



The Efficacy of Shoulder Hydro Dilatation in Treating Adhesive Capsulitis: A Comprehensive Review with Ultrasonographic Guidance

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Abstract

Background: Adhesive capsulitis, commonly known as frozen shoulder, is a debilitating condition characterized by pain and restricted shoulder motion. Ultrasound-guided shoulder hydro dilatation has emerged as a minimally invasive and effective treatment. This study aimed to assess the efficacy of ultrasound-guided hydro dilatation in improving pain, function, and range of motion in Bangladeshi patients with adhesive capsulitis.

Methods: A prospective observational study was conducted in the Department of Physical Medicine and Rehabilitation at Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh, from February 2024 to January 2025. A total of 80 patients with clinically diagnosed adhesive capsulitis underwent ultrasound-guided shoulder hydrodilatation using corticosteroid, saline, and local anesthetic. Pain severity was evaluated using the Visual Analog Scale (VAS), functional disability with the Shoulder Pain and Disability Index (SPADI), and shoulder range of motion (ROM) was measured in degrees. Assessments were performed at baseline, 1 month, and 3 months post-treatment.

Results: The mean VAS score significantly decreased from 7.8 ± 1.1 at baseline to 3.2 ± 1.0 at 1 month and 1.6 ± 0.9 at 3 months ($p < 0.001$). SPADI scores improved from 78.2 ± 6.5 to 24.3 ± 5.2 at 3 months ($p < 0.001$). Significant gains were observed in shoulder ROM across all measured planes ($p < 0.001$). At 3 months, 87.5% of patients reported being satisfied or very satisfied with treatment outcomes.

Conclusion: Ultrasound-guided hydro dilatation is an effective, safe, and well-tolerated treatment for adhesive capsulitis, demonstrating significant improvements in pain relief, mobility, and patient satisfaction in the Bangladeshi population.

Keywords: Adhesive capsulitis; Frozen shoulder; Hydro dilatation; Ultrasound-guided Injection; Bangladesh; Corticosteroid; Shoulder mobility.

Introduction

Adhesive capsulitis, or frozen shoulder, is a common musculoskeletal disease of progressively painful and limited active and passive motion of the glenohumeral joint [1]. It usually occurs in adults aged 40-60 years and is more prevalent in females. It contributes significantly to disability, hindering the activities of daily living and lowering the quality of life [2]. In Bangladesh, where manual labor or repetitive arm movement is depended upon by the majority of people for daily life, adhesive capsulitis can both economically and socially have a heavy load [3]. Though the exact aetiology

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of adhesive capsulitis is still not clearly known, it is assumed to be an illness due to chronic inflammation and fibrosis of the joint capsule [4]. The illness is classically divided into generic primary (idiopathic) and secondary forms, the latter being associated with systemic diseases such as diabetes mellitus, thyroid disorders, and cardiovascular diseases [5]. Diabetes mellitus, in turn, has also a strong correlation with development as well as severity of adhesive capsulitis, and it is highly prevalent in the Bangladeshi population too [6].

Management of adhesive capsulitis involves a range of conservative treatments like oral analgesics, non-steroidal anti-inflammatory agents (NSAIDs), physiotherapy, intra-articular injections of corticosteroids, and mobilization maneuvers [7]. However, in the presence of chronic pain and inadequate response to initial therapy, more advanced interventions such as shoulder hydro dilatation have been found to be effective [8]. Hydro dilatation involves distending the joint capsule by injecting saline, corticosteroid, and local anesthetic mixture, thereby loosening adhesions and improving joint mobility [4]. Ultrasound-guided hydro dilatation offers the additional advantage of real-time visualization of the needle insertion and accurate intra-articular injection, minimizing the risk of complications and maximizing the effectiveness of the procedure [9]. There is sparse data from the South Asian populations, such as Bangladesh, where the availability of healthcare and awareness may be differential [10]. The present study was designed to measure the efficacy of ultrasound-guided shoulder hydrodilatation for increasing pain, range of motion, and functional outcome in patients with adhesive capsulitis in a tertiary level hospital in Bangladesh. The study also aimed to measure patient satisfaction following the intervention and to evaluate common demographic and clinical patterns in affected patients. By generation of local data, this research can potentially inform clinical practice and best evidence-based management strategies for adhesive capsulitis in the Bangladeshi population.

Methodology and Materials

This prospective observational study was conducted in the Department of Physical Medicine and Rehabilitation at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, over a period of one year from February 2024 to January 2025. A total of 80 patients diagnosed with adhesive capsulitis (frozen shoulder) were included based on clinical history, physical examination, and restricted range of motion (ROM), particularly in external rotation, without any underlying shoulder pathology on radiography. Inclusion criteria were female and male patients between 40 and 65 years of age, with more than four weeks' duration of unilateral shoulder pain and stiffness. Patients with a history of shoulder surgery, traumatic injury, rotator cuff tear, or systemic illness such as rheumatoid arthritis were excluded. A single treatment

of shoulder hydro dilatation under ultrasonographic control was given to all the patients who underwent the procedure by a posterior approach in aseptic conditions. 1% lidocaine (5 mL), triamcinolone acetate (40 mg), and normal saline (a maximum of 20 mL) were mixed and injected into the glenohumeral joint for capsular distension. Real-time ultrasound confirmed intra-articular needle placement as well as equal distribution of fluid. Following the procedure, patients were ordered to continue a supervised physiotherapy program that comprised active and passive range of motion exercises for a period of at least six weeks.

Outcome results were assessed in terms of pain using the Visual Analogue Scale (VAS), shoulder ROM (forward flexion, abduction, and external rotation), and Shoulder Pain and Disability Index (SPADI). Measurements were taken in all these assessments at baseline, 1 month, and at 3 months post-intervention. Patient satisfaction was recorded in the final follow-up using a 4-point Likert scale. Data were keyed in and analyzed using SPSS software version 25. Paired t-tests and repeated measures ANOVA were employed to evaluate changes over time, with a statistically significant p-value of <0.05.

Results

Table 1: Baseline Demographic and Clinical Characteristics of the Patients (n = 80)

Characteristics	Categories	Frequency (n)	Percentage (%)
Age (years)	Mean $\pm$ SD	52.6 $\pm$ 8.4	
Gender	Male	30	37.50%
	Female	50	62.50%
Affected Side	Right	42	52.50%
	Left	38	47.50%
Duration of Symptoms (months)	Mean $\pm$ SD	4.2 $\pm$ 1.5	
Comorbidities	Diabetes Mellitus	38	47.50%
	Hypertension	26	32.50%
	None	28	35.00%
Occupation	Housewife	40	50.00%
	Office Worker	25	31.30%
	Others	15	18.70%

Table 1 shows the baseline demographic and clinical characteristics of the patients, with a female predominance (62.5%) and slightly higher involvement of the right shoulder (52.5%). Diabetes mellitus was present in 47.5% of patients, and the majority were housewives (50%). The mean age was 52.6 $\pm$ 8.4 years, and the average duration of symptoms was 4.2 $\pm$ 1.5 months.

Table 2: Comparison of VAS (Pain Score) Before and After Treatment

Time Point	Mean VAS Score $\pm$ SD	p-value
Before Treatment	7.8 $\pm$ 1.1	
1 Month Post-Treatment	3.2 $\pm$ 1.0	< 0.001
3 Months Post-Treatment	1.6 $\pm$ 0.9	< 0.001

Table 3: Improvement in Shoulder Range of Motion (ROM) Over Time

Motion Type	Baseline (°)	1 Month (°)	3 Months (°)	p-value
Forward Flexion	90 $\pm$ 12	125 $\pm$ 15	150 $\pm$ 10	< 0.001
Abduction	80 $\pm$ 10	115 $\pm$ 14	140 $\pm$ 12	< 0.001
External Rotation	20 $\pm$ 6	40 $\pm$ 8	60 $\pm$ 10	< 0.001

Table 2 shows a statistically significant reduction in mean VAS pain scores from 7.8 before treatment to 3.2 at 1 month and 1.6 at 3 months post-treatment ($p < 0.001$), indicating marked pain relief following ultrasound-guided hydrodilatation.

Table 3 presents the progressive improvement in shoulder range of motion (ROM) after ultrasound-guided hydro dilatation. Forward flexion improved from 90° $\pm$ 12 at baseline to 125° $\pm$ 15 at 1 month and 150° $\pm$ 10 at 3 months. Abduction increased from 80° $\pm$ 10 to 140° $\pm$ 12, and external rotation from 20° $\pm$ 6 to 60° $\pm$ 10 over the same period. All improvements were statistically significant ($p < 0.001$).

Table 4 shows a significant reduction in the mean SPADI score from 78.2 $\pm$ 6.5 before treatment to 24.3 $\pm$ 5.2 at 3 months post-treatment, indicating substantial improvement in shoulder pain and disability following ultrasound-guided hydro dilatation ($p < 0.001$).

Table 4: SPADI Score Improvement

Time Point	Mean SPADI Score $\pm$ SD	p-value
Before Treatment	78.2 $\pm$ 6.5	
3 Months Post-Treatment	24.3 $\pm$ 5.2	< 0.001

Table 5: Patient Satisfaction at 3 Months (n = 80)

Satisfaction Level	Frequency (n)	Percentage (%)
Very Satisfied	48	60.00%
Satisfied	22	27.50%
Neutral	6	7.50%
Dissatisfied	4	5.00%

Table 5 illustrates patient satisfaction levels at 3 months following ultrasound-guided hydro dilatation. A majority of patients (60%) reported being very satisfied, while 27.5% were satisfied. Only a small portion expressed neutral (7.5%)

or dissatisfied (5%) responses, indicating overall positive outcomes and high patient acceptance.

Discussion

This study aimed to evaluate the efficacy of ultrasound-guided hydro dilatation in improving pain, shoulder mobility, function, and patient satisfaction in Bangladeshi patients with adhesive capsulitis. The results demonstrate significant improvements in VAS pain scores, SPADI scores, and shoulder range of motion (ROM) over a three-month period. Furthermore, patient satisfaction was notably high, with 87.5% of patients reporting being either satisfied or very satisfied with the treatment outcome. The findings align with prior research highlighting the benefits of hydro dilatation in treating adhesive capsulitis. Wang et al., compared posterior and rotator interval approaches and found both methods effective in pain reduction and functional recovery, suggesting the technique's versatility regardless of anatomical route [11]. Similarly, Yoong et al., demonstrated the effectiveness of targeted hydro dilatation through the rotator interval, emphasizing precise delivery under ultrasound guidance to maximize outcomes [12]. Pain relief observed in our study mirrors results from previous trials, such as those by Latzka et al., and Zeng & Zhu, where corticosteroid-assisted hydro dilatation significantly lowered pain and disability scores compared to corticosteroid injection alone [13,14]. Moreover, the rapid pain reduction observed as early as one-month post-treatment supports the use of hydro dilatation as a timely intervention, a feature echoed in studies by Papa lexis et al. and Yang et al. [15,16].

A key strength of our study was the integration of real-time ultrasound guidance, ensuring accurate placement of the injectate, avoiding unnecessary capsule rupture, and reducing procedural discomfort. Pimenta et al., highlighted that capsule-preserving techniques may provide comparable results to capsule-rupturing ones, with fewer complications and faster recovery [17]. This approach may be particularly important in resource-limited settings like Bangladesh, where repeat procedures or follow-up interventions may not be feasible for all patients. In terms of shoulder ROM improvement, our data showed consistent gains across forward flexion, abduction, and external rotation, aligning with systematic reviews such as Wu et al., which established hydro dilatation as a superior modality in restoring movement compared to physical therapy or corticosteroids alone [18]. Long-term observational studies by Dimitri-Pinheiro et al., also support the durability of these improvements [19]. The significant drop in SPADI scores post-treatment reflects enhanced functional capacity, a critical aspect of quality of life in patients, especially those engaged in domestic and professional work. Bryant et al., found similar results when combining ultrasound-guided hydro dilatation with physiotherapy in primary care settings,

suggesting that a structured post-procedure rehabilitation protocol could further boost outcomes [20].

Interestingly, 47.5% of our participants had diabetes, a known risk factor for adhesive capsulitis and a modifier of treatment response. Dimitri-Pinheiro et al., noted that diabetic patients often respond more slowly to hydrodistension treatment [21]. Despite this, our results showed significant improvement even among diabetic participants, underscoring the robustness of ultrasound-guided hydro dilatation in diverse patient profiles. Patient satisfaction in our study was high, consistent with previous findings by Flores-Villalobos et al., and Hill, who emphasized the importance of combining minimally invasive interventions with conservative rehabilitation strategies [22,23]. The simplicity and safety of the technique make it especially suitable for implementation in tertiary hospitals across Bangladesh. In light of recent advances, newer techniques such as contrast-enhanced ultrasound or sonographically navigated capsule-preserving methods are being explored for further precision [24,25]. However, given the cost and complexity, these may not yet be viable in the Bangladeshi context. Our study confirms that conventional ultrasound-guided hydro dilatation offers substantial benefits and can be scaled effectively in low-resource environments.

Limitations of the study

Limitations of our study include a relatively short follow-up period and the lack of a control group for comparative analysis. Future studies could explore the long-term effects and compare different injectate compositions, approaches (posterior vs. anterior), and combinations with rehabilitation therapies. Inclusion of MRI or ultrasound evaluation of capsular thickness pre- and post-treatment could also offer more objective insights into structural recovery.

Conclusions

In conclusion, ultrasound-guided hydro dilatation is an effective, well-tolerated, and patient-friendly treatment option for adhesive capsulitis. In the context of Bangladeshi clinical settings, it offers a practical and impactful solution, especially when integrated early in the disease course.

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Conflicts of interest

There are no conflicts of interest.

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