outcome measures (except for internal rotation) whereas those with stage 3 disease did not benefit much from the intervention taken up in our study. These results support the findings of previous studies suggesting improvement in early outcome after corticosteroid injection in adhesive capsulitis.^{6,19} Studies have supported the use of early intra-articular steroid injections in stage 1 and 2 idiopathic adhesive capsulitis as being both diagnostic and therapeutic.⁶ Stage 1 patients have also shown faster resolution of symptoms compared to stage 2 patients.⁶

Ahn et al in a retrospective longitudinal study used ultrasound guided intra-articular corticosteroid injections in 339 patients with primary adhesive capsulitis who were unresponsive to atleast 1 month of conservative treatment and found that early injection improves outcomes in both short term and long term follow ups.¹⁹

Treatment for adhesive capsulitis has been controversial varying between 'benign neglect' and institution of appropriate intervention. We found that intra-articular corticosteroid injections are a useful non-surgical treatment modality for management of adhesive capsulitis in early stages. Improvement in stiffness and pain along with improved function is noticeable more so when combined with physiotherapy.

Both the anterior and posterior approaches are reasonably accurate and are equally useful in reducing pain and improving function (reduced disability index) and

shoulder ROM when administered accurately. However, results must be interpreted cautiously given the small sample size in this study and the short follow-up time period. Further studies with larger sample sizes and a longer follow up and imaging assistance should be undertaken to substantiate the results of this study.

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