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Randomized control study comparing the functional outcome of suprascapular nerve block and hydrodistension in the treatment of frozen shoulder

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Abstract

Background: Frozen shoulder or adhesive capsulitis (AC) is a common musculoskeletal disease which imposes significant morbidity and affects the quality of life. The present study was done to compare the effectiveness of the suprascapular nerve block (SSNB) under ultrasound guidance and hydrodistension in the management of AC. **Materials and Methods:** This prospective randomized control study was conducted in 60 patients visiting the Department of Orthopaedic Surgery, BARC Hospital, Mumbai, with AC not improving with physiotherapy. Patients were divided into Group A (n = 30) who received SSNB under ultrasound guidance in addition to physiotherapy and Group B (n = 30) who underwent hydrodistension of shoulder in addition to physiotherapy. Values for the ROM, Quick DASH score, and visual analog scale (VAS) score were obtained for each patient at the baseline and at 4, 8, and 12 weeks. **Results:** Female preponderance was observed in both the groups and overall 22% werediabetics. The difference in improvement in flexion, abduction, external rotation, and internal rotation from baseline to 12 weeks, 4 to 8 weeks, 4 to 12 weeks, and 8 to 12 weeks was higher in hydrodistension group as compared to SSNB group ($p < 0.05$). The decrease in the VAS and Quick DASH scores from baseline to 12 weeks was higher in hydrodistension group as compared to SSNB group ($p < 0.05$). **Conclusion:** Both SSNB and hydrodistension are useful in the management of AC. However, hydrodistension displayed better outcome as compared to SSNB in improving the functional outcome of patients.

Keywords: Diabetes mellitus, Joint capsule, Range of motion, Articular, Shoulder joint, Shoulder pain.

INTRODUCTION

Frozen shoulder or adhesive capsulitis (AC) is a common musculoskeletal disease characterized by insidious onset, progressive pain, and reduction in the active and passive range of motion (ROM) in the glenohumeral joint [1]. The global incidence of AC is between 3% and 5% in the general population and as high as 20% among patients with diabetes mellitus (DM) [2]. In the Indian population, the prevalence is as high as 50% in older patients with diabetes and 2%–10% in patients without diabetes [3]. AC presents clinically as shoulder pain exhibiting both passive and active restricted movement paired with normal radiographic appearance of the glenohumeral joint. Although most authors have reported the involvement of inflammatory change during the initial phase of the disease, followed by joint capsule constriction in the later stages, the exact pathophysiology of AC remains unclear [4]. The final stage of the disease is the recovery stage during which the ROM is gradually restored [5, 6]. AC treatments are aimed at relieving pain and improving the ROM and disability. Several therapeutic options such as simple analgesic, nonsteroidal anti-inflammatory drugs, physical therapy, intra-articular steroid injections, manipulation under general anesthesia, and arthroscopic capsular release are available for the treatment of AC [7–9]. However, conclusions regarding the optimal treatment options are inconsistent. Additionally, refractory cases of AC are detrimental to the quality of life of patients, and their treatment remains a challenge [10]. Suprascapular nerve block (SSNB) has gained attention as an effective treatment option for AC due to its simplicity [10]. Hydrodistension, which involves the injection of saline or steroid into the glenohumeral joint, has proven to be beneficial in alleviating pain and improving ROM in patients with AC [11]. However, to the best of our knowledge, none of the studies have compared the efficacy of these treatments. Therefore, the present study attempted to compare the

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effectiveness of the SSNB under ultrasound guidance and hydrodistension in the management of AC.

MATERIALS AND METHODS

Trial design and participants

The present prospective randomized control trial was conducted in 60 patients with a frozen shoulder visiting the outpatient department of the Department of Orthopaedic Surgery at BARC Hospital, Mumbai, from August 2019 to August 2020. The study was conducted after institutional ethics clearance.

Inclusion criteria

Patients in the age group of 18–80 years with shoulder pain associated with restriction of active shoulder flexion, abduction, internal rotation, and external rotation, and with normal anteroposterior radiographs of the shoulder joint in neutral rotation were included in the study.

Exclusion criteria

Patients with rheumatoid arthritis or post infective shoulder stiffness, those with a history of shoulder trauma or surgery, pregnant and breastfeeding women, and patients whose magnetic resonance imaging of the shoulder exhibited intrinsic glenohumeral pathology such as rotator cuff tears and glenohumeral arthritis were excluded from the study.

The purpose of the study was explained to all the patients, and informed consent was obtained from all of them. The patients underwent physiotherapy for 3 weeks, and only those patients whose condition did not improve with physiotherapy were randomly allocated using a random number table to one of the two groups, namely Group A (n = 30) who received suprascapular nerve block (SSNB) under ultrasound guidance in addition to physiotherapy and Group B (n = 30) who received hydrodistension of shoulder in addition to physiotherapy. All the patients received the participation information sheet, with information regarding the study including the withdrawal rights.

Ultrasound-guided SSNB

The patients were placed in a seated position, with the hands resting on the thighs. The ultrasound transducer was initially placed transversely over the scapular spine before gradually moving in a cephalad and in a slightly lateral direction until the suprascapular notch, and the transverse scapular ligament was identified. The suprascapular nerve lies just inferior to the ligament. A 23-gauge Quincke spinal needle was used to pierce the skin after local infiltration with local anaesthetic solution in a mediolateral direction at an angle of 30°–45° to the vertical under ultrasound guidance. After identification, 5 mL of 0.5% bupivacaine was injected slowly into the area around the nerve.

Hydrodistension of shoulder

The patients were positioned in the supine position, with the affected arm externally rotated and a sandbag on the hand. The image intensifier was centered on the glenohumeral joint to include scapula and upper third of the humerus. After scrubbing, draping, and administering local anaesthesia, skin entry was marked for arthrogram needle site over the inferomedial aspect of the articular surface superomedial to the anatomical neck of the humerus. The arthrogram needle was positioned, connected to the connector tap and tube, and introduced vertically along the axis of the X ray beam at the marked site until the articular cartilage was encountered. Then, 0.5–1 mL of contrast was injected to confirm the intra-articular position of the needle. A further 6 mL of contrast was injected, and a radiograph was taken. A large volume of saline containing local anaesthetic (2% lignocaine) was then injected into glenohumeral joint (total volume 30–50 mL).

Outcome measures

Baseline values for ROM of the affected shoulder; a shortened version of disabilities of the arm, shoulder, and hand (Quick DASH) score; and visual analogue scale (VAS) score were obtained for each patient. The patients were followed up for 12 weeks and reviewed for pain, disability, and ROM data at 4, 8, and 12 weeks after each treatment. Improvement in the active ROM (assessed using clinical goniometer) was the primary outcome measure, whereas VAS and Quick DASH scores for pain and function, respectively, were the secondary outcome measures.

Rehabilitation and follow up

All the patients in both groups were given verbal and written instructions regarding exercise programs, which comprised daily warming up for 5 min, followed by self-mobilization, joint stretching, and pendulum exercises. A gradual increase in exercises from isometric to isotonic in different ranges of motion was used within the painless or slightly painful range. Active ROM exercises were performed up to the point of pain. Use of shoulder wheel, overhead pulleys, or wand exercises were postponed until the shoulder pain was tolerable. Ultrasound therapy was administered (1 MHz, average intensity = 0.5 W/cm2) for 10 min thrice a week. The ROM (abduction, flexion, internal rotation, and external rotation) was assessed at each follow up by a trained assessor with the help of a clinical goniometer, and an average of three readings was considered the final reading. For the assessment of pain levels, VAS score charts were given to every patient at each follow-up visit, and they were asked to mark the level of pain as experienced on the day of follow up.

For assessment of the Quick DASH score, a questionnaire based on the ability to perform daily life activities in the past week was given to the patients on each follow-up visit in Hindi/English/Marathi language, and the score was calculated by a trained assessor based on the responses.

Statistical analysis

Statistical analysis was performed using SPSS Version 25.0. (IBM Corp. srmonk, NY: IBM Corp.). The numeric continuous data are expressed as mean ± standard deviation or median. Numeric data was tested for normality assumption before applying statistical tests. Pre- and post-assessment of the interventions was tested using the Paired Student 'T' test or Wilcoxon Signed test depending upon the distribution. Comparison of intervention was performed using the unpaired 'T' test or Mann–Whitney U test depending upon the distribution. A P value of ≤0.05 was considered statistically significant.

RESULTS

Table 1 describes the demographics of the study population. A majority of the patients in each group were women (53.3% in Group A and 60% in Group B). Most patients were within the age group of 40–60 years. The mean age of patients in the hydrodistension group was 50.1 years, whereas that in the SSNB group was 49.3 years. Diabetes mellitus was the most common comorbidity associated with frozen shoulder, with 40% of patients exhibiting diabetes mellitus in the hydrodistension group, and 33.3% of patients exhibiting DM in the SSNB group.

Table 1: Demographic and clinical characteristics of the study population

Characteristics	Hydrodistension (n=30) n (%)	SSNB (n=30) n (%)
Gender		
Female	18 (60)	16 (53.3)
Male	12 (40)	14 (46.7)
Age group		
30–40	6 (20)	4 (13.3)
40–50	10 (33.3)	10(33.3)
50–60	10 (33.3)	11 (36.7)
60–70	4 (13.3)	5 (16.7)
Duration of symptoms (months)		
1–2	5 (16.7)	6 (20)
2–3	12 (40)	10 (33.3)
3–4	10 (33.3)	8 (26.7)
4–5	3 (10)	6 (2 0)
Comorbidity		
Diabetes mellitus	12 (40)	10 (33.3)
None	18 (60)	20 (66.7)
Side involved		
Left/Non-dominant	17 (56.7)	18 (60)
Right/Dominant	13 (43.3)	12 (40)

The difference in improvement in flexion, abduction, external rotation, and internal rotation from baseline to 12 weeks, 4 to 8 weeks, 4 to 12 weeks, and 8 to 12 weeks was more in the hydrodistension group than in the SSNB group, and this difference was statistically significant ($p < 0.05$) (Table 2).

Table 2: Improvement in range of motion between the SSNB and hydrodistension

Range of Motion (°)	Time Points	SSNB	Hydrodistension
Abduction	Baseline 4 weeks	14.57±3.34	17.47±2.87
	4-8 weeks	16.93±2.95	19.50±3.93 [a*]
	8-12 weeks	13.53±5.37	17.47±3.15 [a*]
Flexion	Baseline 4 weeks	14.87±4.95	17.53±4.44
	4-8 weeks	16.90±4.65	18.70±3.40 [a*]
	8-12 weeks	9.73±2.88	14.87±2.49 [a*]
External Rotation	Baseline 4 weeks	15.97±4.20	14.17±2.35
	4-8 weeks	12.53±2.80	15.53±2.46 [a*]
	8-12 weeks	9.70±2.71	13.17±4.36 [a*]
Internal Rotation	Baseline 4 weeks	9.90±3.09	11.77±2.70
	4-8 weeks	11.47±2.58	16.47±2.06 [a*]
	8-12 weeks	7.47±2.45	10.97±2.81 [a*]

The data were represented as mean ±SD. a- comparison between hydrodistension and SSNB.
* denotes statistically significant p<0.05

The decrease in the VAS score from baseline to 12 weeks, 4 to 12 weeks, and 8 to 12 weeks was more in the hydrodistension group than in the SSNB group, and this difference was statistically significant ($p < 0.05$).

The decrease in the Quick DASH score from baseline to 12 weeks was more in the hydrodistension group than in the SSNB group, and this difference was statistically significant ($p < 0.0001$) (Table 4).

Table 3: Improvement in the VAS score between the SSNB and hydrodistension

Parameters	Time Points	SSNB	Hydrodistension
Pain (VAS Score)	Baseline	8.45±0.56	8.23±0.65
	Baseline 4 weeks	2.02±0.56	1.87±0.57
	4-8 weeks	2.13±0.47	1.22±0.32 [a*]
	8-12 weeks	1.93±0.54	1.05±0.49 [a*]

The data were represented as mean ±SD. a- comparison between hydrodistension and SSNB.
* denotes statistically significant p<0.05.

Table 4: Improvement in the DASH score between SSNB and hydrodistension

Parameters	Time Points	SSNB	Hydrodistension
Quick DASH Score	Baseline	84.53±4.83	83.43±5.50
	Baseline 4 weeks	20.23±3.10	20.23±3.45
	4-8 weeks	17.37±4.05	19.60±4.78 [a*]
	8-12 weeks	9.97±4.51	23.57±4.33 [a*]

The data were represented as mean ±SD. a- comparison between hydrodistension and SSNB.
* denotes statistically significant p<0.05

DISCUSSION

AC is a common regional pain disorder for which multiple treatment options have been proposed. Of these, SSNB and hydrodistension have become popular due to their safety and efficacy. Therefore, the present study attempted to compare the effectiveness of the SSNB under ultrasound guidance and hydrodistension in the management of AC. AC may be classified into the following three stages: stage I is characterized by inflammatory cell infiltration of the synovium; stage II is characterized by proliferation of synovial cell; and stage III is characterized by the accumulation of dense collagenous tissue within the capsule. Thus, the pathophysiology of AC is initial inflammation leading to reactive fibrosis [12].

The present study exhibited a female predilection for frozen shoulder (Table 1). This finding is concurrent with those of Sheridan *et al*. [12] and Le *et al*. [13]. Given that frozen shoulder is common in individuals aged 40–60 years, its incidence is high in post-menopausal women. Estrogen has potent anti-inflammatory properties. The onset of menopause leads to a significant decrease in estrogen levels [14]. Thus, post-menopausal women are more prone to inflammation and inflammatory disorders. This may be the reason for the predisposition of females to frozen shoulder. Additionally, the present study exhibited the increased incidence of frozen shoulder in patients with diabetes (Table 1). This finding is concurrent with those of Hsu *et al*. [15] and Arkkila *et al*. [16] who exhibited a strong correlation between diabetes and AC. Hyperglycaemia is associated with the formation, accumulation, and overexpression of advanced glycosylation end-products (AGEs) [15]. These AGEs induce inflammation and increase cross-linking in the collagen, ligaments, and tendons, making these structures weaker and stiffer [15]. This explains the fibroblastic proliferation and deposition of collagen matrix in AC [17].

The suprascapular nerve supplies sensory fibres to approximately 70% of the glenohumeral joint. Thus, the SSNB is effective in the management of AC as it increases the patient's pain threshold, allowing more intense physical therapy to be administered to the patient, which in turn increases the ROM [10]. The present study also exhibited improvement in the ROM, VAS score, and Quick DASH score from baseline to 12 weeks ($p < 0.001$).

Hydrodistension of the glenohumeral joint by using steroid, normal saline, or local anaesthetic agent distends the capsule by breaking the

fibrosis. This helps in improving the ROM and Quick DASH score [18]. In the present study, a mixture of local anaesthetic was injected in the joint. Therefore, a decrease in VAS scores along with the improvement in the ROM and Quick DASH score was observed. A contrast agent was also added to identify capsule rupture.

The present study demonstrated that hydrodistension exhibited a significant improvement in the ROM, VAS score, and Quick DASH score from baseline to 12 weeks ($p < 0.05$). This may be due to the fact that hydrodistension breaks adhesions in addition to providing analgesic action through the local anaesthetic.

Limitations

The present study has certain limitations. The relatively small sample size and single-center design of the study prevent the generalization of its findings. Additionally, the multiple aspects included in the ROM may introduce false negative readings. Further multicentre studies with a larger sample size are required to strengthen the findings of the present study.

CONCLUSION

Both SSNB and hydrodistension are useful in the management of AC; however, hydrodistension exhibited greater improvements in the ROM, VAS score, and Quick DASH score from baseline to 12 weeks. Thus, hydrodistension must be considered prior to SSNB for early onset pain relief and early improvement in ROM, with less complications and side effects.

REFERENCES

1. Le HV, Lee SJ, Nazarian A, Rodriguez EK. Adhesive capsulitis of the shoulder: review of pathophysiology and current clinical treatments. Shoulder Elbow 2017; 9(2):75-84. https://doi.org/10.1177/1758573216676786
2. Hand GC, Athanasou NA, Matthews T, Carr AJ. The pathology of frozen shoulder. J Bone Joint Surg Br. 2007; 89(7):928-32. https://doi.org/10.1302/0301-620X.89B7.19097
3. Bhale AA, Wani SK. Evaluation of shoulder kinesthesia in patients with unilateral frozen shoulder. Int J Res Med Sci. 2019; 7(6):2187–2191. https://doi.org/10.18203/2320-6012.ijrms20192496
4. Bunker TD, Anthony PP. The pathology of frozen shoulder. A Dupuytren-like disease. J Bone Joint Surg. 1995; 77(5):677–683. PMID: 7559688.
5. Rodeo SA, Hannafin JA, Tom J, Warren RF, Wickiewicz TL. Immunolocalization of cytokines and their receptors in adhesive capsulitis of the shoulder. J Orthop Res. 1997; 15(3):427-436. https://doi.org/10.1002/jor.1100150316.
6. Hannafin JA, Chiaia TA. Adhesive capsulitis: a treatment approach. Clin Orthop Relat Res. 2000; 372:95–109.
7. Jones DS, Chattopadhyaya C. Suprascapular nerve block for the treatment of frozen shoulder in primary care: a randomized trial. Br J Gen Pract. 1999; 49(438):39–41. PMC1313316
8. Kivimäki J, Pohjolainen T. Manipulation under anaesthesia for frozen shoulder with and without steroid injection. Arch Phys Med Rehabil. 2001; 82(9):1188–1190. https://doi.org/ 10.1053/apmr.2001.24169
9. Nicholson GP. Arthroscopic capsular release for stiff shoulders: Effect of etiology on outcomes. Arthroscopy 2003; 19(1):40–9. https://doi.org/ 10.1053/apmr.2001.24169, 10.1053/jars.2003.50010
10. Ozkan K, Ozcekic AN, Sarar S, Cift H, Ozkan FU, Unay K. Suprascapular nerve block for the treatment of frozen shoulder. Saudi J Anaesth. 2012; 6(1):52–55. https://doi.org/10.1016/j.jse.2015.10.015
11. Bryant M, Gough A, Selfe J, Richards J, Burgess E. The effectiveness of ultrasound guided hydrodistension and physiotherapy in the treatment of frozen shoulder/adhesive capsulitis in primary care: a single center service evaluation. Should Elbow. 2017; 9(4):292–298. https://doi.org/10.1177/1758573217701063
12. Le HV, Lee SJ, Nazarian A, Rodriguez EK. Adhesive capsulitis of the shoulder: review of pathophysiology and current clinical treatments. Shoulder Elbow. 2017; 9(2):75–84. https://doi.org/10.1177/1758573217701063
13. Sheridan MA, Hannafin JA. Upper extremity: emphasis on frozen shoulder. Orthop Clin North Am. 2006; 37(4):531–539. https://doi.org/10.1016/j.ocl.2006.09.009
14. Monteiro R, Teixeira D, Calhau C. Estrogen signalling in metabolic inflammation. Mediators Inflamm. 2014; 615917. https://doi.org/10.1155/2014/61591715.
15. Hsu C, Sheu WH. Diabetes and shoulder disorders. J Diabetes Investig. 2016; 7(5):649–651. https://doi.org/10.1111/jdi.12491
16. Arkkila PE, Kantola IM, Viikari JS, Ronnemaa T. Shoulder capsulitis in type I and II diabetic patients: association with diabetic complications and related diseases. Ann Rheum Dis. 1996; 55(12):907–914. https://doi.org/10.1136/ard.55.12.907
17. Hwang KR, Murrell GA, Millar NL, Bonar F, Lam P, Walton JR. Advanced glycation end products in idiopathic frozen shoulders. J Shoulder Elbow Surg. 2016; 25(6):981–988. https://doi.org/10.1016/j.jse.2015.10.015
18. Pandey V, Madi S. Clinical guidelines in the management of frozen shoulder: an update! Indian J Orthop. 2021; 55(2):299–309. https://doi.org/10.1007/s43465-021-00351-3