Hydrodilatation: The Effective Treatment Modality in Adhesive Capsulitis

Prasenjeet Singh, Munish Sood1, Amresh Ghai2, G. R. Joshi2, Romesh Dubey3, Anjan Prabhakara4

Department of Orthopaedics, Military Hospital, Agra, Uttar Pradesh, 1Department of Orthopaedics, CH (WC) Chandimandir, Haryana, 2Department of Orthopaedics, Base Hospital Delhi, Cantt, New Delhi, 3Department of Orthopaedics, BVP Hospital, Pune, Maharashtra, 4Department of Orthopaedics, 166 Military Hospital, Jammu and Kashmir, 5Department of Orthopaedics, Military Hospital Kirkee, Pune, Maharashtra, India

Abstract

Introduction: Adhesive capsulitis of the shoulder joint is the commonly seen condition by the orthopedic surgeon. Hydrodilatation (HD) has been used as one of the treatment options in the management of adhesive capsulitis but with variable results. The aim of this prospective interventional study was to assess the functional outcome using the HD technique. Materials and Methods: Forty-one patients with adhesive capsulitis who were managed with HD technique and were meeting the inclusion criteria were included in the study. Patients were evaluated before the intervention and at the regular follow-up after the treatment using the constant score for functional assessment and Visual Analog Scale (VAS) for pain. Results: Seventeen (41.5%) patients were male and 24 (58.5%) were female. The mean age of the patients was 54.75 years (range 29–75 years). Eight out of 41 (19.5%) were patient with diabetes. At the final follow-up of 13.48 months (range 12–16 months), the mean constant score improved significantly from the preintervention level of 29.85 ± 9.09 to 82.02 ± 8.147 (P = 0.001), whereas the median VAS improved from before the intervention level of 8 (range 05–10) to 1 (range 0–3), respectively. Conclusions: HD technique yield satisfactory functional outcome and is an effective treatment modality in the management of adhesive capsulitis.

Keywords: Adhesive capsulitis, hydrodilatation, shoulder joint

INTRODUCTION

The term “Adhesive Capsulitis” also known as periarthritis shoulder was coined by Neviaser to describe a contracted, thickened joint capsule that seemed to be drawn tightly around the humeral head with a relative absence of synovial fluid and chronic inflammatory changes within the subsynovial layer of the capsule. Clinically, the adhesive capsulitis is characterized by pain and progressive loss of passive and active movement of the shoulder joint. Various treatment options, including oral medications (nonsteroidal anti-inflammatory drugs), physiotherapy, intraarticular steroid injections, hydrodilatation (HD), shoulder manipulation, and arthroscopic or open capsular release, have been developed to loosen the shoulder contraction and adhesion. These interventions can be used individually or in combination.

HD as one of the options in the management of adhesive capsulitis was first described by Andren and Lundberg. It involves the intraarticular injection of a large amount of normal saline to distend and rupture the capsular adhesions of the shoulder joint.

In our search of PubMed data, many studies have been done to analyze the effectiveness of various treatment modalities for adhesive capsulitis. However, there is a lack of evidence on the effectiveness of HD followed by physiotherapy in the management of adhesive capsulitis, especially from the Indian subcontinent. This study is an attempt to fill this gap by evaluating functional outcome after HD followed by physiotherapy in the management of adhesive capsulitis.

Address for correspondence: Dr. Munish Sood, CH (WC), Chandimandir - 134 107, Haryana, India. E-mail: soodmunishafmc@gmail.com

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Singh P, Sood M, Ghai A, Joshi GR, Dubey R, Prabhakara A. Hydrodilatation: The effective treatment modality in adhesive capsulitis. J Orthop Traumatol Rehabil 2019;11:100-3.

Submission: 13.08.2018 Revision: 07.04.2019
Acceptance: 26.12.2019 Web Publication: 24.03.2020
**MATERIALS AND METHODS**

This is a prospective interventional study carried out at the tertiary care center from September 2012 to September 2015. Forty-five patients who presented with the complaint of primary adhesive capsulitis shoulder and meeting the inclusion criteria were included in the study.

**Inclusion criteria**
The inclusion criteria were as follows:
1. Age >18 years
2. Symptoms of pain and stiffness in the shoulder for minimum 4 weeks
3. Restriction of passive motion of the shoulder in ≥2 planes of movement
4. Normal anterior-posterior and lateral view radiographs of the shoulder joint.

**Exclusion criteria**
The exclusion criteria were as follows:
1. Systemic inflammatory diseases
2. Glenohumeral joint arthritis
3. Malignancy
4. Contraindications to arthrograms and/or HD such as warfarin therapy, allergy to local anesthetic, or iodinated contrast
5. Pregnancy
6. Acute trauma, fracture, or shoulder surgery.

**Sample size calculation**
The sample size was estimated based on the previous study. The mean difference of the Visual Analog Scale (VAS) score from baseline to 6 months was 3.9 with standard deviation of 1.65. Our sample size came out to be five participants at a power of 90% and confidence interval of 95%. However, to increase the power of the study, we have included the number of patients in our study.

**Steps of intervention**
The procedure was performed on an outpatient basis. The patients were explained about the procedure, risks, and benefits associated with the procedure before the intervention. The intervention (HD) was carried out in the operation theater under local anesthesia. A needle was inserted into the glenohumeral joint through the anterior approach and the position checked by image intensifier before and after the injection of a small quantity of radioopaque contrast material [Figure 1a-c]. Approximately 50–100 ml of normal saline was injected into the joint to progressively distend the capsule and continued until the capsule ruptured [Figure 1d].

**Posttechnique rehabilitation**
All the patients were advised pendulum exercises followed by the range of motion exercises after the intervention as per the patient’s tolerance for the pain. These exercises were advised to be done in a repetition of 6–8 times on the affected hand. Patients were followed up in the outpatient department (OPD) at 1 week, 1 month, 6 month and final follow-up after the intervention using the constant score and VAS.

**Statistical analysis**
The statistical analysis was performed using the SPSS software version 22.00. The functional outcome was compared using the constant score before the intervention and after the intervention at regular follow-ups and $P$ value was calculated using the paired $t$-tests while VAS level was using the Wilcoxon signed-rank test. The functional outcome in different gender and diabetic and nondiabetic patients was compared using unpaired $t$-tests ($P < 0.05$ was considered statistically significant).

**Ethical clearance and informed consent**
Ethical clearance was obtained from the Ethics Committee of the hospital before the start of the intervention study. Written informed consent was obtained from all the patients.

**RESULTS**
At a mean follow-up of 13.48 months (range 12–16 months), 41 of 45 patients with adhesive capsulitis were evaluated. Four patients were lost to follow-up. Seventeen out of 41 (41.5%) patients were male and 24 (58.5%) were female. The mean age of the patients was 54.75 years (range 29–75 years). The dominant side was involved in 16 patients (39.1%), whereas the nondominant side was involved in 25 patients (60.9%). Eight out of 41 (19.5%) were patients with diabetes.

The mean constant score before the intervention and after the intervention at 1 week, 1 month, 6 months, and at the final follow-up was 29.85 ± 9.09, 45.98 ± 9.52, 67.88 ± 12.84, 82.24 ± 7.65, and 82.02 ± 8.147, respectively [Table 1]. The increase in mean constant score from before the intervention level to the final follow-up was found to be statistically significant ($P < 0.001$).
The mean constant score for females and males was evaluated at each follow-up separately. There was a significant improvement in the mean score from before the intervention level (male – 33.29 and female – 27.42) to the final follow-up after the intervention (male – 83.24 and female – 81.17). However, this variation was not found to be statistically significant while comparing both the genders at the final follow-up ($P = 0.43$).

The mean constant score was also compared between diabetics and nondiabetic patients. There was a significant improvement in the mean score from before the intervention level (diabetic – 29.25 and nondiabetic – 30) to the final follow-up after the intervention (diabetic – 77.25 and nondiabetic – 83.18). However, there was no statistically significant relation seen between the constant score and presence or absence of diabetes ($P = 0.06$).

The median VAS level before the treatment level at 1 week, 1 month, 6 months, and at the final follow-up after the intervention was 8 (range 5–10), 6 (range 3–10), 1 (range 0–6), 1 (range 0–3), and 1 (range 0–3), respectively [Table 1]. The decrease in VAS from pretreatment to final follow-up was found to be statistically significant ($P = 0.001$).

Median VAS at the final follow-up in both the gender was male (1; range 0–3) and female (range 1; 0–2), and there was a significant improvement of mean VAS in both the gender at the final follow-up. However, there was no statistically significant relation found between the mean VAS and the gender of the patient at the final follow-up ($P = 0.55$).

Median VAS in diabetic patients was compared with nondiabetic patients. Although the decrease in VAS was observed in each group after treatment, no statistically significant trend in the difference in VAS observed between the diabetic and nondiabetic patients at the final follow-up ($P = 0.15$).

**DISCUSSION**

The adhesive capsulitis is a commonly seen condition in orthopedics OPD, characterized by pain and progressive loss of movements of the shoulder joint.$^{[2,3]}$ Three phases have been described for this condition in the literature.$^{[2,3]}$

- **Phase I:** It is also known as an acute or painful phase that lasts for weeks to months and is associated with gradually progressive shoulder pain
- **Phase II:** It is known as stiffening or adhesive phase which lasts for 4–12 months. In this phase, the patient avoids the movements of the shoulder joint to prevent pain, which leads to the stiffness of the joint
- **Phase III:** It is known as resolution or thawing phase, which lasts for weeks to months. The patient gradually regains movements as pain in the shoulder joint decreases. However, some restriction in range of motion remains in patients without treatment.

Clinically, pain followed by the restriction of internal rotation of the shoulder joint are the presenting complaints. Later, the restriction of flexion and external rotation occur.$^{[4]}$ The radiographs of the shoulder joint are usually normal. Bone scans have been found to be positive in patients with adhesive capsulitis by Wright et al.$^{[14]}$ However, Binder et al.$^{[15]}$ found no correlation between the positive bone scan and symptoms, recovery, or other findings. Magnetic resonance imaging (MRI) of the shoulder joint can show increased blood flow to the synovium in patients with adhesive capsulitis, but the main role of the MRI is to diagnose or rule out other pathologies of the shoulder joint. Arthrogram of the shoulder joint can reveal a reduced joint volume (<10 ml) with the irregularity of margins of the capsule.

The present study was carried out to assess the effectiveness of HD in the treatment of primary adhesive capsulitis. A total of 41 patients with frozen shoulder were evaluated. All these patients were managed by HD followed by physiotherapy. The demographic profile (mean age, gender, and side involved) in the present case series was similar to various other studies.$^{[16,17]}$

HD procedure is usually performed under local anesthesia with the help of fluoroscopy and involves an intraarticular injection of saline to distend the shoulder joint.$^{[9]}$ The goal of this procedure is to increase the volume of the shoulder joint.
with the aim of rupturing the contracted capsule and adhesions of the shoulder joint. The rupture of contracted capsule and adhesiolysis leads to the opening up of the joint which increases the range of movement of the shoulder. This intervention can be used individually or in combination with other modalities like physiotherapy. However, various studies on HD have reported varied clinical results.\(^5\)\(^,\)\(^11\)

The results of the present study showed a statistically significant \((P < 0.001)\) increase in mean constant score before the intervention level to the final follow-up after the intervention. Thus, the current study shows the beneficial effect of HD followed by physiotherapy as a treatment modality for the primary adhesive capsulitis shoulder. None of the patients had procedure-related complication. Various other studies\(^5\)\(^,\)\(^11\) have also advocated HD as the treatment modality for the primary frozen shoulder.

The present study showed a decrease in median VAS from before the treatment level to final follow-up after the intervention, and this decrease has been found statistically significant \((P < 0.001)\). This decrease in median VAS plateaus after 1 month. No significant decrease in median VAS was observed between follow-up 1 month postintervention and at the final follow-up. Our results also showed no statistically significant difference in increase in the mean constant score or decline in median VAS among female patients compared to male patients.

Some studies have shown that patients with diabetes have lower functional outcome score as compared to nondiabetic patients.\(^11\)\(^,\)\(^19\) In the present study, the final follow-up results in both diabetic and nondiabetic was similar. However, the number of patients with diabetes was less. Therefore, we need to study a larger group of patients to compare the functional outcome in diabetic and nondiabetic population.

One of the main limitations of the present study was that there was no control group to compare the functional outcome which would have added further evidence to our study.

**Conclusions**

HD is a simple, cost-effective procedure that can be done on an outpatient basis; it causes breaking of adhesions and eventual rupture of capsule thus improving the range of motion and functional capacity of the shoulder joint.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**References**

1. Neviasser JS. Adhesive capsulitis of the shoulder: A study of the pathological findings in periartiritis of the shoulder. JBJS 1945;27:211-22.
2. Holloway GB, Schenk T, Williams GR, Ramsey ML, Iannotti JP. Arthroscopic capsular release for the treatment of refractory postoperative or post-fracture shoulder stiffness. J Bone Joint Surg Am 2001;83:1682-7.
3. Reeves B. The natural history of the frozen shoulder syndrome. Scand J Rheumatol 1975;4:193-6.
4. Canale ST, Beaty JF. Campbell’s Operative Orthopaedics. 11th ed. Philadelphia: Mosby, Elsevier; 2008. p. 2625-6.
5. Rizk TE, Gavant ML, Pinals RS. Treatment of adhesive capsulitis (frozen shoulder) with arthrographic capsular distension and rupture. Arch Phys Med Rehabil 1994;75:803-7.
6. Trehan RK, Patel S, Hill AM, Curtis MJ, Connell DA. Is it worthwhile to offer repeat hydrodilatation for frozen shoulder after 6 weeks? Int J Clin Pract 2010;64:356-9.
7. Watson L, Bialocerkowski A, Dalziel R, Balster S, Burke F, Finch C. Hydrodilatation (distension arthrography): A long-term clinical outcome series. Br J Sports Med 2007;41:167-73.
8. Shah N, Lewis M. Shoulder adhesive capsulitis: Systematic review of randomised trials using multiple corticosteroid injections. Br J Gen Pract 2007;57:662-7.
9. Andre L, Lundberg BJ. Treatment of rigid shoulders by joint distension during arthropagy. Acta Orthop Scand 1965;36:45-53.
10. Bell S, Coghlan J, Richardson M. Hydrodilatation in the management of shoulder capsulitis. Australas Radiol 2003;47:247-51.
11. Quraishi NA, Johnston P, Bayer J, Crowe M, Chakrabarti AJ. Thawing shoulder. Orthop Proc 2011;93:570.
12. Mukherjee RN, Pandey RM, Nag HL, Mittal R. Frozen shoulder – A prospective randomized clinical trial. World J Orthop 2017;8:394-9.
13. Constant CR, Murley AH. A clinical method of functional assessment of the shoulder. Clinical orthopaedics and related research 1987;(214):160-4.
14. Wright MG, Richards AJ, Clarke MB. Letter: 99mTc-pertechnetate scanning in capsulitis. Lancet 1975;2:1265-6.
15. Binder AI, Bulgen DY, Hazleman BL, Tudor J, Waight P. Frozen shoulder: An arthrographic and radionuclear scan assessment. Ann Rheum Dis 1984;43:365-9.
16. Pushpasekaran N, Kumar N, Chopra RK, Borah D, Arora S. Thawing frozen shoulder by steroid injection. J Orthop Surg (Hong Kong) 2017;25:2309499016684470.
17. Paul A, Rajkumar JS, Peter S, Lambert L. Effectiveness of sustained stretching of the inferior capsule in the management of a frozen shoulder. Clin Orthop Relat Res 2014;472:2262-8.
18. Ahmad ZI, Ingham C, Roberts C. 87-hydrodilatation in the frozen shoulder. Orthop Proc 2011;93:570.
19. Hamdan TA, Al-Essa KA. Manipulation under anaesthesia for the treatment of frozen shoulder. Int Orthop 2003;27:107-9.