RESEARCH ARTICLE

Manipulation under anaesthesia versus ultrasound-guided neuronal block for primary frozen shoulder: short-term outcomes and comparative analysis

Murat Mert[1], Abdullah Yener Ince[2], Sibel Caglar[3]

Abstract

Objective: To compare the short-term clinical outcomes of manipulation under general anesthesia versus ultrasound-guided neuronal block in patients with primary frozen shoulder.

Method: The retrospective, single-center study was conducted at the Department of Orthopedics, Yeniyuzyil University, Istanbul, Turkiye, from April 10 to May 10, 2021, and comprised data from January 1, 2010, to December 31, 2020, of patients having frozen shoulder. They were divided into manipulation under general anaesthesia group A, manipulation under ultrasound-guided neuronal block group B, and control group C that received self-administered physical rehabilitation exercises. Preoperative passive range of motion and pain scores were recorded, and postoperative assessments were conducted at two different follow-up points. Data was analysed using SPSS 23.

Results: Of the 54 patients, there were 18(33.3%) in group A with mean age 43.88±12.48 years, 18(33.3%) in group B with mean age 48.67±13.57 years, and 18(33.3%) in group C with mean age 50.68±11.89 years. Each group had 10(55.5%) females and 8(44.4%) males (p>0.05). Groups A and B showed significant improvements compared to baseline measures (p<0.05). Group A demonstrated greater improvement in flexion immediately after the intervention (p<0.05), while group B showed superiority in abduction, external rotation and pain relief one week after the intervention (p<0.05). No major complications were observed in any group.

Conclusion: Manipulation under general anaesthesia and ultrasound-guided neuronal block were both effective treatment options for primary frozen shoulder, with potential advantages in specific outcomes.

Key Words: Frozen shoulder, Adhesive capsulitis, Manipulation, Anaesthesia, Ultrasound-guided, Nerve block, Treatment.

(JPMA 75: 1923; 2025) **DOI: https://doi.org/10.47391/JPMA.25-20807**

Introduction

Frozen shoulder (FS), also referred to as adhesive capsulitis of the shoulder, was first described by the French physician S. Duplay in 1872 as 'peri-arthritis scapulo-humerale'.[1] Both active and passive range of motion (ROM) are commonly affected, involving various shoulder structures, such as the rotator interval, superior and inferior glenohumeral ligaments, and the coracohumeral ligament.[2]

FS causes shoulder pain and restricted ROM, affecting approximately 2-5% of the global population, with a higher incidence observed between the ages of 40-60 years, with a female predominance.[3,4,5]

Arthroscopic examination often reveals characteristic findings of FS, such as fibrosis, joint capsule contraction, and restricted intrasynovial space, which are specific to the condition.[6]

The pathophysiology of primary FS may be associated with various factors, such as diabetes, cardiovascular disease, thyroid disease, trauma and stroke. On the other hand, secondary FS typically affects individuals aged >60 years, and is often linked to trauma or surgery-.[7]

Traditionally, FS is classified into freezing, frozen, and thawing phases, with varying durations[8].

While FS may spontaneously resolve over time with a slow pace of recovery, several conservative non-operative treatments are available, including non-steroidal anti-inflammatory drugs (NSAIDs), intra-articular steroid and local anaesthetic injections, as well as physical therapy9.

The choice of treatment modality depends on patient preference and the physician's experience, with approximately half of the cases showing no resolution with non-invasive methods. In such cases, strategies such as manipulation under anesthesia (MUA), open or arthroscopic capsular release, and open capsulotomy may be considered.[10, 11]

[1]Department of Orthopaedics, Yeni Yuzyil University, Istanbul, Turkey. [2] Department of Orthopaedics, Istinye University, Liv Hospital, Istanbul, Turkey. [3]Department of Physical Medicine and Rehabilitation, Istanbul Bakirkoy Dr. Sadi Konuk Training and Research Hospital, Istanbul, Turkey.

Correspondence: Murat Mert. **Email:** muratmertdr@gmail.com

ORCID ID: 0000-0002-1972-9518

Submission complete: 18-10-2024 **First Revision received:** 11-02-2025

Acceptance: 24-09-2025 **Last Revision received:** 23-09-2025

MUA, the most commonly used procedure, is relatively easy-to-perform and efficient, and can be combined with injections. Currently, there is no standardised medical management for primary FS. The current study was planned to assess the effectiveness of short-term clinical outcomes of MUA under general anesthesia (GA) and manipulation under ultrasonogram (USG)-guided neuronal block in patients with primary FS.

Materials and Methods

The retrospective, single-center study was conducted at the Department of Orthopedics, Yeniyuzyil University, Istanbul, Turkiye, from April 10 to May 10, 2021, and comprised data from January 1, 2010, to December 31, 2020, of patients having primary FS. They were divided into MUA under GA group A, MUA under ultrasound-guided neuronal block group B, and a control group C that received self-administered physical rehabilitation exercises for four weeks. Data was retrieved after approval from the institutional ethics review board. Written informed consent had been obtained from each patient at the time of the intervention.

Those included were patients with at least a 1-month history of unilateral shoulder pain and stiffness with normal imaging studies, having passive shoulder movement with a reduction of >30° in at least two planes when compared with the opposite side, and were refractory to at least 1-month conservative treatment. Patients with secondary causes of FS, intrinsic or extrinsic shoulder pathology, systemic inflammatory conditions, and allergy to narcotic drugs were excluded. Anteroposterior X-rays had been taken to exclude other shoulder disorders.

MUA was performed either under propofol anaesthesia with manual mask ventilation, or a USG-guided interscalene nerve block in the operating room. Passive mobilisations and active ROM exercises were used together with a home exercise programme.

USG-guided neuronal block had been performed by a trained physician specialised in physical treatment and rehabilitation and pain management. Bupivacaine solution (18ml 0.25% isobaric bupivacain with 2ml dexamethasone) was used.

Following the MUA, the ROM was controlled by applying forward flexion, abduction, and external rotation. Passive ROM exercises were started on the first postoperative day with the same rehabilitation protocol.

Age, gender, preoperative ROM and visual analogue scale (VAS) scores were recorded at baseline and at follow-up points. After the manipulation, all the patients in groups A and B were examined immediately after the procedure, and one week following the treatment. Group C evaluations were done on the 4th and 6th week after the initiation of the physical treatment.

Data was analysed using SPSS 23. Using power analysis, the sample size wsa calculated power 0.8 and significance level 0.05. Data normality was tested using Shapiro-Wilk test. Paired or unpaired Student's t-test was used for continuous variables with a parametric distribution. P<0.05 was considered statistically significant.

Results

Of the 54 patients, there were 18(33.3%) in group A with mean age 43.88±12.48 years, 18(33.3%) in group B with mean age 48.67±13.57 years, and 18(33.3%) in group C with a mean age 50.68±11.89 years. Each group had 10(55.5%) females and 8(44.4%) males. There were no significant differences among the groups in terms of baseline characteristics (p>0.05) (Table 1).

Table-1: Baseline characteristics.

	General anaesthesia (n=18)	USG-guided neuronal block (n=18)	Control group (n=18)	p value
Age (years)	43.88±12.48	48.7±13.57	50.68±11.89	0.286
Baseline weight (kg)	67.82±9.442	67.50±10.23	66.84±8.99	0.923
Baseline BMI (kg/m2)	26.38±6.761	24.10±4.439	24.65±4.871	0.242
F/M	10/8	10/8	10/8	1.00

USG: Ultrasonogram, BMI: Body mass index, F: Female, M: Male.

Group A showed significant improvements in abduction and flexion at both the first and second follow-up assessments compared to baseline measures (p<0.05), while external rotation remained unchanged, and VAS scores significantly decreased on the 2nd follow-up compared to the first evaluation (p<0.0001). In group B, ROM measurements showed no significant improvement between before manipulation and the 1st follow-up (p>0.05), but all ROM measures significantly improved between before manipulation and the 2nd follow-up (p<0.0001). VAS scores showed a notable reduction at the initial follow-up compared to baseline (p=0.040). There was a significant improvement in pain relief between the first and second follow-up assessments (p<0.0001) (Table 2).

Comparison of ROM and VAS scores between the 1st and 2nd follow-ups showed that group A patients had significantly greater improvement in flexion compared group B patients (p<0.0001). Both groups had significant improvement of flexion compared to the control group (p<0.0001). At the second follow-up, group B patients

Table-2: Comparison of baseline and post-intervention values

	General anaesthesia (n=18)				
	Before manipulation	1st follow-up	p value*	2nd follow-up	p value**
Abduction (°)	48.53±12.09	62.65±11.61	0.0034	131.5±25.30	<0.0001
Flexion (°)	44.12±13.61	87.65±17.51	<0.0001	137.1±22.36	<0.0001
External rotation (°)	46.18±15.96	53.82±19.00	0.2309	46.47±19.67	0.294
VAS	6.529±1.841	5.824±1.015	0.1876	3.118±1.111	<0.0001
	USG-guided neuronal block (n=18)				
	Before manipulation	**1st follow-up**	**p value***	**2nd follow-up**	**p value****
Abduction (°)	57.50±20.53	58.89±20.48	0.8596	155.0±24.55	<0.0001
Flexion (°)	56.94±21.43	58.61±20.21	0.7327	152.2±25.10	<0.0001
External rotation (°)	51.11±15.68	46.39±12.46	0.3279	72.78±15.74	<0.0001
VAS	6.667±1.749	5.611±0.9164	0.040	2.444±0.8556	<0.0001

USG: Ultrasonogram, VAS: Visual analogue scale.
*Comparison with the initial measures
** Comparison with the previous measures

Table-3: Intergroup comparison of study variables post-intervention.

	1st follow-up					
	General anesthesia (n=18)	p value*	USG-guided neuronal block (n=18)	p value**	Control group (n=18)	p value***
Abduction (°)	62.65±11.61	0.316	58.89±20.48	0.147	59.12±17.62	0.5122
Flexion (°)	87.65±17.51	<0.0001	58.61±20.21	<0.0001	59.24±13.67	<0.0001
External rotation (°)	53.82±19.00	0.487	46.39±12.46	0.216	51.43±14.86	0.1779
VAS	5.824±1.015	0.561	5.611±0.9164	0.316	5.821±0.847	0.5198
	2nd follow-up					
	General anesthesia (n=18)	**p value***	**USG-guided neuronal block (n=18)**	**p value****	**Control group (n=18)**	**p value*****
Abduction (°)	131.5±25.30	<0.0001	155.0±24.55	<0.0001	63.28±19.59	0.0086
Flexion (°)	137.1±22.36	<0.0001	152.2±25.10	<0.0001	78.10±32.64	0.0686
External rotation (°)	46.47±19.67	<0.05	72.78±15.74	<0.0001	52.68±15.12	0.0001
VAS	3.118±1.111	<0.0001	2.444±0.8556	<0.0001	5.416±1.921	<0.05

USG: Ultrasonogram, VAS: Visual analogie scale.
* Comparison between the general anesthesia and control groups
** Comparison between the USG-guided neuronal block and control groups
***Comparison between the intervention groups.

demonstrated significantly greater improvements in abduction (p=0.008), external rotation (p=0.0001) and VAS scores (p<0.05) compared to those in group A (Table 3). Both groups A and B showed significant improvement for all variables compared to group C. No major complications were observed in any group.

Discussion

The findings of the current study suggest that both MUA under GA and USG-guided neuronal block are efficient treatment options for primary FS. While both procedures were equally effective in reducing pain, USG-guided neuronal block showed superiority in improving shoulder abduction, flexion and external rotation flexion. The significant improvement in all ROM and pain parameters by the 2nd -up suggests that the manipulation procedure provided benefit over time.

While the underlying cause of FS remains unclear, research indicates it involves a prolonged inflammatory process, primarily involving fibroblasts and myofibroblasts as the key cellular players.[2]

Tsvieli et al. studied 112 individuals who underwent MUA using the Codman paradox technique in the supine position under GA in combination with an interscalene nerve block.[12] They evaluated patients at 3 weeks and 3 months post-MUA, and revealed significant enhancements across various parameters, including the Constant-Murley functional shoulder score, pain, ROM, subjective shoulder value, and return to previous activities.

In an observational study, the impact of MUA combined with intra-articular steroid injection was investigated in primary FS patients.[13] The 6-month follow-up indicated that MUA with steroid injection outperformed conservative treatments. In the current study, steroid injections were not administered prior to or after MUA, hence, the outcomes were not influenced by the effects of local steroid injections.

A multicentre, randomised clinical trial involving patients with a primary FS compared MUA and arthroscopic capsular release with physiotherapy plus steroid injection.[14] Although none of the three interventions demonstrated clinical superiority, the study suggested that MUA was the most cost-effective treatment option for the condition.

Takahashi et al. assessed the risk factors associated with the recurrence of FS following manipulation under USG-guided cervical nerve root block.[15] Factors such as a lower Constant Shoulder (CS) score, poorly controlled diabetes, and higher VAS scores were identified as independent risk factors.

Another study retrospectively analysed complications following MUA performed under USG-guided cervical nerve root block16, and reported a 2.9% incidence of vasovagal reflex and a 1.5% occurrence of panic attacks during the block procedure.

The management of FS remains controversial, and is largely dependent on the phase of the disease. Physiotherapy or home exercise is commonly recommended as the primary treatment option for all stages, as it has been shown to result in significant improvements in pain scores, functionality and ROM. While some argue that earlier intervention with manipulation may lead to better outcomes, the timing of MUA is still uncertain and requires further research to determine the most effective approach. A study17 reported that patients who underwent manipulation between 6 and 9 months after the onset of symptoms exhibited significantly better abduction and external rotation, experienced less pain both at rest and during nighttime, and demonstrated better results on the Simple Shoulder Test compared to those manipulated at other time points.

Serious complications of MUA for FS include humeral shaft fracture and rotator cuff injury11. However, the current study did not observe any minor or major complications associated with shoulder manipulation. Studies have reported an overall complication rate of MUA in FS patients ranging from 0.4% to 0.5%2,.[18] Additionally, dissatisfaction and re-intervention rates have been reported to be approximately 10-15% and 14%, respectively.[2]

A retrospective cohort study involving 110 patients with stage-3 FS examined patient satisfaction following awake manipulation with a brachial plexus block.[19] It documented several complications in three cases, including brachial plexus injury, glenoid fracture, and persistent pain and stiffness. However, that study utilized a technique with certain variations, which should be considered when assessing the reported complications.

The current study has limitations, like a relatively small sample size, and short follow-up durations. Besides, the study did not employ global scales to evaluate shoulder function, quality of life and patient satisfaction. Further investigations with larger cohorts are warranted to validate the curemt findings.

Conclusion

MUA under GA and USG-guided neuronal block were both found to be effective treatment options for primary FS with potential advantages in specific outcomes.

Disclaimer: None.

Conflict of Interest: None.

Source of Funding: None.

References

1. Duplay S. De la periarthrite scapulo-humerale et des raideurs de l'epaule qui en sont la consequence. Arch Gen Med 1872;20:513-542.
2. Kraal T, Beimers L, The B, Sierevelt I, van den Bekerom M, Eygendaal D. Manipulation under anaesthesia for frozen shoulders: outdated technique or well-established quick fix? EFORT Open Rev. 2019 Mar 19;4(3):98-109. doi: 10.1302/2058-5241.4.180044.
3. Jacob L, Gyasi RM, Koyanagi A, Haro JM, Smith L, Kostev K. Prevalence of and Risk Factors for Adhesive Capsulitis of the Shoulder in Older Adults from Germany. J Clin Med. 2023 Jan 14;12(2):669. doi: 10.3390/jcm12020669.
4. Mezian K, Coffey R, Chang KV. Frozen Shoulder. [Updated 2023 Aug 28]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK482162/
5. Meregawa, P. F., Nolan, J. Physical Therapy and Manipulation under Anesthesia for Patients with a Frozen Shoulder. International Journal of Medical Reviews, 2022; 9(1): 227-231. doi: 10.30491/IJMR.2021.269764.1180
6. Itoi, Eiji et al. Shoulder stiffness: current concepts and concerns arthroscopy. Arthroscopy. 2016;32(7):1402–14.
7. White D, Choi H, Peloquin C, Zhu Y, Zhang Y. Secular trend of adhesive capsulitis. Arthritis Care Res (Hoboken). 2011;63(11):1571–5. https://doi.org/ 10.1002/acr.20590.
8. Reeves B. The natural history of the frozen shoulder syndrome. Scand J Rheumatol 1975;4:193-6.
9. Forsythe B, Lavoie-Gagne O, Patel BH, Lu Y, Ritz E, Chahla J, et al. Efficacy of Arthroscopic Surgery in the Management of Adhesive Capsulitis: A Systematic Review and Network Meta-analysis of Randomized Controlled Trials. Arthroscopy. 2020 Nov 20:S0749-8063(20)30804-5. doi: 10.1016/j.arthro.2020.09.041.
10. Oshiro T, Yagi M, Harada K, Park K. Results of repeat manipulation under ultrasound-guided cervical nerve root block with corticosteroid and local anaesthetic injection for recurrence of frozen shoulder. J Orthop Surg Res. 2020 Dec 7;15(1):586. doi: 10.1186/s13018-020-02120-8.
11. Xu Q, Li H, Jiang D, Wang L, Chen Y, Wu Y, et al. The Effect of Manipulation Under Anesthesia for Secondary Frozen Shoulder: A

Randomized Controlled Trial. Pain Ther. 2022 Dec;11(4):1373-1387. doi: 10.1007/s40122-022-00438-1.
12. Tsvieli O, Atoun E, Consigliere P, Polyzois I, Walecka J, Pradhan R, et al. Manipulation under anaesthetic for frozen shoulder using Codman's paradox: a safe and early return of function. Int Orthop. 2018 Feb;42(2):339-344. doi: 10.1007/s00264-017-3558-3.
13. Song C, Song C, Li C. Outcome of manipulation under anesthesia with or without intra-articular steroid injection for treating frozen shoulder: A retrospective cohort study. Medicine (Baltimore). 2021 Apr 2;100(13):e23893. doi: 10.1097/MD.0000000000023893.
14. Rangan A, Brealey SD, Keding A, Corbacho B, Northgraves M, Kottam L, et al. Management of adults with primary frozen shoulder in secondary care (UK FROST): a multicentre, pragmatic, three-arm, superiority randomised clinical trial. Lancet. 2020 Oct 3;396(10256):977-989. doi: 10.1016/S0140-6736(20)31965-6. Erratum in: Lancet. 2021 Jan 9;397(10269):98.
15. Takahashi R, Kajita Y, Fujii S, Harada Y. Risk factors for recurrence of frozen shoulder after shoulder manipulation under ultrasound-guided cervical nerve root block. JSES Int. 2023 Oct 10;8(1):90-94. doi: 10.1016/j.jseint.2023.09.002.
16. Takahashi R, Iwahori Y, Kajita Y, Harada Y, Muramatsu Y, Ikemoto T, et al. Clinical Results and Complications of Shoulder Manipulation under Ultrasound-Guided Cervical Nerve Root Block for Frozen Shoulder: A Retrospective Observational Study. Pain Ther. 2019 Jun;8(1):111-120. doi: 10.1007/s40122-018-0109-6.
17. Vastamäki H, Varjonen L, Vastamäki M. Optimal time for manipulation of frozen shoulder may be between 6 and 9 months. Scand J Surg. 2015 Dec;104(4):260-6. doi: 10.1177/1457496914566637.
18. Grant JA, Schroeder N, Miller BS, Carpenter JE. Comparison of manipulation and arthroscopic capsular release for adhesive capsulitis: a systematic review. J Shoulder Elbow Surg 2013;22:1135-1145.
19. Inglese F, Montemagno M, Brigo A, Nigro M, Giorgini A, Micheloni GM, et al. High satisfaction rate and range of motion can be expected in frozen shoulder after awake manipulation with brachial plexus block. J Orthop Traumatol. 2024 Jan 28;25(1):3. doi: 10.1186/s10195-024-00747-5.

AUTHOR'S CONTRIBUTION:
MM & AYI: Data evaluation, supervision and review.
SC: Data collection, study conduction and writing.