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Comparison of ultrasound guided intraarticular shoulder injection and suprascapular nerve block versus ultrasound guided intraarticular shoulder injection in pain management of frozen shoulder patients.

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ABSTRACT… Objective: To compare ultrasound guided intraarticular shoulder injection and suprascapular nerve block versus ultrasound guided intraarticular shoulder injection in pain management of frozen shoulder patients. **Study Design:** Quasi Experimental study. **Setting:** Department of Anesthesia and Pain Medicine, Shaikh Zayed Hospital, Lahore. **Period:** Sep 2023 to Feb 2024. **Methods:** Patients aged 18 years and above presenting with symptoms consistent with frozen shoulder, confirmed through clinical evaluation and imaging studies. Patients with history of shoulder surgery, concomitant shoulder pathology were excluded. Participants were allocated to two groups: Group A received ultrasound-guided intraarticular shoulder injections, while Group B underwent a combination of ultrasound-guided intraarticular shoulder injections and suprascapular nerve blocks. The primary outcome measure was pain intensity assessed using the Visual Analog Scale (VAS) at baseline and follow-up intervals (2nd day, 1st week, 2nd week, and 4th week post-intervention). Secondary outcome measures included passive and active range of motion (ROM) of the shoulder joint assessed using a goniometer at corresponding time points. Collected data were processed and analyzed using IBM SPSS, version 27.0. **Results:** Mean age of patients in Group A was 50.04 ± 12.45 years and that of Group B was 50.60 ± 11.64 years with majority of them being females in both groups. Mean duration of the condition was 3.65 ± 1.08 months and 3.36 ± 1.31 months in Group A and B, respectively. At the time of enrollment into the study, the mean VAS score in Group-A was 7.20 ± 1.12 and in Group-B was 7.12 ± 0.93 without any statistical difference ($p=0.784$). On the 2nd day, Group A exhibited a significantly lower mean VAS score compared to Group B ($p = 0.004$). Statistically significant improvement in active as well as passive ROM was recorded following intervention in both the groups. This improvement was observed in all directions of motion. At first follow-up (2nd day) following intervention the improvement in passive and active abduction, flexion and extension were comparable in the two groups ($p>0.05$). **Conclusion:** In conclusion, our study highlights the significant advantage of Group A over Group B in achieving greater passive range of motion post-injection, particularly evident in abduction, flexion, extension, internal rotation, and external rotation. These findings emphasize the potential benefits of tailored rehabilitation protocols in optimizing functional outcomes following shoulder injection.

Key words: Active Range of Motion, Flexion, Group Comparison, Intervention, Passive Range of Motion, Rehabilitation, Shoulder Injection.

INTRODUCTION

Frozen shoulder, medically known as adhesive capsulitis, is a debilitating condition characterized by stiffness, pain, and limited range of motion in the shoulder joint. The onset of frozen shoulder often occurs gradually, with patients experiencing increasing discomfort and restricted movement in the affected shoulder.[1] Initially, individuals may attribute the symptoms to overuse or minor injury, unaware of the underlying complexities of the condition. As the condition progresses, pain intensifies, particularly at night, affecting sleep and exacerbating fatigue. Simple home tasks like reaching overhead, dressing, or combing hair become arduous challenges, significantly impacting independence and self-esteem.[2,3] Frozen shoulder is a prevalent musculoskeletal disorder worldwide, epidemiological data suggest a prevalence ranging from 2% to 5% in the general population.[4]

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The etiology of frozen shoulder remains multifactorial, several predisposing factors contribute to its development, including age, gender, systemic diseases, trauma, and immobilization. Individuals between the ages of 40 and 60 years are particularly susceptible, with a higher prevalence observed in women compared to men. Systemic conditions such as diabetes mellitus, thyroid disorders, and cardiovascular disease are commonly associated with frozen shoulder, suggesting a potential role of metabolic and hormonal factors in its pathogenesis.[5] The pathophysiology of frozen shoulder centers around inflammatory and fibrotic changes within the shoulder joint capsule, ultimately resulting in capsular thickening, adhesion formation, and contracture. The initial inflammatory phase is characterized by synovitis and capsular inflammation, leading to pain and progressive loss of range of motion.[6,7]

Among the various treatment modalities, intraarticular shoulder injections have gained prominence for their efficacy in pain relief. Among the emerging techniques, ultrasound-guided interventions have garnered attention for their precision and efficacy in delivering therapeutic agents directly to the affected shoulder joint.[8] Specifically, ultrasound-guided intraarticular shoulder injections have demonstrated promising results in alleviating pain and improving function. In recent years, the integration of suprascapular nerve block with ultrasound-guided intraarticular shoulder injections has emerged as a potential augmentation strategy.[9]

By exploring these interventions, we seek to elucidate whether the addition of suprascapular nerve blocks offers superior pain relief and functional improvement compared to intraarticular injections alone, informing clinicians' decision-making and potentially optimizing treatment strategies for this challenging condition. This comparative analysis addresses a critical gap in the literature, paving the way for more evidence-based and tailored approaches to pain management in frozen shoulder patients.

METHODS

This study used a randomized controlled trial (RCT) design. The study obtained approval from the institutional review board (TERC/SCANT/2024/212). Total 50 patients diagnosed with frozen shoulder were recruited from Department of Anesthesia and Pain Medicine Shaikh Zayed Hospital, Lahore between Sep 2023 and Feb 2024. The sample size of 50 patients was calculated using the WHO calculator, considering a frozen shoulder prevalence of 41.3%, a margin of error of 0.5%, and a significance level of 0.05%.[10] Inclusion criteria included patients aged 18 years and above presenting with symptoms consistent with frozen shoulder, confirmed through clinical evaluation and imaging studies. Exclusion criteria included a history of shoulder surgery, concomitant shoulder pathology, or contraindications to the study interventions. Informed consent was obtained from all participants before enrollment.

Participants were randomly allocated to two groups: Group A received ultrasound-guided intraarticular shoulder injections, while Group B underwent a combination of ultrasound-guided intraarticular shoulder injections and suprascapular nerve blocks. All procedures were performed under ultrasound guidance by experienced clinicians following standardized protocols.

In Group A, patients received ultrasound-guided intraarticular shoulder injections with meticulous aseptic precautions. Comfortably positioned, the skin overlying the shoulder was sterilized, and under real-time ultrasound guidance, a fine needle accurately entered the glenohumeral joint. A blend of local anesthetic and corticosteroid was then injected to alleviate inflammation and pain directly. In Group B, patients underwent a dual approach, combining ultrasound-guided intraarticular shoulder injections with suprascapular nerve blocks. Following strict aseptic protocols, ultrasound imaging identified the suprascapular nerve's course. A precise needle insertion delivered a mixture of local anesthetic and corticosteroid around the nerve to attenuate pain signals and inflammation.

Simultaneously, intraarticular injections targeted the glenohumeral joint, ensuring comprehensive management of intraarticular pathology.

The primary outcome measure was pain intensity assessed using the Visual Analog Scale (VAS) at baseline and follow-up intervals (2nd day, 1st week, 2nd week, and 4th week post-intervention). Secondary outcome measures included passive and active range of motion (ROM) of the shoulder joint assessed using a goniometer at corresponding time points.

Demographic data, including age, gender, laterality, duration of symptoms, and presence of comorbidities (diabetes mellitus), were collected at baseline. Pain intensity and ROM measurements were recorded by trained assessors blinded to the treatment allocation. Statistical analysis was conducted using appropriate parametric and non-parametric tests, with $p < 0.05$ considered statistically significant. Between-group comparisons were performed using independent t-tests or Mann-Whitney U tests for continuous variables and chi-square tests for categorical variables.

RESULTS

A total of 50 subjects were enrolled in the study, with 25 individuals allocated to each group. Group A received ultrasound-guided intraarticular steroid shoulder injection (IASI) combined with suprascapular nerve block (SSNB), while Group B received ultrasound-guided IA steroid shoulder injection alone.

Mean age of patients in Group A was 50.04 ± 12.45 years and that of Group B was 50.60 ± 11.64 years with majority of them being females in both groups. Mean duration of the condition was 3.65 ± 1.08 months and 3.36 ± 1.31 months in Group A and B, respectively. There were no statistically significant differences between the two groups in terms of gender distribution ($p = 0.774$), age ($p = 0.675$), laterality of frozen shoulder ($p = 0.569$), duration of symptoms ($p = 0.396$), and presence of diabetes mellitus ($p = 0.556$) as shown in Table-I and Figure-1.

At the time of enrollment into the study, the mean VAS score in Group-A was 7.20 ± 1.12 and in Group-B was 7.12 ± 0.93 without any statistical difference ($p=0.784$). On the 2nd day, Group A exhibited a significantly lower mean VAS score compared to Group B ($p = 0.004$). This trend persisted through the 1st week ($p < 0.001$), 2nd week ($p < 0.001$), and 4th week ($p < 0.001$) post-intervention, indicating superior pain relief in Group A [Table-II & Figure-2].

Objective measurement of ROM of the shoulder joint in the two groups was comparable at initial assessment. Statistically significant improvement in active as well as passive ROM was recorded following intervention in both the groups. This improvement was observed in all directions of motion. At first follow-up (2nd day) following intervention the improvement in passive and active abduction, flexion and extension were comparable in the two groups ($p>0.05$). However, in the case of rotational movements Group-A patients showed better improvement at first follow-up (2nd day). In the rest of the follow-ups both the groups showed significant improvement as compared to baseline. Intergroup comparison at 1st week, 2nd week and 4th week follow-ups showed better improvement in group-A in both active and passive movements in all directions ($p<0.05$) as shown in Table-III & IV.

Characteristics	Group A	Group B	P-Value
	n (%)	n (%)	
Gender			
Female	14 (56.0%)	15 (60.0%)	0.774 [a]
Male	11 (44.0%)	10 (40.0%)	
Age (years) Mean ± SD	52.04 ± 12.45	50.60 ± 11.64	0.675 [b]
Laterality			
Left	10 (40.0%)	12 (48.0%)	0.569 [a]
Right	15 (60.0%)	13 (52.0%)	
Duration (months) Mean ± SD	3.65 ± 1.08	3.36 ± 1.31	0.396 [b]
Diabetes Mellitus			
Yes	10 (40.0%)	8 (32.0%)	0.556 [a]
No	15 (60.0%)	17 (68.0%)	

Table-I. Comparison of demographic and clinical characteristics between the two groups
[a] Chi square test; [b] Unpaired t-test.

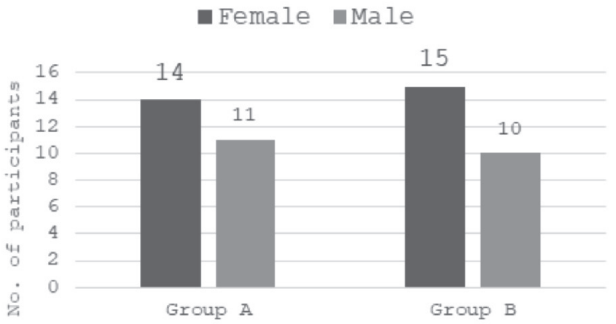

Figure-1. Gender distribution between the two groups.

Figure-2. Comparison among study group VAS Score at various time intervals in Group A and Group B.

VAS Score	Group A	Group B	P-Value [a]
	Mean ± SD	Mean ± SD	
Pre-op	7.20 ± 1.12	7.12 ± 0.93	0.784
2nd Day	4.88 ± 1.30	5.92 ± 1.12	0.004
1st Week	3.80 ± 1.00	5.24 ± 0.93	< 0.001
2nd Week	3.60 ± 0.76	5.16 ± 0.90	< 0.001
4th Week	3.24 ± 1.13	4.60 ± 1.12	< 0.001

Table-II. Comparison of mean Visual Analogue Scale (VAS) Score between the two groups
[a] Unpaired t-test.

DISCUSSION

Frozen shoulder, a debilitating condition marked by stiffness and pain in the shoulder joint, often requires precise interventions for effective pain management. Among these interventions, ultrasound-guided intraarticular shoulder injections stand out as a targeted approach to deliver medication directly into the affected area, offering relief and promoting mobility.[11]

Variables	Duration	Group A	Group B	P-Value [a]
		Mean ± SD	Mean ± SD	
Abduction (Passive)	Pre-op	111.24 ± 19.26	112.20 ± 24.61	0.879
	2nd Day	125.76 ± 23.31	119.36 ± 16.19	0.265
	1st Week	141.76 ± 17.28	125.16 ± 20.85	0.004
	2nd Week	143.32 ± 26.55	125.64 ± 24.82	0.019
	4th Week	155.52 ± 24.93	131.84 ±17.10	< 0.001
Flexion (Passive)	Pre-op	117.68 ± 22.53	123.16 ± 27.78	0.447
	2nd Day	134.32 ± 23.63	130.68 ± 23.02	0.584
	1st Week	147.44 ± 21.98	137.32 ± 17.35	0.077
	2nd Week	149.20 ± 19.09	138.40 ± 24.67	0.09
	4th Week	159.04 ± 16.56	141.52 ±16.52	< 0.001
Extension (Passive)	Pre-op	43.52 ± 11.35	43.12 ± 11.76	0.903
	2nd Day	54.56 ± 9.44	50.12 ± 10.34	0.119
	1st Week	63.16 ± 9.85	54.24 ± 7.98	< 0.001
	2nd Week	64.44 ± 12.21	54.88 ± 8.18	0.002
	4th Week	67.44 ± 8.92	57.92 ± 9.05	< 0.001
Internal Rotation (Passive)	Pre-op	32.44 ± 10.22	31.64 ± 10.58	0.787
	2nd Day	49.04 ± 12.22	35.44 ± 16.62	0.002
	1st Week	60.84 ± 13.69	41.60 ± 12.14	< 0.001
	2nd Week	62.64 ± 11.42	43.24 ± 10.02	< 0.001
	4th Week	68.64 ± 10.20	45.84 ± 11.20	< 0.001
External Rotation (Passive)	Pre-op	33.40 ±9.48	32.60 ± 9.61	0.768
	2nd Day	49.44 ± 16.01	39.24 ± 11.80	0.014
	1st Week	62.08 ± 13.02	43.20 ± 12.09	< 0.001
	2nd Week	64.32 ± 12.85	44.48 ± 12.62	< 0.001
	4th Week	70.52 ± 15.44	46.80 ± 12.82	< 0.001

Table-III. Comparison of mean passive ROM (degrees) between the two groups
[a] Unpaired t-test.

Variables	Duration	Group A	Group B	P-Value [a]
		Mean ± SD	Mean ± SD	
Abduction (Active)	Pre-op	102.48 ± 24.25	108.80 ± 23.09	0.350
	2nd Day	122.44 ± 16.70	116.68 ± 18.32	0.251
	1st Week	139.52 ± 19.33	123.52 ± 27.65	0.022
	2nd Week	142.24 ± 23.02	124.84 ± 26.94	0.018
	4th Week	153.44 ± 20.15	129.20 ± 21.53	< 0.001
Flexion (Active)	Pre-op	109.16 ± 18.81	114.32 ± 21.15	0.367
	2nd Day	130.08 ± 21.74	127.72 ± 19.96	0.691
	1st Week	143.44 ± 20.63	131.24 ± 19.58	0.037
	2nd Week	147.56 ± 21.87	134.28 ± 20.73	0.032
	4th Week	158.44 ± 18.89	141.04 ± 23.78	0.006
Extension (Active)	Pre-op	40.00 ± 13.95	40.92 ± 13.69	0.815
	2nd Day	52.92 ± 12.23	48.36 ± 8.87	0.138
	1st Week	58.16 ± 7.30	49.56 ± 6.95	< 0.001
	2nd Week	61.12 ± 7.87	54.24 ± 10.00	0.009
	4th Week	65.64 ± 10.27	57.04 ± 9.70	0.004
Internal Rotation (Active)	Pre-op	29.36 ± 6.30	27.60 ± 9.37	0.440
	2nd Day	46.56 ± 10.59	34.04 ± 7.69	< 0.001
	1st Week	58.00 ± 10.33	41.24 ± 8.21	< 0.001
	2nd Week	60.64 ± 11.08	42.60 ± 6.84	< 0.001
	4th Week	66.52 ± 6.93	45.28 ± 9.88	< 0.001
External Rotation (Active)	Pre-op	30.68 ± 12.86	30.16 ± 11.88	0.883
	2nd Day	46.44 ± 12.68	38.00 ± 8.94	0.009
	1st Week	58.64 ± 7.27	43.04 ± 8.92	< 0.001
	2nd Week	62.60 ± 10.89	44.08 ± 9.10	< 0.001
	4th Week	68.68 ± 8.03	46.16 ± 8.07	< 0.001

Table-IV. Comparison of mean active ROM (degrees) between the two groups
[a] Unpaired t-test.

However, the choice between this method and suprascapular nerve blocks depends on various factors, including the patient's specific condition and the physician's expertise. Both techniques aim to alleviate pain and restore function, highlighting the importance of individualized treatment plans in managing frozen shoulder effectively.[12]

Our study, compared to Sheikh et al. (2012), revealed comparable gender distributions: 56.0% female and 44.0% male in Group A, and 60.0% female and 40.0% male in Group B. Mean ages in our study were 50.04 years in Group A and 50.60 years in Group B, similar to Sheikh et al.'s reported average age of 49.4 years across both groups. Disease duration in our study ranged from 3.36 to 3.65 months, while Sheikh et al. reported a range of 3 to 12 months.[13] Our study and Verma et al. (2019) both revealed similar mean ages: 50.04 ± 12.45 years in Group A, 50.60 ± 11.64 years in Group B, and median ages of 51 years in the SSNB group, and 55 years in the IASI group, respectively. Gender distribution favored females in both studies, with no significant differences between groups (p = 0.774 in our study, p = 0.2316 in Verma et al.). Duration of symptoms showed no significant disparities (p = 0.396 in our study, p = 0.9419 in Verma et al.), while pain laterality did not differ significantly between groups in either study (p = 0.569 in our study, p = 0.796 in Verma et al.).[14] Despite slight variations, these figures highlight similarities and differences in participant demographics and disease characteristics between the studies.

In both our study and Jain et al. (2021), mean pain scores at enrollment were comparable: 7.20 ± 1.12 in Group A and 7.12 ± 0.93 in Group B in our study, and 7.64 ± 1.2 in Group A and 7.72 ± 1.29 in Group B in Jain et al.'s study, with no statistical difference (p=0.784 in our study, p=0.7 in Jain et al.). Both studies demonstrated significant pain reduction post-intervention (p<0.001), with Group A consistently showing superior improvement

over Group B (p=0.004 in our study).[15] These findings underscore the efficacy of the intervention and highlight Group A's sustained pain relief superiority throughout the study period. While Jain et al. (2021) found initially comparable ROM between groups, our study highlighted significant discrepancies post-surgery. Group A consistently demonstrated superior passive ROM compared to Group B, notably evident in abduction, flexion, extension, internal rotation, and external rotation during the initial weeks. These findings suggest a distinct advantage for Group A in post-operative rehabilitation and functional outcomes, aligning with Jain et al.'s observation of better improvement in rotational movements in Group A patients at one week.[15]

While Naorem et al. (2018) reported significant improvements in passive range of motion (ROM) for internal and external rotation in both control and study groups[16], our study and the findings of Sonune et al. (2016) corroborate similar improvements in passive ROM over subsequent follow-ups, aligning with previous literature.[17] Notably, our study found comparable ROM between groups at initial assessment, consistent with Sonune et al.'s observation. However, we observed better improvement in rotational movements in Group A at the first follow-up, akin to Naorem et al.'s findings. Moreover, our study demonstrated sustained superiority of Group A over Group B in both active and passive movements across subsequent follow-ups, emphasizing the efficacy of the intervention. Additionally, our findings align with previous studies regarding significant reduction in pain and disability, with the study group showing superior improvement at the 4-week follow-up.[18,19] This highlights the clinical significance of our results and supports the implementation of similar interventions in rehabilitation protocols.

The findings of Jung et al. (2019) closely parallel our study results, particularly in terms of improvements in shoulder range of motion (ROM) parameters. Both studies observed significant improvements in all measured parameters over the course of the intervention period. However, similar to our study, Jung et al. noted superior improvements in certain ROM parameters, specifically forward flexion (FF) and abduction (ABD), in the group receiving a specific intervention (SSNB þ IAI) compared to the control group (IAI alone).[20] This suggests that targeted interventions, such as SSNB þ IAI, may lead to more substantial improvements in specific shoulder movements compared to standard interventions alone. These findings underscore the importance of tailored rehabilitation strategies in optimizing post-operative outcomes and functional recovery following shoulder surgery.

Potential limitations of the study include its single-center design, relatively small sample size, and the absence of long-term follow-up data. Additionally, inherent biases associated with subjective outcome measures such as pain assessment may impact the study findings.

CONCLUSION

In conclusion, our study highlights the significant advantage of Group A over Group B in achieving greater passive range of motion post-injection, particularly evident in abduction, flexion, extension, internal rotation, and external rotation. These findings emphasize the potential benefits of tailored rehabilitation protocols in optimizing functional outcomes following shoulder injection.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Hajra Shuja:** Manuscript writing, data analysis, final draft.
2	**Syed Mehmood Ali:** Proof reading, critical analysis.
3	**Yusra Hussain:** Data collection, proof reading.
4	**Sadaf Bukhari:** Data collection proof reading.
5	**Adnan Bashir:** Data collection.