

# A Prospective Study on Management of Frozen Shoulder by Hydrodilatation Method

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## ABSTRACT

**Introduction:** Frozen Shoulder is primarily an inflammatory reaction in the capsule and synovium that subsequently leads to the formation of adhesions. Current research aimed to study the efficacy of Hydrodilatation of shoulder under local anaesthesia in the management of frozen shoulder and to study the age and sex distribution of frozen shoulder.

**Material and methods:** This was a prospective study conducted in a tertiary care hospital. A total of fifty patients were included in the study after getting clearance from research and ethical committee. Frozen shoulder is commonly seen in orthopaedic outpatient department affecting approximately 2–5% of the population. The condition is characterized by a thickening and contracture of the capsule. Night pain with a reduced range of movement, particularly external rotation is one of the cardinal symptoms.

**Result:** Frozen shoulder is a clinical syndrome seen in the age group between 40 to 85 years with a mean age of 54.16 years. Slight predominance was noticed in female patients. Excellent results were limited to shoulders treated in early stages of frozen shoulder but improvement was noticed in all shoulders treated by this method. About 14% of the diabetics had an associated frozen shoulder. Diabetics are at a relatively high risk of developing frozen shoulder. Concomitant home exercises program is a must and is the hallmark of success following hydrodilatation.

**Conclusion:** The reduction in surgical procedures will lead to financial savings and create a non operative pathway for the management of this condition. Hydrodilatation is a safe, reliable, cost effective, without requiring specialized equipments in the management of frozen shoulder.

**Keywords:** Frozen Shoulder, Adhesive Capsulitis, Hydrodilatation.

## INTRODUCTION

Frozen shoulder is a condition of unknown aetiology characterized by gradually progressive, painful restriction of all shoulder joint motion, chronicity and slow spontaneous restoration of partial or complete motion over months to year.<sup>1</sup>

Objectives of the study

To study the efficacy of “Hydrodilatation under local anaesthesia” in the management of frozen shoulder.

To study the age and sex distribution of frozen shoulder.

Review of literature

One of the earliest descriptions of the pathology of a frozen shoulder was by Neviaser, in 1945, who found thickened, contracted capsule around the humeral head. Histology of the capsule showed fibrosis and inflammatory cells.<sup>5</sup>

In 1969, Lundberg, reaffirmed the microscopic findings of increased fibrous tissue, fibroblasts, and vascularity but found an unchanged synovial lining and no inflammatory cell infiltrate.<sup>8</sup>

In 1982, Matsen FA and Kirby RM, described that the frozen shoulder may arise from any cause of shoulder pain, immobility, or dysfunction, whether intrinsic or extrinsic.<sup>11</sup>

In 1989, Donald O. Fareed, William R. Gallivan Jr., reported 90% return of function and range of movement with hydraulic distension under local anaesthesia.<sup>3</sup>

In 1994, Rizk TE, Gavant ML, Pinals RS., reported that disruption of the constricted capsule by hydraulic distension seems to be the mechanism for achieving symptomatic relief in adhesive capsulitis.

In 2005, Khan AA, et al., compared distension arthrography with intraarticular steroid plus physical therapy with physical therapy alone and concluded that distension arthrography with intraarticular steroid plus physical therapy was superior over physical therapy alone in the functional improvement of the frozen shoulder.

The present work is based on the study conducted by Donald O. Fareed, and William R, Gallivan Jr. 1989.

## Pathology

It is primarily an inflammatory reaction in the capsule and synovium that subsequently leads to the formation of adhesions, specifically in the axillary fold and in the attachment of the capsule at the anatomic neck of the humerus. Recent arthroscopic evaluation of patient with arthrographically documented adhesive capsulitis has established four stages of the disease.

**Stage I (pre-adhesive stage):** Is seen in patients with minimal or no limitation of motion.

**Stage II (acute adhesive synovitis):** There is a proliferative synovitis and early adhesion formation.

**Stage III (Stage of maturation):** Has less synovitis with loss of axillary fold.

**Stage IV (chronic stage):** Adhesions are fully mature and

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markedly restrictive.<sup>6</sup>

### Predisposing factors:

**1. Age incidence:** It is uncommon below the age of 40 years or over the age of 70. Patients are usually middle aged, with the mean age for males being greater than females (55 years compared to 52 years).<sup>25</sup>

**2. Trauma:** It is observed that frozen shoulder is associated with major trauma to the shoulder or other parts of the extremity. The post surgery frozen shoulder can be prevented by careful post operative exercises.<sup>28</sup>

**3. Immobilization period:** Common to most patients presenting with frozen shoulder, is a period during which the shoulder has been relatively immobile. The reason for the period of immobility is diverse, a flare up of cervical spondylosis, minor shoulder trauma, pain after overuse etc.<sup>25</sup>

**4. Diabetes mellitus:** In general population the incidence of frozen shoulder is about 2-5%, where as among diabetics it is 10-20%. Insulin dependent diabetics have a higher incidence of frozen shoulder (36%). Incidence of bilateral involvement is still higher (46%). So, whenever a patient comes with the bilateral shoulder pain, investigations should exclude diabetes. Patients with frozen shoulder and diabetes are more likely to have retinopathy. Patients who are insulin dependent for more than 10 years have a more serious risk of developing shoulder symptoms persisting for more than two years.<sup>2</sup>

**5. Cervical disc disease:** Lundberg and others reported an increased incidence of frozen shoulder in patients with degeneration of the intervertebral disc of cervical spine. The peak incidence of cervical disc degeneration coincides with the peak incidence of frozen shoulder.<sup>28</sup>

**6. Hyperthyroidism:** Association of frozen shoulder with hyperthyroidism has been reported. Shoulder disorder resolves with the correction of hyper thyroidism.<sup>25</sup>

**7. Thoracic disorders:** Saha reported association of frozen shoulder and emphysema. Upper lobe bronchogenic carcinoma may be associated with frozen shoulder. Long standing association of ischemic heart disease with frozen shoulder is well known.<sup>2</sup>

**8. Intracranial pathology and frozen shoulder:** Patients with hemiplegia, cerebral haemorrhage, tumours have an increased risk for frozen shoulder.<sup>2</sup>

### Clinical presentation:

Frozen shoulder is a clinical syndrome rather than a specific diagnostic entity, a high index of suspicion is needed for proper diagnosis. Not all patients are typical, but an awareness of typical clinical course of primary frozen shoulder and secondary frozen shoulder is essential.<sup>11</sup>

### Primary frozen shoulder:

This is a unique condition that rarely recurs in the same shoulder. Involvement is unilateral in most of the patients. Subsequent involvement of other shoulder may occur in 20% cases. Classically there are three stages to the clinical

course of the primary frozen shoulder.

1. The freezing stage
2. The frozen stage
3. The thawing stage

### The freezing stage

Also called as painful stage. There is a gradual onset of diffuse shoulder pain which cannot be localized. Progressive onset of pain lasting for weeks to months before they consult orthopaedic surgeon is the usual description of the patients. The pain is worse at night and is exacerbated by lying on the affected side. History of sleep disturbance is very common and it is during this stage, that most of the patients are anxious. The duration of the phase varies from 2-9 months. Usually there is less discomfort as the patient use the arm less because of pain. It is often difficult to obtain a history of precipitating factors.

### The frozen stage

Also called as stiffening stage. The painful stage is usually followed by progressive loss of shoulder motion. This may present for 4-12 months. Patient notices inability to use the arm in daily activities like dressing, washing hair or personal hygiene coincide with the objectively measured shoulder motion. Patient complain of difficulty in reaching out for objects, using the back pocket etc., inability to reach the back of the head or interscapular area is expressed by female patients. The pattern of shoulder movements restriction is characteristic, first external rotation, second internal rotation and then abduction. Most of the patients will have a restriction of external rotation of less than 30 degree. Internal rotation is limited where the patient is unable to lift the thumb past lumbar L2 vertebra. The abduction is restricted allowing less than 110 degree. About 10% with negligible glenohumeral movement. Patients often experience a dull ache and a periscapular pain punctuated by sharp pains which occur when the arm comes to its free range of motion. As the motion is regained, pain subsides.

### Thawing stage

Final stage described as thawing or the gradual regaining of motion is measured in weeks or months; rather than in days. As motion slowly increases there is progressive lessening of discomfort. The time taken is quite unpredictable. Time taken by the patients to regain functional range of movement may be 6-9 months sometime it may be even upto 2 years. Shoulder movement is regained gradually without specific treatment.<sup>3, 25</sup>

### Secondary frozen shoulder

Precipitating event can be identified in these patients. There may have been a recent episode of shoulder pain, due to over use. Localized shoulder pain suggesting a subacromial bursitis or tendinitis may have occurred which may have resolved. Frozen shoulder may develop after a soft tissue trauma or a fracture. A history of an upper extremity fracture followed by a full-blown frozen shoulder is seen less now a days due to emphasis on early mobilization of shoulder. Frozen shoulder may also be due to a partial thickness tear of the rotator cuff that has been misinterpreted as an intrinsic

shoulder pain or any inflammatory condition of the shoulder joint or adjacent soft tissue. These stages noted above may not be notable in secondary frozen shoulder.<sup>2</sup>

## MATERIALS AND METHODS

50 Patients with frozen shoulder syndrome of which 4 cases with bilateral shoulder involvement were studied in the out and in-patient departments. All the patients were treated with hydrodilatation under local anesthesia, on an outpatient and inpatient basis. All these cases were treated from June 2020 to July 2021

A detailed history was elicited with particular reference to frozen shoulder. A preliminary general physical examination was done. The built and nourishment, physiological age and psychological status of the patients were assessed. Systemic examination of cardiovascular, Respiratory, gastrointestinal, and genitourinary examinations was followed as routine, to rule out any specific cause for pain restricted movements of the shoulder joint and a detailed local examination was done. Inspection:

The patients both shoulders were adequately exposed so as to compare the affected side with normal side and the following points noted;

1. Attitude
2. Deformities and swelling
3. Muscle wasting

### Palpation

Palpation of the shoulder was regionalized by considering the anterior, lateral, posterior and superior aspect of the shoulder separately.

Tenderness, Swelling, Temperature changes, deformities, muscle contractures and relationship of various structures were also noted.

### Movement:

Both the quality and the range of motion of both shoulders were recorded. The quality of motion was seen as the ease of movement of the upper limb in toto when the patient was undressing.

### Range of Motion

As per the recommendation of the "Society of American Shoulder and elbow surgeons" the following arcs of motion were recorded.<sup>2</sup>

1. Passive forward elevation with the patient in supine position measured as the angle between the arm and thorax.
2. Passive external rotation with the arm at the side measured as an angle between the fore arm and the sagittal plane with the elbow flexed to 90°.
3. Active internal rotation measured as the level of spinous process that the patient can reach behind the back with the tip of the thumb of the affected hand
4. Active abduction in the plane of the scapula, measured as the angle between the trunk and the arm.

### The scoring system for pain are as follows:

- Score 0 Complete disability  
Score 1 Marked pain.

- Score 2 Moderate pain.  
Score 3 After usual activity  
Score 4 Slight  
Score 5 None.

### The scoring system for function are as follows:

Different basic function like tucking the saree of back if female or using the back pocket if male and touching the opposite axilla, eating, combing hair and use of hand overhead were assessed.

The functional scores were as follows:

- Score 0 Patient unable to do function  
Score 1 Impaired function  
Score 2 Function done with difficulty  
Score 3 Mild compromise in doing function  
Score 4 Normal range of function

This scoring pattern was based on the recommendation of "The society of American Shoulder and elbow surgeons".<sup>2</sup>

### Investigations

Before starting treatment with hydraulic distension, the following routine investigations were carried out.

1. Urine: Albumin, Sugar, Microscopy
2. Blood: Haemoglobin %  
Total count  
Differential count  
Erythrocyte sedimentation rate  
Random blood sugar, Blood urea, serum creatinine
3. X-ray: AP view of the shoulder joint.<sup>2</sup>

### Diagnostic Criteria

Different authors have indicated different range of restricted shoulder motion for a patient to be diagnosed as having frozen shoulder. In this study the diagnostic criteria used by Patrik. J. Mumaghan has been used. It includes patients who has progressive shoulder pain and stiffness with reduced movement, for which no specific cause was identifiable, patient should have had less than 30 degree of external rotation, less than 130 degree of forward elevation and less than 120 degree of abduction to be included in the study. There was variable limitation of internal rotation.<sup>2</sup>

### Hydrodilatation:

**Technique:** The distension of the affected shoulder was performed in the supine posture and with all aseptic precautions. The affected side was exposed, painted with povidone iodine solution, cleaned with spirit and draped with a holed sterile towel.

The shoulder was palpated and good understanding of the anatomical configuration was made. The arm was held in as much external rotation as possible to facilitate the needle placement into the anterior aspect of the joint under C-Arm guidance. This position was maintained while palpating anatomical landmarks and also during procedure.

The joint space was entered at a point just inferior to angle of the acromion. 2 ml of 2% injection Xylocaine and 80mg of triamcinolone acetate was injected into the joint cavity.

Distension of the capsule was then performed with normal

saline using a 10ml disposable syringe with a 22 gauge needle. The quantity of normal saline used for distension depended on the distensibility of the joint capsule. Distension was continued till the resistance was felt. The patient then had active assisted Range of movement exercises. The patients were advised to continue regular home exercises. This consisted of pendulum exercises, resisted flexion, extension, internal and external rotation and abduction exercises performed four times daily. The patient was sent home with an advice to take a course of antibiotics, (Amoxycillin with clavulanic acid 625mg twice a day for 5 days) with diclofenac tablets 50 mg twice a day for 5 days. They were followed up at 2 weeks interval, Range of movements and functions were examined, as second distension was repeated if necessary. At 6 weeks follow up examination, function and range of movements were again documented.

### DEMOGRAPHIC AND CLINICAL DATA

Fifty patients with 54 shoulders of frozen shoulder syndrome were treated with Hydrodilatation under local anaesthesia as an outpatient procedure.

1. Pre and post distension comparison  
The pain score in this study before and after distension is as follows:
2. For the purpose of analysis, the sum of the external rotation, forward elevation, abduction was, calculated and average was taken.
3. All the functional scores were added up and average was calculated. Any decimal in the results was rounded off to the nearest whole number for the purpose of analysis. In this study the shoulder had the following functional scores.
4. The overall results were as follows:

Pain Score	No. of shoulders			Percentage		
	Pre Distension	Post Distension	Follow up	Pre Distension	Post Distension	Follow up
0	1	0	0	2	0	0
1	17	6	0	34	12	0
2	16	15	4	32	30	8
3	20	24	10	40	48	20
4	0	9	34	0	18	68
5	0	0	6	0	0	12

**Table-1:** Pre and post distension comparison:

Range of Movements	No. of shoulders			Percentage		
	Pre distension	Post distension	Follow up	Pre distension	Post Distension	Follow up
0-20	1	0	0	2	0	0
21-40	14	2	1	28	4	2
41-60	10	12	1	20	24	2
61-80	23	12	12	46	24	24
81-100	6	12	8	12	24	16
101-120	0	16	18	0	32	36
121-140	0	0	14	0	0	28

**Table-2:** Sum of the external rotation, forward elevation, abduction was, calculated and average was taken.

Functional Score	No. of shoulders			Percentage		
	Pre distension	Post distension	Follow up	Pre distension	Post distension	Follow up
0	1	1	0	12	2	0
1	12	5	0	24	10	0
2	19	22	9	38	44	18
3	16	23	23	32	46	46
4	1	3	22	2	6	44

**Table-3:** All the functional scores were added up and average was calculated. Any decimal in the results was rounded off to the nearest whole number for the purpose of analysis

Results	No. of shoulders		Percentage	
	Post distension	Follow up	Post distension	Follow up
Excellent	2	19	4	38
Good	22	26	44	52
Fair	23	8	46	16
Poor	7	1	14	2

**Table-4:** The overall results

### INTRA OP PICTURES



### DISCUSSION

In this study, a descriptive term "Frozen shoulder" issued to describe a clinical syndrome where the patient has restricted range of movement (both active and passive) for which no other cause can be identified.

**1. Age incidence:** In this study the average age documented was 54.16 years. 42 of the 50 cases were under 60 years. It was observed that frozen shoulder was common in 5<sup>th</sup> and 6<sup>th</sup> decades of life<sup>1</sup>. R.J. Neviasser, and T.J. Neviasser, has noted that frozen shoulder is very commonly affected the patients between the age group of 40 to 60 years<sup>6</sup>.

**2. Sex incidence:** The female male ratio in this study is 1.77 : 1 was established. Most authors have documented a female predominance<sup>1,6,25,28</sup>.

**3. Side affected:** In this study there was predominance of the non-dominant arm. Most authors have concluded that there is significant difference in the involvement of dominant arm and non-dominant arm<sup>6</sup>. 34.1% had their dominant arm involved, 58% had non dominant arm involvement and 8% had their bilateral shoulder involvement.

**4. Associated diseases:** It is observed that association of diabetes mellitus is very common, particularly in insulin dependent diabetes mellitus<sup>2,25</sup>. In our study there were 7 cases of diabetes mellitus and these were non-insulin dependent and were under control.

Four cases were hypertensive under control of treatment. We

noticed 5 case of OA of knee joint, 2 peptic ulcer, 1 bilateral cataract and 1 pulmonary Koch's disease.

### 4. Range of Movement:

**Range 0-60 degree:** Before distension 25 patients had range of movement less than 60 degree, out of these 14 had this range of movement after distension and 2 at follow up.

**Range 61-100 degree:** 29 patients had this range of movements before distension, 24 had this range of movement after distension, and 20 at follow up.

**Range 101-140 degree:** None of the patients had this range of movements before distension, 16 patients had after the distension, and 32 patents at follow up.

### CONCLUSION

Frozen shoulder is a clinical syndrome seen in the age group between 40 to 85 years with a mean age of 54.16 years. Slight predominance was noticed in female patients. Excellent results were limited to shoulders treated in early stages of frozen shoulder but improvement was noticed in all shoulders treated by this method. About 14% of the diabetics had an associated frozen shoulder. Diabetics are at a relatively high risk of developing frozen shoulder. The hydrodilatation done at follow up had no additional advantage. The best improvement in their range of movements was observed in forward elevation, then in abduction with minimal to moderate improvement in external rotation. Concomitant home exercises program is a must and is the hallmark of success following hydrodilatation. Hydrodilatation is a safe, reliable, cost effective without requiring specialized equipment's in the management of frozen shoulder. Under total aseptic precautions, when performed with a right technique absolutely there are no side effects.

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