International Journal of Research in Orthopaedics
Jena AS et al. Int J Res Orthop. 2026 Nov;12(6):1708-1712
https://www.ijoro.org

Original Research Article

DOI: https://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20263266

Medical versus surgical management of frozen shoulder: a prospective observational comparative study at 6 months

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Received: 24 August 2026
Revised: 02 September 2026
Accepted: 07 September 2026

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ABSTRACT

Background: Frozen shoulder is characterized by pain and progressive restriction of shoulder movement. Conservative treatment is commonly used initially, whereas surgery is considered in selected patients with persistent or severe functional limitation. This study compared outcomes after medical and surgical management at 6 months.
Methods: This prospective observational study included 70 patients with frozen shoulder: 50 received corticosteroid injection with physiotherapy and 20 underwent arthroscopic capsular release followed by physiotherapy. Range of motion (ROM), Constant-Murley score (CMS), DASH score and patient satisfaction were assessed at baseline and 6 months.
Results: Both groups improved significantly at 6 months ($p<0.001$). CMS improvement was greater in the surgical group than in the medical group (43.05±11.95 vs 25.86±10.05; $p<0.001$), and DASH reduction was greater after surgery (-38.95±12.57 vs -29.48±13.26; $p=0.010$). Surgical treatment was associated with greater gains in flexion, abduction and external rotation and higher patient satisfaction (8.45±1.19 vs 6.42±1.16; $p<0.001$). Similar differences were observed in patients in the freezing and frozen stages.
Conclusions: Both modalities were associated with significant functional improvement at 6 months. In this non-randomized cohort, surgical management was associated with greater improvement in ROM and functional scores, particularly in patients with severe disease.

Keywords: Adhesive capsulitis, Arthroscopic capsular release, Corticosteroid injection, DASH, Frozen shoulder, CMS

INTRODUCTION

Frozen shoulder, or adhesive capsulitis, is characterized by pain and progressive restriction of active and passive shoulder movement, causing substantial functional disability. The condition is commonly described in freezing, frozen and thawing stages. Although many patients improve with time, symptoms may persist and require intervention.[1]

Conservative treatment includes physiotherapy and corticosteroid injection, while arthroscopic capsular release is used in selected patients with persistent stiffness or inadequate response to non-operative treatment.[2-6] Comparative evidence is complicated by differences in disease severity and treatment selection. The present prospective observational study compared ROM, functional outcomes and patient satisfaction at 6 months after medical and surgical management of the frozen shoulder.

METHODS

This prospective observational study was conducted in the Department of Orthopaedics, Apollo Hospitals, Bannerghatta Road, Bengaluru, from February 2024 to January 2025 after institutional ethical clearance. Patients aged 30-60 years with shoulder stiffness diagnosed as

frozen shoulder and willing to provide informed consent were included.

Exclusion criteria were previous hand surgery on the affected limb, injury to the articular capsule, upper-limb injuries interfering with rehabilitation, implanted electrical devices, abnormal posture/kyphosis, osteoarthritis, rheumatoid arthritis, calcific tendinitis, fracture or dislocation.

Non-probability purposive sampling was used. Seventy patients were included: 50 received corticosteroid injections with physiotherapy and 20 underwent arthroscopic capsular release followed by physiotherapy. Treatment allocation was non-randomized. Participants were assessed at baseline and at 6 months.

Outcomes included shoulder ROM, CMS, DASH score and patient satisfaction. ROM assessment included flexion, extension, abduction, adduction, internal rotation, external rotation and circumduction.

Patients in the freezing and frozen stages were analyzed as a severe-disease subgroup. Descriptive and comparative statistical analyses were performed, with $p<0.05$ considered statistically significant.

RESULTS

The study included 70 patients. Mean age was 43.43±9.51 years; 43 (61.4%) were men and 27 (38.6%) were women. Fifty patients (71.4%) received medical treatment and 20 (28.6%) underwent surgery.

Both groups showed significant within-group improvement at 6 months. In the surgical group, flexion improved from 76.05° to 148.35°, abduction from 68.60° to 140.75°, and external rotation from 17.30° to 53.95°. CMS increased from 35.30±8.93 to 78.35±5.29 and DASH decreased from 64.95±9.74 to 26.00±7.34 (all $p<0.001$). In the medical group, flexion improved from 80.86° to 129.80°, abduction from 73.16° to 123.24°, and external rotation from 19.10° to 43.92°. CMS increased from 36.82±7.01 to 62.68±7.99 and DASH decreased from 65.38±9.34 to 35.90±10.44 (all $p<0.001$).

In the severe-disease subgroup (freezing and frozen stages), surgery was associated with greater improvement in flexion (74.08±18.83° vs 50.86±17.26°; $p<0.001$), abduction (73.85±17.64° vs 51.62±18.09°; $p<0.001$), external rotation (38.00±9.95° vs 25.62±9.04°; $p<0.001$), CMS (40.62±10.92 vs 23.97±9.40; $p<0.001$) and DASH score (-41.08±14.20 vs -29.48±13.30; $p=0.014$).

Table 1: Baseline characteristics of the study population.

Characteristics	Results
Age, mean±SD (in years)	43.43±9.51
Male/Female	43 (61.4%)/27 (38.6%)
Left/right shoulder	44 (62.9%)/26 (37.1%)
Freezing/frozen/thawing stage	23 (32.9%)/19 (27.1%)/28 (40.0%)
Medical/surgical management	50 (71.4%)/20 (28.6%)
Diabetes mellitus	38 (54.3%)
Hypothyroidism	22 (31.4%)

Table 2: Comparison of improvement and satisfaction between treatment groups.

Outcome: change from baseline	Surgical, mean±SD	Medical, mean±SD	P value
Flexion (°)	72.30±18.37	48.94±17.26	<0.001
Extension (°)	20.00±7.03	15.20±5.72	0.004
Abduction (°)	72.15±17.59	50.08±18.64	<0.001
Adduction (°)	22.85±5.36	16.32±6.11	<0.001
Internal rotation (°)	35.25±8.52	24.60±9.00	<0.001
External rotation (°)	36.65±9.68	24.82±9.29	<0.001
Circumduction (°)	73.90±19.19	50.08±18.64	<0.001
CMS	43.05±11.95	25.86±10.05	<0.001
DASH score	-38.95±12.57	-29.48±13.26	0.010
Patient satisfaction	8.45±1.19	6.42±1.16	<0.001

Table 3: Functional improvement in the severe subgroup.

Severe subgroup: change from baseline	Surgical, mean±SD	Medical, mean±SD	P value
Flexion (°)	74.08±18.83	50.86±17.26	<0.001
Extension (°)	20.15±7.38	15.66±5.51	0.034
Abduction (°)	73.85±17.64	51.62±18.09	<0.001
Adduction (°)	23.23±5.37	16.90±6.00	0.002

Continued.

Severe subgroup: change from baseline	Surgical, mean±SD	Medical, mean±SD	P value
Internal rotation (°)	36.23±8.67	25.24±8.54	<0.001
External rotation (°)	38.00±9.95	25.62±9.04	<0.001
Circumduction (°)	76.54±19.79	51.62±18.09	<0.001
CMS	40.62±10.92	23.97±9.40	<0.001
DASH score	−41.08±14.20	−29.48±13.30	0.014

DISCUSSION

Both treatment groups showed significant improvement at 6 months, but the magnitude of improvement was consistently greater in the surgical group. This overall pattern agrees with previous literature showing that both non-operative and operative treatment can improve frozen shoulder, while outcomes vary according to disease severity, patient selection and the intervention used.[2,9,11] The present study adds a direct prospective comparison of ROM, functional scores and satisfaction at the same 6-month follow-up within one clinical setting.

Flexion improved by 72.30±18.37° after surgery compared with 48.94±17.26° after medical treatment (p<0.001), and abduction improved by 72.15±17.59° compared with 50.08±18.64° (p<0.001). Thus, the largest improvements in the major elevation movements were observed after arthroscopic capsular release. Previous studies of capsular release have also reported substantial postoperative gains in shoulder elevation and function in patients with persistent or refractory frozen shoulder.[6-8] The greater flexion and abduction gains in the present cohort are therefore consistent with the reported benefit of releasing capsular restriction in selected patients.

Extension improved by 20.00±7.03° in the surgical group and 15.20±5.72° in the medical group (p=0.004). Adduction improved by 22.85±5.36° and 16.32±6.11°, respectively (p<0.001), while circumduction improved by 73.90±19.19° after surgery and 50.08±18.64° after medical treatment (p<0.001). These findings indicate that the greater postoperative improvement was not limited to forward elevation and abduction but was seen across additional planes of shoulder motion. Published evidence similarly supports improvement in global shoulder mobility following arthroscopic capsular release, although the exact magnitude of individual ROM gains varies among studies because of differences in measurement methods and patient populations.[4,7,8]

Internal rotation improved by 35.25±8.52° after surgery compared with 24.60±9.00° after medical treatment (p<0.001), and external rotation improved by 36.65±9.68° compared with 24.82±9.29° (p<0.001). Restoration of rotational movement is clinically important because capsular contracture in frozen shoulder commonly produces marked restriction, particularly of external rotation.[1,4] The greater rotational recovery observed after surgery is compatible with the mechanism of arthroscopic capsular release and with previous reports of significant motion improvement after operative treatment for refractory adhesive capsulitis.[6-8]

Functional outcomes showed the same pattern as ROM. CMS improved by 43.05±11.95 points in the surgical group compared with 25.86±10.05 points in the medical group (p<0.001). This suggests greater recovery of overall shoulder function after surgery in the present cohort. Previous comparative and randomized studies have shown that operative and non-operative strategies can both improve functional outcomes, while differences between interventions may depend on treatment selection and follow-up duration.[2,5,12] The present CMS findings are consistent with the improvement in shoulder function reported after arthroscopic capsular release, but the non-randomized design prevents a definitive causal conclusion.

DASH score decreased by 38.95±12.57 points after surgery and by 29.48±13.26 points after medical treatment (p=0.010), indicating a greater reduction in upper-limb disability in the surgical group. Previous evidence supports meaningful symptomatic and functional improvement with corticosteroid injection and physiotherapy, while operative treatment remains an option for patients with persistent disability or inadequate response to conservative management.[3,9,13] The greater DASH improvement in the present study therefore complements the CMS findings and supports the observation of greater short-term functional recovery after surgery in this cohort.

Patient satisfaction was significantly higher after surgery (8.45±1.19) than after medical treatment (6.42±1.16; p<0.001). This finding is consistent with the greater improvements in ROM, CMS and DASH observed in the surgical group. Previous comparative evidence has emphasized that treatment outcomes should be interpreted together with patient characteristics, baseline severity and treatment expectations rather than by a single outcome alone.[2,5,11] Accordingly, the higher satisfaction observed here should be viewed as supporting, rather than independently proving, the apparent functional advantage of surgery.

In the freezing and frozen stages, surgery was again associated with greater improvement in flexion, extension, abduction, adduction, internal rotation, external rotation and circumduction, as well as greater CMS improvement and DASH reduction. The differences were statistically significant for all reported ROM parameters and functional scores. This subgroup pattern is consistent with literature recognizing that patients with persistent or severe capsular restriction may be considered for operative treatment when

clinically appropriate.[1,4,7,8] However, because treatment allocation in the present study was not randomized, these findings should be interpreted as an association and not as proof that surgery is superior for every patient in these stages.

The present findings should also be considered in light of the study design. The groups were unequal in size (50 medical and 20 surgical patients), treatment allocation was non-randomized, and baseline clinical differences or previous treatment response may have influenced the choice of management. Such factors can produce selection bias and confounding by indication. Randomized and comparative studies have highlighted the importance of standardized protocols and careful patient selection when comparing treatments for frozen shoulder.[5,6,10,12,13] The 6-month follow-up also does not establish long-term durability, recurrence, late complications or cost-effectiveness.

Overall, comparison of each major study parameter shows a consistent direction of effect: both groups improved, whereas the surgical group demonstrated greater short-term improvement in flexion, extension, abduction, adduction, internal rotation, external rotation, circumduction, CMS, DASH score and patient satisfaction. These findings are broadly consistent with previous evidence supporting both conservative and operative management while suggesting that arthroscopic capsular release may provide greater short-term recovery in selected patients with substantial stiffness.[2,6-9,11,12] Larger randomized studies with standardized treatment-selection criteria and longer follow-up are required to determine the extent to which the observed differences represent treatment effect rather than differences between patients selected for each treatment.

CONCLUSION

Both medical management and arthroscopic capsular release were associated with significant improvement in shoulder function at 6 months. In this prospective non-randomized cohort, surgical management was associated with greater improvement in ROM, CMS, DASH score and patient satisfaction, with particularly greater improvement in the freezing and frozen stages. The study advances the understanding of short-term comparative recovery by providing real-world outcome data from the same clinical setting; however, because of potential selection bias and confounding, these findings should be interpreted as an association rather than definitive evidence that surgery is universally superior.

Recommendations

Conservative treatment should remain an important management option, while timely surgical referral may be considered for selected patients with persistent functional limitation, inadequate response to medical management or severe stiffness. Future studies should use standardized treatment protocols, clearer treatment-selection criteria, adjustment for baseline severity and longer follow-up to determine comparative long-term outcomes.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee AHB/IEC/DNB/ Orthopedics/086/2024.

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Cite this article as: Jena AS, Kocheeppan P, Kumar SR, Plackiel AS. Medical versus surgical management of frozen shoulder: a prospective observational comparative study at 6 months. Int J Res Orthop 2026;12:1708-12.