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To Study the Comparison Between Ultrasound Guided Local Intra Articular Corticosteroid Injection vs Anatomical Landmark Guided Local Corticosteroid Intra Articular Injection in Frozen Shoulder

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ABSTRACT

Adhesive capsulitis is a debilitating disease in an otherwise healthy individual. Intra-articular corticosteroid injections offer a cost-effective, non-operative treatment option. However, it is currently unclear whether an ultrasound-guided injection relieves the symptoms of shoulder pain more effectively than if the injection was delivered landmark-guided. Ultrasound guided intra articular corticosteroid injections are used for increasing the accuracy of delievery of drug. However, the clinical efficacy of ultrasound guided injections compared to blind injections is still controversial. The aim of study was to find the functional outcome following USG guided vs anatomical landmark guided intra-articular steroid injection in the treatment of Frozen shoulder in adults. Intra-articular corticosteroid injections were administered to 50 patients with frozen shoulder who were randomly assigned to either an Ultrasound guided (n=25) or a blind technique (n=25). The outcome was assessed using a visual analogue scale (VAS) and Shoulder Pain and Disability Index (SPADI) for pain for all patients at the time of presentation and at one week, four week, three month and six month. The accuracy of injection in the ultrasound guided and anatomical landmark guided groups was 100% (25/25) and 71.1% (18/25), respectively this difference was significant ($p<0.001$). Both groups had significant improvements in VAS pain score, SPADI score throughout follow-up until 4 weeks after injection (all $p<0.001$) then it tend to fall down as the affect of steroid wean off. There were no significant differences between the VAS pain score and SPADI score between the two groups at the time points assessed after 4 weeks (all $p>0.05$). No injection-related adverse effects were noted in either group. There is significant difference between two groups during the first 4 weeks for usg guided local infiltration as compared to anatomical landmark guided injection which become insignificant after 4 weeks . In spite of more accuracy, anatomical landmark guided injection is more preferred in comparison to ultrasound guided as ultrasound guided injection is time consuming and more costly.

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Key Words
Corticosteroid, ultrasound, intra articular injection

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INTRODUCTION

Frozen shoulder, also known as "adhesive capsulitis", is defined as a pathological process which limits movement of the shoulder joint in at least two planes which leads to pain, stiffness and disturbed sleep, causing limitation in activities of daily living[1].

When there is no detectable underlying cause, it is known as "primary idiopathic frozen shoulder" and when there is a known cause such as a systemic disorder (diabetes, thyroid disorders) or any injury, it is known as "secondary frozen shoulder"[2].

Mostly, trigger factor is a microtrauma which initiates a cascade of pathophysiological events like release of inflammatory markers, fibroblast proliferation and their activation into myofibroblasts and collagen III deposition[3].

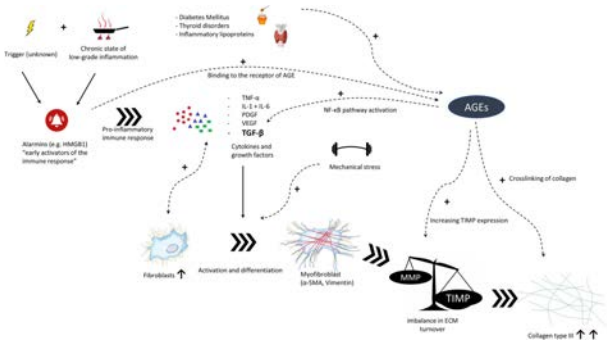

Fig. 1: Pathophysiology adapted from Kraal et al[9]

Clinical course is further divided into three stages, initial being the stage of Freezing, which is characterized by symptoms like acute pain, decreased movement in two planes-abduction and internal rotation, which lasts over 2-9 months, next is the stage of Frozen, which presents with pain and increased stiffness in all directions, lasting for 4-12 months and last is the stage of Thawing, in which range of motion improves gradually, lasting for 6-9 months[4]. It is difficult to treat. It causes substantial reduction in active and passive range of motion (ROM) of glenohumeral joint[5].

Frozen shoulder has two sub types-primary or idiopathic (If there exist no exogenous cause or preexisting disease or when it is linked to another systemic disorder). The most common association being diabetes mellitus with incidence of 10%-36%. Hyperlipidemia, adrenal disease, thyroid disease, cardiopulmonary disease are also associated[6]. Secondary frozen shoulder can be traumatic (fracture, dislocation, soft-tissue injury) or nontraumatic (rotator cuff tendinopathy, calcific tendinitis and osteoarthritis)[7].

Treatment depends upon the stage of presentation, currently the various modalities include non-operative techniques like non-steroidal anti-inflammatory drugs, hydrodilatation, intra-articular steroid injections. Operative management options include manipulation under general anesthesia and arthroscopic capsular release[8]. Physiotherapy is an integral part of management which includes range of motion exercises, wall climbing and stretching exercises, scapular stabilization exercises.

MATERIALS AND METHODS

The study is randomized prospective study conducted in the Department of Orthopaedics, at Government Medical College and Hospital, Patiala, Punjab. It was conducted over a period from 1st January 2023-30th june 2023 with a minimum follow up of 6 months from the date of enrollment. All the patients in the outpatient department diagnosed with frozen shoulder who fall in the desired age group and who fulfill the study criteria are enrolled in the study.

The enrollment of the study started after a due institutional ethics committee approval.

Inclusion Criteria:

- Age group 18 years and older.
- Clinical diagnosis of frozen shoulder.
- Duration of symptoms >3 months.

Exclusion Criteria:

- Patients with generalized arthritis.
- Patients with acute/chronic infections around shoulder.
- Patients on anticoagulant therapy.
- Previous shoulder surgery.
- Previous intra-articular shoulder injection within 6 months.
- Previous history of trauma with or without fracture around shoulder.
- Any other pathology around shoulder (eg Tumor, instability, paralysis).

Case Illustration: We have following results after conducting study over a period of 6 months following local infiltration of steroid in frozen shoulder via ultrasound guided (group A) and antomical landmark guided (group B) . In both groups local infiltration of steroid done via posterior approach.

Post-Injection Pain (VAS score): In group A, at pre-injection stage, post-injection pain (VAS score) was 8-10 in 17 (68%) patients, 4-7 in 8 (32%) patients and 0-3 in none of patients. At 1-week, post-injection pain was 8-10 in none of the patients, 4-7 in 17 (68%) patients and 0-3 in 8 (32%) patients. At 4 weeks, post-injection pain was 8-10 in none of the patients, 4-7 in 9 (36%) patients and 0-3 in 16 (64%) patients. At 3 months, post-injection pain was 8-10 in 12 (48%) patients, 4-7 in 12 (48%) patients and 0-3 in 1 (4%) patient. At 6 months, post-injection pain was 8-10 in 12

Table 1 A: Post- Injection Pain (VAS Score) in Group A at Different Time Lines

VAS score	Pre-injection	1 week	4 weeks	3 months	6 months
0-3	0 (0%)	8 (32%)	16 (64%)	1 (4%)	0 (0%)
4-7	8 (32%)	17 (68%)	9 (36%)	12 (48%)	13 (52%)
8-10	17 (68%)	0 (0%)	0 (0%)	12 (48%)	12 (48%)
Total	25 (100%)	25 (100%)	25 (100%)	25 (100%)	25 (100%)
Mean±SD	8.70±1.51	3.76±1.45	2.88±1.30	6.64±1.60	6.80±1.29

Table 2 B: Post-Injection Pain (VAS score) in Group B at Different Time Lines

VAS score	Pre-injection	1 week	4 weeks	3 months	6 months
0-3	0 (0%)	5 (20%)	7 (28%)	0 (0%)	0 (0%)
4-7	6 (24%)	18 (72%)	18 (72%)	16 (64%)	13 (52%)
8-10	19 (76%)	2 (8%)	0 (0%)	9 (36%)	12 (48%)
Total	25 (100%)	25 (100%)	25 (100%)	25 (100%)	25 (100%)
Mean±SD	7.92±1.35	4.72±1.81	3.76±1.33	6.40±1.41	6.64±1.49

Table 3 C: Comparison of Post- Injection Pain (VAS score) Between two Groups

Time Interval	Groups	Mean±SD	Std. Error	t-test	p value
Pre-injection	Group A	8.70±1.51	0.405	-1.925	0.0601 (NS)
	Group B	7.92±1.35			
1 week	Group A	3.76±1.45	0.464	2.070	0.0439 (S)
	Group B	4.72±1.81			
4 weeks	Group A	2.88±1.30	0.372	2.366	0.0221 (S)
	Group B	3.76±1.33			
3 months	Group A	6.64±1.60	0.427	-0.563	0.5763 (NS)
	Group B	6.40±1.41			
6 months	Group A	6.80±1.29	0.394	-0.406	0.6866 (NS)
	Group B	6.64±1.49			

Table 4 A: Post- Injection Pain (SPADI Score) in Group A at Different Time Lines

SPADI Score	Pre-injection	1 week	4 weeks	3 months	6 months
≤50	0 (0%)	16 (64%)	20 (80%)	2 (8%)	1 (4%)
51-75	7 (28%)	9 (36%)	5 (20%)	17 (68%)	16 (64%)
76-100	17 (68%)	0 (0%)	0 (0%)	5 (20%)	7 (28%)
>100	1 (4%)	0 (0%)	0 (0%)	1 (4%)	1 (4%)
Total	25 (100%)	25 (100%)	25 (100%)	25 (100%)	25 (100%)
Mean±SD	82.72±14.83	49.00±14.34	38.64±13.32	67.20±16.42	73.00±14.94

Table 5 B: Post- Injection Pain (SPADI Score) in Group B at Different Time Lines

SPADI Score	Pre-injection	1 week	4 weeks	3 months	6 months
≤50	0 (0%)	9 (36%)	15 (60%)	6 (24%)	5 (20%)
51-75	8 (32%)	9 (36%)	7 (28%)	13 (52%)	11 (44%)
76-100	14 (56%)	6 (24%)	3 (12%)	6 (24%)	7 (28%)
>100	3 (12%)	1 (4%)	0 (0%)	0 (0%)	2 (8%)
Total	25 (100%)	25 (100%)	25 (100%)	25 (100%)	25 (100%)
Mean±SD	84.00±16.52	60.68±21.52	49.68±20.71	65.08±19.30	71.84±22.73

Table 6 C: Comparison of Post- Injection Pain (SPADI Score) Between two Groups

Time Interval	Groups	Mean±SD	Std. Error	t-test	p value
Pre-injection	Group A	82.72±14.83	4.440	0.288	0.7744 (NS)
	Group B	84.00±16.52			
1 week	Group A	49.00±14.34	5.172	2.258	0.0285 (S)
	Group B	60.68±21.52			
4 weeks	Group A	38.64±13.32	4.925	2.242	0.0296 (S)
	Group B	49.68±20.71			
3 months	Group A	67.20±16.42	5.068	-0.418	0.6776 (NS)
	Group B	65.08±19.30			
6 months	Group A	73.00±14.94	5.440	-0.213	0.8320 (NS)
	Group B	71.84±22.73			

(48%) patients, 4-7 in 13 (52%) patients and 0-3 in none of the patients.

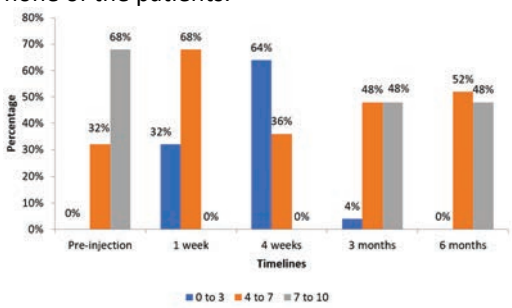

Fig .2: post injection pain (vas score) in group A at different time line

The mean (±SD) VAS score at pre-injection stage, 1 week, 4 weeks, 3 months and 6 months were 8.70±1.51, 3.76±1.45, 2.88±1.30, 6.64±1.60 and 6.80±1.29, respectively.

In group B, at pre-injection stage, post-injection pain (VAS score) was 8-10 in 19 (76%) patients, 4-7 in 6 (24%) patients and 0-3 in none of patients. At 1-week, post-injection pain was 8-10 in 2 (8%) patients, 4-7 in 18 (72%) patients and 0-3 in 5 (20%) patients. At 4 weeks, post-injection pain was 8-10 in none of the patients, 4-7 in 18 (72%) patients and 0-3 in 7 (28%) patients. At 3 months, post-injection pain was 8-10 in 9 (36%) patients, 4-7 in 16 (64%) patients and 0-3 in

none of the patients. At 6 months, post-injection pain was 8-10 in 12 (48%) patients, 4-7 in 13 (52%) patients and 0-3 in none of the patients.

The mean (±SD) VAS score at pre-injection stage, 1 week, 4 weeks, 3 months and 6 months were 7.92±1.35, 4.72±1.81, 3.76±1.33, 6.40±1.41 and 6.64±1.49, respectively.

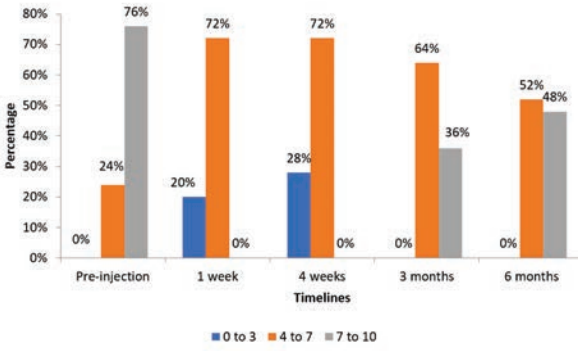

Fig. 3: post injection pain (vas score) in group B at different time lines

This table shows the comparison of post-injection pain (VAS score) between both groups. The difference between the groups for post-injection pain was statistically significant at 1-week and 4 weeks ($p<0.05$). While the difference between the groups for post-injection pain was statistically non-significant at pre-injection stage, 3 months and 6 months ($p>0.05$).

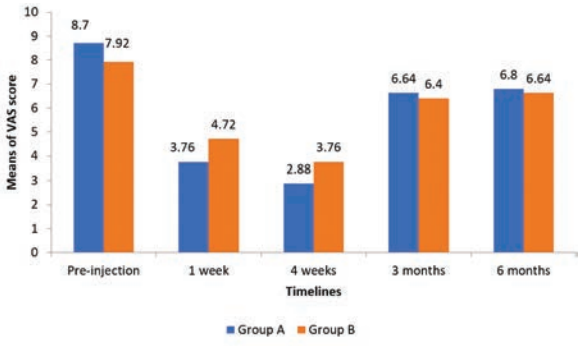

Fig. 4: comparison of post injection pain(vas score) between two groups

Post-Injection Pain (SPADI Score): In group A, at pre-injection stage, post-injection pain (SPADI score) is >100 in 1 (4%) patient, 76-100 in 17 (68%) patients, 51-75 in 7 (28%) patients and ≤50 in none of the patients. At 1-week, post-injection pain is >100 and 76-100 in none of the patients, 51-75 in 9 (36%) patients and ≤50 in 16 (64%) patients. At 4 weeks, post-injection pain is >100 and 76-100 in none of the patients, 51-75 in 5 (20%) patients and ≤50 in 20 (80%) patients. At 3 months, post-injection pain is >100 in 1 (4%) patient, 76-100 in 5 (20%) patients, 51-75 in 17 (68%) patients and ≤50 in 2 (8%) patients. At 6 months, post-injection pain is >100 in 1 (4%) patient, 76-100 in 7 (28%) patients, 51-75 in 16 (64%) patients and ≤50 in 1 (4%) patient.

The mean (±SD) SPADI score at pre-injection stage, 1 week, 4 weeks, 3 months and 6 months are 82.72±14.83, 49.00±14.34, 38.64±13.32, 67.20±16.42, and 73.00±14.94, respectively.

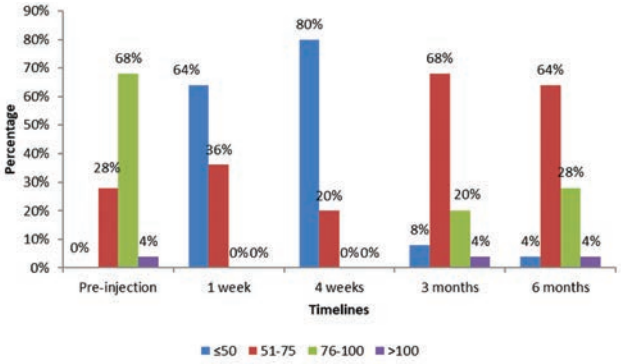

Fig. 5: post injection pain (spadi score) in group A at different time lines

In group B, at pre-injection stage, post-injection pain (SPADI score) is >100 in 3 (12%) patients, 76-100 in 14 (56%) patients, 51-75 in 8 (32%) patients and ≤50 in none of the patients. At 1-week, post-injection pain is >100 in 1 (4%) patient, 76-100 in 6 (24%) patients, 51-75 in 9 (36%) patients and≤50 in 9 (36%) patients. At 4 weeks, post-injection pain is >100 in none of the patients, 76-100 in 3 (12%) patients, 51-75 in 7 (28%) patients and ≤50 in 15 (60%) patients. At 3 months, post-injection pain is >100 in none of the patients, 76-100 in 6 (24%) patients, 51-75 in 13 (52%) patients, and ≤50 in 6 (24%) patients. At 6 months, post-injection pain is >100 in 2 (8%) patients, 76-100 in 7 (28%) patients, 51-75 in 11 (44%) patients and ≤50 in 5 (20%) patients.

The mean (±SD) SPADI score at pre-injection stage, 1 week, 4 weeks, 3 months and 6 months are 84.00±16.52, 60.68±21.52, 49.68±20.71, 65.08±19.30, and 71.84±22.73, respectively.

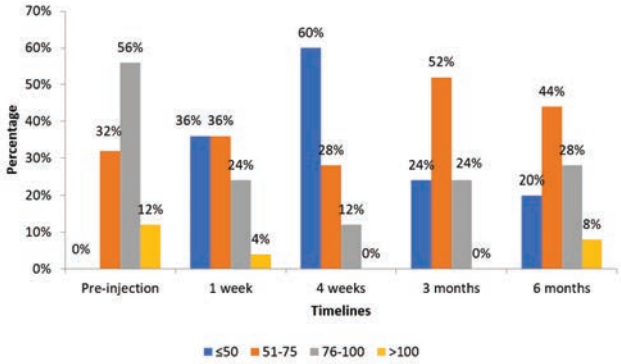

Fig. 6: post injection pain(spadi score) in group b at different time lines

This table shows the comparison of post-injection pain (SPADI score) between both groups. The difference between the groups for post-injection pain was statistically significant at 1-week and 4 weeks ($p<0.05$). While the difference between the groups for post-injection pain was statistically non-significant at pre-injection stage, 3 months and 6 months ($p>0.05$).

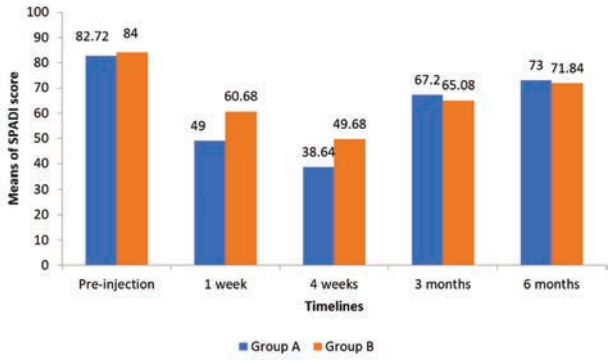

Fig. 7: Comparison of post injection pain (spadi score) between two groups

RESULTS AND DISCUSSIONS

Adhesive capsulitis is a self-limiting condition in the vast majority of patients and is often treated conservatively. However, the symptoms may take as long as 2-3 years to resolve completely. With shoulder joint mobility being the key to improvement in quality of life, it is essential that symptomatic relief be the cornerstone of therapy.

On the whole, our study demonstrated significant difference In the ability of ultrasound-guided versus landmark-guided corticosteroid injections into the glenohumeral joint to improve patient self-reported pain and function or clinician-measured range of motion in shoulder forward flexion and abduction during first few weeks of injection.

Our results are consistent with those of a study by Ucuncu *et al* examining ultrasound-guided vs landmark-guided injections for treatment of shoulder pain pathologies and noted that patients injected under ultrasound guidance had significantly improved pain and functional outcomes compared with patients injected via landmark guidance at 1-week and 4 week follow-up[10].

However, the Ucuncu study utilized injections in the subacromial space whereas our study injected into the glenohumeral joint.

Our study also consistent with a study by Mohamed Magdy ElMeligie *et al* examining Systematic review and meta-analysis on the effectiveness Of ultrasound-guided versus landmark corticosteroid injection for treatment of shoulder pain and noted that Ultrasound guided and landmark guided corticosteroid injection show significant improvement in pain and functional outcome of patient and both the compared groups were comparable in terms of disability score and side effects[12].

In contrast, a prior randomized controlled trial by Lee *et al* examining landmark-guided versus ultrasound-guided intra-articular injections for adhesive capsulitis, did not find any significant difference between the two treatment groups at the 6-week follow-up visit[11].

Limitations: Ideally, the study would have included a control group undergoing no treatment, however, this would not have been an ethically acceptable study design as both the treatment modalities proposed in this study had a benefit over conservative management.

Future work in the field can be considered injecting a mix of corticosteroid and contrast dye to visualize the accuracy of injection.

CONCLUSIONS

US-guided intra-articular injections offers advantages over a blind technique for the treatment of adhesive capsulitis and may deliver clinical benefits during the first few weeks of treatment. This finding suggests that the improved targeting to the intra-articular space by using US can result in better treatment of adhesive capsulitis. However after few weeks there is no significant difference between two methods as both provide similar results after few weeks.

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