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ORIGINAL ARTICLE

Effectiveness of subacromial steroid injection and hydrodilatation in the treatment of adhesive capsulitis: A comparative analysis.

Muhammad Salman Masroor[1], Naseem Munshi[2], Athar Muniruddin Siddiqui[3], Muhammad Hassam[4], Arham Azizi[5], Zahra Salahuddin[6]

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ABSTRACT… Objective: To compare the effectiveness of Subacromial Steroid Injection (SAI) and Hydrodilatation in treating adhesive capsulitis (frozen shoulder). **Study Design:** Observational study. **Setting:** Department of Orthopedic, Dr. Ziauddin Hospital, Located in North Nazimabad, Karachi, Pakistan. **Period:** March 2023 to September 2023. **Methods:** Included 138 participants with primary adhesive capsulitis. Participants were divided into two groups: one received hydrodilatation and the other received SAI. The Disability of Arm, Shoulder, and Hand (DASH) Score and Visual Analogue Scale (VAS) were used for pre and post-treatment assessments at intervals of 2 weeks, 6 weeks, and 6 months. SPSS version 23 was used to analyze the data. **Results:** Both groups show significant reductions in pain scores and DASH scores over time (p-value<0.05 for changes within each group). There are significant differences in pain scores and DASH scores between the groups at 6 weeks, 12 weeks, and 6 months (p-value<0.05), with the hydrodilatation group showing better outcomes. Moreover, the mean reduction in pain scores and DASH scores from pre-treatment to 6 months is significantly greater in the hydrodilatation group compared to the SAI group (p-value<0.05). **Conclusion:** While both Hydrodilatation and SAI are effective in reducing pain and improving functionality in patients with adhesive capsulitis, Hydrodilatation appears to be more effective in achieving these outcomes, particularly in terms of pain management and functional improvement.

Key words: Adhesive Capsulitis, Functional Improvement, Frozen Shoulder, Hydrodilatation, Pain Management, Subacromial Steroid Injection.

INTRODUCTION

Adhesive capsulitis, commonly known as frozen shoulder, represents a prevalent condition characterized by pain and limited range of motion in the shoulder, affecting both passive and active movements.[1,2] Almost 2% to 5% of the general population, and nearly 20% of the diabetic patients experienced it.[3] This condition may arise due to unknown cause (idiopathic or primary) or as a consequence of other health issues, such as stroke (hemiparesis), rotator cuff injuries, diabetes, and heart diseases.[4,5] Despite its tendency to be a self-limiting condition that often resolves spontaneously within 18 to 30 months, the primary therapeutic goals are to alleviate symptoms and enhance shoulder mobility.[4,6] Various conservative treatments of adhesive capsulitis may include physiotherapy along with NSAIDs, steroid injections, hydrodilatation, arthroscopic release of capsule and manipulation under anesthesia.[7]

Among the steroid injection techniques, intra-articular injection (IAI) and subacromial injection (SAI) are notably popular. IAI requires fluoroscopy and a controlled setting, making it technically more challenging compared to SAI, which can be administered in a clinic without fluoroscopy. Both methods aim to reduce pain and improve the range of motion of the glenohumeral joint in patients with adhesive capsulitis.[1,7,8] However, shoulder hydrodilatation, a more invasive procedure introduced by Andren and Lundberg, involves the introduction of fluid into the glenohumeral joint to induce capsular rupture, thereby enhancing range of motion and alleviating shoulder pain.

1. MBBS, PG Trainee Orthopedic, Ziauddin University, Karachi.
2. MBBS, FCPS, MRCS, Consultant Orthopedic Surgeon, Ziauddin University, Karachi.
3. MBBS, FRCS (Edinburg), FRCS (England), Consultant Orthopedic and Spine Surgeon, Ziauddin University, Karachi.
4. MBBS, PG Trainee Orthopedic, Ziauddin University, Karachi.
5. MBBS, PG Trainee Orthopedic, Ziauddin University, Karachi.
6. MBBS, PG Trainee Orthopedic, Ziauddin University, Karachi.

Correspondence Address:
Dr. Naseem Munshi
Department of Surgeon
Ziauddin University, Karachi.
naseemmunshi@hotmail.com

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This method is recognized for being relatively safe, cost-effective, and capable of producing rapid and satisfactory outcomes.[9,10]

Despite these treatments, there remains a lack of conclusive evidence regarding the superiority of steroid injections over hydrodilatation in managing adhesive capsulitis. Addressing this knowledge gap, our study aims to compare the effectiveness of SAI and hydrodilatation in treating frozen shoulder, providing valuable insights into optimizing non-surgical treatment approaches for this condition. This would help in guiding clinicians regarding selection of the most appropriate, effective, and patient-centric treatment modality.

METHODS

This observational study was carried out in the Orthopedic department of Dr. Ziauddin Hospital, located in North Nazimabad, Karachi, Pakistan from March 2023 to September 2023. To determine the required sample size, we utilized the Open Epi sample size calculator, considering parameters such as the mean pain score at 6 months—2.8±1.6 for the SAI group and 2.1±1.3 for the hydrodilatation group[11] with a test power of 80% and a 95% confidence interval. Based on these calculations, a total of 138 participants were recruited for the study, evenly divided into two groups of 69 each. The study included patients diagnosed with primary adhesive capsulitis, characterized by non-traumatic onset and the failure of conservative treatment measures, including physiotherapy, for a minimum duration of three months in individuals aged 40 years and above. Exclusion criteria were patients with a history of any prior interventions on the affected shoulder, those who had suffered trauma to the shoulder, or presented with associated neurological weaknesses in the upper limb on the side of the affected shoulder.

This study was approved by ethical review committee (ERC07-03/23) of the institute. Informed consent was obtained from all the eligible patients. Exposed group included patients who had hydrodilatation (n=69) and unexposed group included patients who had SAI (n=69). Baseline data such as age, gender and BMI was collected from all the patients. All patients were admitted as daycare as per hospital protocol. Pre and post procedure assessment of patients regarding Disability of arm, shoulder and hand (DASH) Score and Visual Analogue Scale (VAS) undergoing either procedure was done. Disability of arm, shoulder and hand (DASH) Score is based on a 30 items questionnaire encompassing symptoms and physical, social and psychosocial aspects of function of upper limb, each item scored from 1-5 on a Likert scale, resulting in a raw initial score of 0 for minimum and 100 for maximum disability. Whereas, Visual Analogue Scale (VAS); self-respondent graphical 10 points scale, which is depicted by score 0 (no pain) and 10 (worst imaginable pain). The study outcomes were measured at pre- treatment, 2 weeks, 6 weeks and 6 months after treatment.

Data analysis was done using SPSS software version 26. All quantitative variables were summarized by descriptive statistics. Frequencies and percentages were reported for categorical variables and mean and standard deviation for numeric data. The outcomes i.e. pain and DASH score within groups at different time intervals were compared using Repeated Measure ANOVA. The outcomes between groups at pre and post treatment levels were compared using independent samples T test. Mean difference (pre and post treatment at 6 months) in pain score and DASH were also compared between groups using independent samples T test. A p-value < 0.05 was considered as statistically significant.

RESULTS

The mean age of the participants is approximately 49.20 years, with a standard deviation of 9.45 and mean BMI is about 25.58, with a standard deviation of 4.04. The average age and BMI are similar between the two groups, with no significant differences (p-values > 0.05). Out of the 138 participants, 74 are female and 64 are male. Both groups have a similar proportion of males and females, with no significant difference in gender distribution (p-value=0.495). About 39 participants have diabetes and 26 have hypertension. Furthermore, the proportion of

patients with diabetes and hypertension is also similar across the two groups, with no significant differences (p-values > 0.05). (Table-I)

Table-II compares the pain scores at different time points (pre-treatment, 6 weeks, 12 weeks, and 6 months) between the hydrodilatation and SAI groups. Both groups show significant reductions in pain scores over time (p-value = 0.001 for changes within each group). There are significant differences in pain scores between the groups at 6 weeks, 12 weeks, and 6 months (p-value = 0.001), with the hydrodilatation group showing greater reductions in pain. Similar to pain scores, both groups exhibit significant improvements in DASH scores over time (p-value = 0.001 within each group), indicating improvements in arm, shoulder, and hand function following treatment. There are significant differences in DASH scores between the groups at 6 weeks, 12 weeks, and 6 months (p-value = 0.001).

The mean reduction in pain scores from pre-treatment to 6 months is significantly greater in the hydrodilatation group compared to the SAI group (p-value = 0.001), underscoring the greater effectiveness of hydrodilatation in pain management. Similarly, the mean improvement in DASH scores is significantly higher in the hydrodilatation group (p-value = 0.001), indicating more substantial functional improvements compared to the SAI group. (Table-III)

Characteristics	Total (n=138)	Hydrodilatation (n=69)	SAI (n=69)	P-Value
Age (years)	49.18±9.42	49.63±9.82	48.73±9.04	0.567
BMI (kg/m2)	25.58±4.03	25.47±4.14	25.69±3.95	0.747
Gender				
Male	64 (46.4)	34 (49.3)	30 (43.5)	0.495
Female	74 (53.6)	35 (50.7)	39 (56.5)	
Diabetes				
Yes	39 (28.3)	22 (31.9)	17 (24.6)	0.345
No	99 (71.7)	47 (68.1)	52 (75.4)	
Hypertension				
Yes	26 (18.8)	11 (15.9)	15 (21.7)	0.384
No	112 (81.2)	58 (84.1)	54 (78.3)	
Data presented as mean±SD or n(%)				

Table-I. Baseline characteristics of the patients (n=138)

Group	Pain Score				P-Value
	Pre-treatment	Pain at 6 Weeks	Pain at 12 Weeks	Pain at 6 Months	
Hydrodilatation (n=69)	7.22±0.95	4.15±0.91	3.06±0.99	2.12±0.94	0.001
SAI (n=69)	7.10±0.98	4.95±1.09	3.88±0.97	3.22±0.91	0.001
p-value	0.455	0.001	0.001	0.001	
Group	**DASH Score**				**P-Value**
	Pre-treatment	**Pain at 6 Weeks**	**Pain at 12 Weeks**	**Pain at 6 Months**	
Hydrodilatation (n=69)	50.56±3.93	35.13±3.89	24.97±4.45	19.14±3.67	0.001
SAI (n=69)	49.36±4.52	39.81±4.91	35.32±4.53	30.19±5.84	0.001
p-value	0.099	0.001	0.001	0.001	
Data presented as mean±SD					

Table-II. Comparison of pain scores within and between groups (n=138)

Group	Pain Score	P-Value	DASH Score	P-Value
	Mean Difference		Mean Difference	
Hydrodilatation (n=69)	5.09±1.40	0.001	31.42±4.74	0.001
SAI (n=69)	3.87±1.26		19.16±7.65	
Data presented as mean±SD or n(%)				

Table-III. Comparison of mean difference in Pain and DASH score (Pre-treatment and after 6 months) among groups

DISCUSSION

The prevalence of adhesive capsulitis, commonly known as frozen shoulder, necessitates effective non-surgical treatment options such as steroid injection are required to reduce pain and restore range of motion.[12-14] When medication and physical therapy fail to relieve the symptoms of frozen shoulder, these injections may be considered as a last resort before more invasive or traumatic therapies.[10,15,16] Hence, this study evaluated the effectiveness of SAI versus hydrodilatation for functional outcomes in adhesive capsulitis among patients presented at a tertiary care hospital.

The findings of the current study revealed that the hydrodilatation group exhibited lower VAS scores and better DASH scores at the conclusion of the study. This indicates that shoulder hydrodilatation has promising results in terms of pain reduction and range of motion in forward flexion and external rotation over the first two follow ups. In the study by Yoon et al. have similarly showed that the potential of hydrodilatation in improving shoulder function and pain reduction, highlighting its role as a viable alternative to traditional steroid injections.[11] Choudary et al. in their study also revealed that hydrodilatation has significantly better outcomes as compared to SAI in terms of VAS and SPADI with p-value$<$0.05.[17] Singh et al. also found that hydrodilatation technique yielded satisfactory functional outcomes and is an effective treatment modality for adhesive capsulitis.[18] In another study by Swaroop et al. reported that single SAI and hydrodilatation with steroids improved symptoms, but the group receiving only the steroid injection had better outcomes and required less analgesia in follow-up period. Thus, the steroid-only injection was deemed more effective for managing frozen shoulder during its frozen phase.[19] However, the results of systematic review and meta-analysis by Saltychev et al. revealed that hydrodilatation had a small and clinically insignificant impact on pain reduction, disability level, and improvement in shoulder motion. Additionally, the volume of fluid injected did not significantly affect outcomes.[20] Another systematic review found that some studies showed hydrodilatation combined with corticosteroid injection benefits within three months, while others found no additional advantage.[21] These findings reflect the potential benefits of employing the hydrodilatation injection method for the treatment of primary adhesive capsulitis, but further research is required to gain a comprehensive understanding of the long-term effectiveness and impacts of this method.

The study's strengths lie in its rigorous methodological approach, including a robust sample size and comprehensive outcome measures (VAS and DASH scores), which bolster the reliability of our findings. Additionally, the longitudinal follow-up enabled a detailed assessment of treatment efficacy over time, contributing valuable data to the sparse literature on long-term outcomes of these treatments. Nevertheless, the study is not without limitations. The lack of randomization and potential selection bias may affect the generalizability of the results. Furthermore, the study's single-center design might limit the applicability of findings across different populations and clinical settings. Our study emphasizes on the need for more observational studies and randomized controlled trials (RCTs) to establish definitive treatment guidelines and evidence-based practices for such a prevalent condition encountered in daily general practice, orthopedics, and rheumatology outpatient services. This research contributes significantly to the ongoing sevolution of medical practices, guiding future exploration in this field.

CONCLUSION

Both Hydrodilatation and SAI treatments are effective in reducing pain and improving functionality, but Hydrodilatation appears to be more effective in achieving these outcomes in patients with adhesive capsulitis.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Muhammad Salman Masroor	Concept & Design of the study & literature review.	
2	Naseem Munshi	Concept of study, methodology, final review of manuscript.	
3	Athar Muniruddin Siddiqui	Literature search, final review.	
4	Muhammad Hassam	Results, discussion and final review of the manuscript.	
5	Arham Azizi	Manuscript writing and final revisions.	
6	Zahra Salahuddin	Data analysis, manuscript writing, final review.	