

Physiotherapy Management of Frozen Shoulder with Complex Comorbidities: A Case Report

Rahdiah Idarwati¹, Yery Mustari², Nindrahayu³

¹Professional Physiotherapy Study Program, Faculty of Nursing, Hasanuddin University, Makassar, South Sulawesi, Indonesia

²Department of Physiotherapy, Faculty of Nursing, Hasanuddin University, Makassar, South Sulawesi, Indonesia

³Physiotherapy Unit, Medical Rehabilitation Installation, Hasanuddin University Teaching Hospital, Makassar, South Sulawesi, Indonesia

Corresponding author:

Name: Rahdiah Idarwati

E-mail: rahdiahbr@gmail.com

Phone: 081243098280

Received 31 July 2026; Revised 21 August 2026; Accepted 22 August 2026; Published 29 September 2026.

©2026 The Authors. Published by the Physiotherapy Study Program, Faculty of Medicine, Udayana University, in collaboration with the Indonesian Physiotherapy Association (Ikatan Fisioterapi Indonesia). This is an open-access article distributed under the terms of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).

Abstract

Background: Frozen shoulder may be more difficult to assess and manage when metabolic, neurological, and structural shoulder conditions coexist.

Objective: To describe the physiotherapy management and clinical response of a patient with frozen shoulder, type 2 diabetes mellitus, postischemic stroke hemiparesis, and a full thickness supraspinatus tear.

Methods: This case report followed the CARE guideline. A 52-year-old man with right frozen shoulder underwent 12 physiotherapy sessions. The first three sessions were assessed directly using SOAP documentation, whereas nine subsequent sessions were reviewed retrospectively from medical records. The primary outcome was pain measured with the Visual Analog Scale. Secondary outcomes included range of motion, Manual Muscle Testing, and selected clinical tests.

Results: Pain at rest decreased from 8 to 5, pain on movement from 10 to 8, and tenderness from 8 to 6 over the documented treatment period. During direct assessment across the first three sessions, muscle strength remained unchanged: 5/5 for flexion, extension, and adduction, 4/5 for abduction, and 3/5 for external and internal rotation. Shoulder range of motion also remained unchanged: flexion 100°, extension 30°, abduction 100°, adduction 45°, external rotation 15°, and internal rotation 30°. Objective outcomes were not consistently documented during the subsequent nine sessions.

Conclusion: This case documented a reduction in pain during multimodal physiotherapy, while changes in strength and range of motion could not be demonstrated within the directly assessed period. The findings should be interpreted cautiously because the contribution of individual modalities cannot be separated and long-term objective follow-up was incomplete.

Keywords:

Adhesive Capsulitis; Diabetes Mellitus, Type 2; Rehabilitation; Shoulder Pain; Case Reports

Introduction

Frozen shoulder, also known as adhesive capsulitis, is a painful shoulder disorder characterized by progressive pain and multidirectional restriction of glenohumeral movement. It can substantially limit self-care, work, and other daily activities. The condition is commonly described as progressing through painful, stiff, and recovery phases, although the duration and clinical course vary considerably between individuals.^{1,2} The prevalence is commonly reported at approximately 2% to 5% of the general population, with a higher burden among adults in middle age and among people with metabolic comorbidities.³

Type 2 diabetes mellitus is one of the most consistently reported risk factors for frozen shoulder. A systematic review and meta-analysis found that diabetes is associated with an increased likelihood of developing frozen shoulder, while subsequent cohort evidence has also shown a close temporal association between newly diagnosed frozen shoulder and later recognition of type 2 diabetes.^{4,5} Chronic hyperglycemia may contribute through nonenzymatic glycation, collagen cross-linking, reduced tissue extensibility, and persistent inflammatory and fibrotic activity within the shoulder capsule.^{6,7} These mechanisms may help explain why patients with diabetes can present with greater stiffness and a slower response to conservative management.

Conservative rehabilitation remains a central component of frozen shoulder management. Exercise therapy can improve pain, range of motion, and function, and manual therapy combined with exercise may provide additional benefit compared with isolated approaches.^{8,9} Nevertheless, evidence from controlled studies generally concerns patients without the specific combination of metabolic disease, neurological impairment, and structural tendon injury observed in complex clinical cases. Therefore, clinical decision-making may require greater attention to symptom irritability, motor capacity, tissue loading, and the interpretation of outcome measures.

The present case was further complicated by postischemic stroke hemiparesis and magnetic resonance imaging evidence of a full thickness supraspinatus tear with subacromial subdeltoid bursitis. Stroke-related shoulder problems are often discussed as hemiplegic shoulder pain or secondary complications of neurological impairment, whereas the patient in this report had shoulder symptoms before the stroke.^{10–12} In addition, concomitant rotator cuff pathology may alter the interpretation of weakness and influence the tolerance of active movement and strengthening.^{13,14}

Previous studies have largely examined these clinical problems separately. Diabetes has been investigated as a risk factor for frozen shoulder, stroke literature has focused primarily on hemiplegic shoulder pain, and studies of concomitant rotator cuff tears have emphasized diagnosis or imaging rather than rehabilitation responses in patients with combined metabolic and neurological comorbidities.^{4,10,11,13} This case therefore contributes a detailed description of assessment, intervention tailoring, and documented outcomes in a patient whose frozen shoulder management was influenced simultaneously by diabetes, mild poststroke motor

impairment, and a full thickness supraspinatus tear. The objective was to describe the physiotherapy management and clinical response while explicitly recognizing the limitations of a single case and incomplete longitudinal outcome documentation.

Methods

This report was prepared as a case report and structured according to the CARE guideline to support completeness and transparency. The primary outcome was pain intensity measured with the Visual Analog Scale (VAS). Secondary outcomes were shoulder range of motion measured with a goniometer, muscle strength assessed by Manual Muscle Testing (MMT), Cyriax capsular pattern, Coracoid Pain Test, Shoulder Shrug Sign, and descriptive observations of functional movement. Functional instruments such as the Shoulder Pain and Disability Index, Disabilities of the Arm, Shoulder and Hand questionnaire, and Constant Score were not part of the routine assessment protocol at the time of data collection.

The patient was a 52-year-old man with right shoulder pain and stiffness beginning in early 2024. Symptoms had progressively affected dressing and lifting activities and had become more severe during the three days before the initial physiotherapy assessment. He had a history of type 2 diabetes mellitus for approximately three years and experienced an ischemic stroke in July 2025, resulting in right hemiparesis. A medical assessment reported shoulder strength of 4/5, while other documented neurological findings were within normal limits.

Radiography of the right shoulder showed no dislocation, fracture, destructive osseous lesion, or other major structural abnormality. Magnetic resonance imaging without contrast demonstrated discontinuity of the supraspinatus tendon with increased signal intensity, changes involving the inferior glenohumeral and coracohumeral ligaments, and fluid in the subscapular recess and subacromial subdeltoid bursa. The imaging impression was a full thickness supraspinatus tear, adhesive capsulitis, and subacromial subdeltoid bursitis.

Laboratory results also documented changing glycemic control. On 4 August 2025, fasting blood glucose was 253 mg/dL and HbA1c was 10.3%. Fasting blood glucose decreased to 103 mg/dL on 9 October 2025 and to 84 mg/dL on 7 November 2025, while HbA1c on the latter date was 6.9%. These results were reported descriptively and were not used to establish a causal relationship with the rehabilitation response.

Clinical assessment included history taking, inspection, palpation, active and passive shoulder range of motion, MMT, and VAS ratings for pain at rest, pain on movement, and tenderness. The initial findings were consistent with a multidirectional shoulder movement restriction, a positive capsular pattern, positive Coracoid Pain Test, and positive Shoulder Shrug Sign. The patient was assessed directly during three sessions on 15, 17, and 21 October 2025 using SOAP documentation. Nine subsequent visits from 29 October to 10 December 2025 were reviewed retrospectively from medical records. Thus, the total treatment period comprised 12 physiotherapy sessions.

The intervention used a multimodal approach consisting of therapeutic ultrasound, transcutaneous electrical nerve stimulation (TENS), passive and active range of motion exercise, pendulum exercise, glenohumeral traction and translation, static stretching, and submaximal isometric strengthening. The purpose of combining modalities was to address pain, capsular restriction, maintenance of mobility, and muscle activation while limiting symptom provocation. TIDieR principles were used to organize the intervention description, particularly the rationale, materials, procedures, provider, setting, dose, and tailoring of each component.

Ultrasound was used as an adjunctive modality before or alongside exercise to support pain management and exercise tolerance. It was applied to the rhomboid and shoulder regions using a BTL 5000 unit with probe BTL-237-4-13, frequency 1 MHz, effective radiating area 5 cm², continuous mode, intensity 1.3 W/cm², and a longitudinal application technique for 6 minutes. Coupling gel was used and the transducer was moved continuously.

TENS was applied to the shoulder region using a TL-4000 Smart & Premium Electrotherapy device with contra pad electrodes. Documented settings were continuous mode, frequency 100 Hz, pulse width 200 μ s, and 10 minutes of application. Intensity was adjusted to a strong but comfortable sensory level according to patient tolerance. The purpose was analgesia and facilitation of participation in active rehabilitation rather than treatment of the underlying capsular or tendon pathology in isolation.

Passive range of motion exercise was assisted by the therapist and performed slowly within pain tolerance to maintain glenohumeral mobility while limiting active loading of the shoulder. Active range of motion exercise was used to maintain active use, motor control, and functional participation, with particular attention to the right hemiparesis and avoidance of excessive loading of the supraspinatus. For the documented program, active and passive range of motion exercise was performed for 10 repetitions in 2 sets over approximately 6 minutes. Pendulum exercise was performed with the contralateral hand supporting the body while the affected arm remained relaxed and moved gently in anterior posterior, medial lateral, and circular directions.

Glenohumeral traction and translation were applied manually, gradually, and within symptom tolerance to address restricted joint play and capsular mobility. Static stretching targeted the deltoid, subscapularis, supraspinatus, infraspinatus, and biceps brachii. Each stretch was held for 15 to 30 seconds and repeated 3 to 5 times, with reduced intensity for structures related to the supraspinatus tear and with avoidance of sharp pain. Isometric strengthening targeted the deltoid and rotator cuff using submaximal effort. The available documentation supports tailoring according to pain, tolerance, and motor capacity, but does not provide sufficient detail to define a fixed progression algorithm for every exercise component.

The type of intervention remained unchanged across the treatment period. Dose, intensity, and exercise progression were adjusted according to the documented clinical response and pain tolerance. The first three sessions were delivered by a professional physiotherapy student under physiotherapist supervision. The nine subsequent sessions were delivered by physiotherapists in the same unit. Home exercise was prescribed, but adherence was not monitored systematically and therefore could not be quantified.

Written informed consent for the use of clinical information and publication of the case was documented, and patient information was anonymized. The available records do not provide a verifiable institutional policy, formal exemption letter, or waiver number supporting the statement that formal ethical approval was not required. Accordingly, the final ethics basis should be completed from an institutional policy or ethics committee documentation before submission. No intervention-related adverse event was documented during the treatment period.

Results

The clinical chronology is summarized in Table 1. The patient developed right shoulder symptoms before the ischemic stroke, which is important when interpreting the shoulder presentation. The three directly assessed sessions occurred on 15, 17, and 21 October 2025. Nine additional visits were subsequently identified in the medical record through 10 December 2025, confirming a total of 12 physiotherapy sessions.

Table 1. Clinical timeline

Time	Clinical event
2022	Diagnosis of type 2 diabetes mellitus.
Early 2024	Onset of right shoulder pain and stiffness with progressive restriction and activity-related symptoms.
2024 to 2025	Progressive stiffness and restriction of shoulder movement; dressing and lifting became difficult.
July 2025	Ischemic stroke with right hemiparesis.
4 Aug 2025	Fasting blood glucose 253 mg/dL; HbA1c 10.3%.
9 Oct 2025	Fasting blood glucose 103 mg/dL.
12 to 14 Oct 2025	Marked increase in shoulder pain before physiotherapy assessment.
13 Oct 2025	MRI impression: full thickness supraspinatus tear, adhesive capsulitis, and subacromial subdeltoid bursitis.
15 Oct 2025	Initial direct physiotherapy assessment; VAS, ROM, MMT, capsular pattern, Coracoid Pain Test, and Shoulder Shrug Sign recorded.
17 and 21 Oct 2025	Direct follow-up assessments; pain reduction was documented, while ROM and MMT remained unchanged. Ability to touch the chest and raise the arm forward was observed clinically with mild pain.
7 Nov 2025	Fasting blood glucose 84 mg/dL; HbA1c 6.9%.
29 Oct to 10 Dec 2025	Nine additional physiotherapy visits documented retrospectively; pain data were available more consistently than other objective outcomes.

The timeline clarifies that only the first three sessions had comprehensive direct outcome assessment. Later visits contributed primarily to the longitudinal description of pain because ROM, MMT, and special test findings were not consistently re-evaluated.

Primary outcome data are presented in Table 2. To maintain consistency across the abstract, results, table, and figure, tenderness is reported as 8 at baseline and 6 at the final documented follow-up, matching the repeated primary outcome reporting in the manuscript. The timeline entry containing a tenderness score of 9 was treated as an internal inconsistency and should not be retained in the final manuscript.

Table 2. Primary outcome: pain intensity measured with the Visual Analog Scale

Pain condition	Baseline 15 Oct 2025	Final documented follow-up 10 Dec 2025
At rest	8	5
On movement	10	8
Tenderness	8	6

VAS scores decreased in all three pain conditions. The largest absolute reduction was observed for pain at rest. Because the treatment was multimodal and later visits were evaluated retrospectively, the observed change cannot be attributed to any individual modality.

Secondary outcomes from the directly assessed period are summarized in Table 3. No change was documented in MMT, ROM, capsular pattern, Coracoid Pain Test, or Shoulder Shrug Sign between the initial assessment and the third direct session.

Table 3. Secondary outcomes during direct assessment

Parameter	15 Oct 2025	21 Oct 2025
MMT flexion	5/5	5/5
MMT extension	5/5	5/5
MMT abduction	4/5	4/5
MMT adduction	5/5	5/5
MMT external rotation	3/5	3/5
MMT internal rotation	3/5	3/5
Cyriax capsular pattern	Positive	Positive
Coracoid Pain Test	Positive, pain present	Positive, pain present
Shoulder Shrug Sign	Positive	Positive
Flexion	100°	100°
Extension	30°	30°
Abduction	100°	100°
Adduction	45°	45°
External rotation	15°	15°
Internal rotation	30°	30°

The observed ability to touch the chest and raise the arm forward with mild pain was recorded as a clinical observation rather than a validated quantitative functional outcome. Changes in objective outcomes during the nine later visits cannot be determined because repeated measurements were not consistently available. Figure 1 presents the available VAS values from baseline and the final documented follow-up. The figure is provided at publication resolution to replace the previously low-resolution pain graphic.

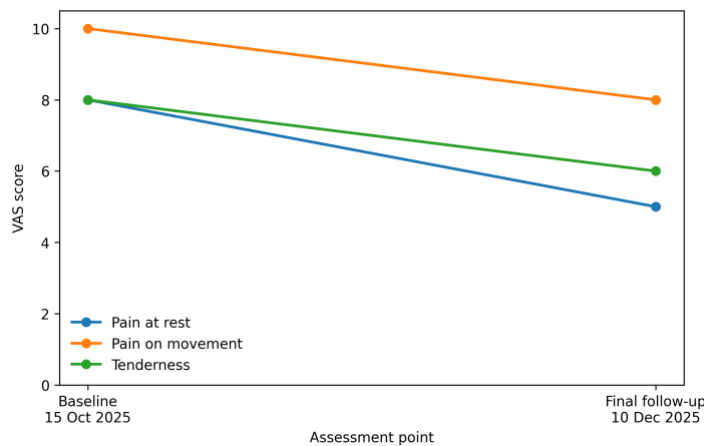


Figure 1. Change in Visual Analog Scale pain scores from baseline to the final documented follow-up.

The patient reported that pain decreased after treatment, the shoulder felt better, and pain before subsequent visits was less severe than at the beginning of therapy. These statements are presented as the patient's perspective and do not constitute a standardized functional outcome.

Discussion

This case describes a patient with frozen shoulder whose rehabilitation was complicated by type 2 diabetes mellitus, right hemiparesis after ischemic stroke, and a full thickness supraspinatus tear. Across 12 documented physiotherapy sessions, the clearest longitudinal change was a reduction in pain. By contrast, strength and range of motion remained unchanged during the three sessions that were directly assessed, and objective outcomes were not documented consistently during the subsequent nine visits. The principal interpretation is therefore limited to a documented improvement in pain rather than proof of recovery of shoulder mobility or strength.

The clinical diagnosis was supported by progressive pain, multidirectional movement restriction, a positive capsular pattern, positive Coracoid Pain Test, positive Shoulder Shrug Sign, and MRI findings consistent with adhesive capsulitis. The distribution of movement loss was compatible with the clinical pattern of capsular restriction described in adhesive capsulitis literature.^{2,6,15} The structural findings were nevertheless important because the full thickness supraspinatus tear could contribute to weakness and pain, making it inappropriate to attribute all findings to frozen shoulder alone.

The coexistence of diabetes is clinically relevant because hyperglycemia and advanced glycation processes may contribute to capsular fibrosis and reduced tissue extensibility.^{4,6} The improvement in fasting glucose and HbA1c observed during the clinical period suggests better metabolic control, but this case cannot establish whether that change influenced the rehabilitation response. Fibrotic changes that have developed over time may not reverse in parallel with short term improvements in glycemic markers. Consequently, the metabolic findings should be viewed as contextual information rather than evidence of a treatment mechanism.

The neurological history also requires careful interpretation. The shoulder symptoms began before the ischemic stroke, distinguishing this presentation from a typical poststroke shoulder pain trajectory in which shoulder dysfunction develops after neurological injury.^{10–12} Mild hemiparesis could nevertheless affect active movement, muscle activation, and functional use of the involved limb. For this reason, active exercise and strengthening were performed with attention to motor capacity and symptom response rather than assuming that all movement limitation represented capsular stiffness.

The supraspinatus tear further influenced exercise selection. The persistent weakness in abduction and rotation may reflect a combination of pain inhibition, disuse, neurological factors, and structural tendon pathology. MRI evidence of concomitant rotator cuff pathology has been increasingly recognized in patients with severe frozen shoulder stiffness, particularly with increasing age.¹³ Therefore, strengthening in this case was performed isometrically and submaximally, while stretching and active movement were modified to avoid excessive symptom provocation or loading of the involved tendon.

The multimodal program combined ultrasound and TENS for analgesic support with mobility exercises, pendulum exercise, manual glenohumeral techniques, stretching, and isometric strengthening. Exercise and manual therapy have evidence for improving pain and function in frozen shoulder, although optimal combinations and dosing vary.^{8,9} The rationale for ultrasound and TENS in this case was to reduce pain sufficiently to facilitate participation in movement and exercise, not to claim that either modality independently altered capsular fibrosis. Evidence for ultrasound and electrotherapy remains mixed, and the contribution of these components cannot be separated from the rest of the program.^{16–20}

The absence of measurable ROM and MMT improvement during the directly assessed period should not be interpreted as treatment failure. The direct observation window was short, while adhesive capsulitis and complex comorbidity often require longer rehabilitation periods. At the same time, the later nine sessions cannot be used to infer improvement in these outcomes because repeat objective measurements were not consistently recorded. This distinction is essential: pain was documented longitudinally, whereas mobility and strength were not. The patient's observed ability to touch the chest and raise the arm forward provides some clinical context but cannot substitute for a validated functional instrument.

Several limitations constrain interpretation. First, this was a single case without a comparator, blinding, or a standardized longitudinal outcome protocol. Second, direct assessment covered only three early sessions, whereas later data were obtained retrospectively from routine records. Third, no validated functional outcome instrument was used, and home exercise adherence was not quantified. Fourth, the multimodal design prevents attribution of pain reduction to a specific intervention. Fifth, the case included diabetes, poststroke hemiparesis, and a supraspinatus tear, which improves clinical relevance but also increases uncertainty regarding the relative contribution of each condition to the observed response.

Despite these limitations, the case highlights practical considerations for individualized rehabilitation. In complex frozen shoulder, intervention selection may need to account for symptom irritability, motor capacity, structural tendon pathology, and metabolic status rather than applying a uniform protocol. Future prospective studies should use standardized functional outcomes, repeated ROM and strength assessments, explicit intervention progression criteria, adherence monitoring, and longer follow-up. More detailed reporting of complex rehabilitation programs using TIDieR principles would also improve reproducibility. The TIDieR checklist

specifically emphasizes sufficient reporting of materials, procedures, providers, dose, tailoring, modifications, and fidelity across evaluative study designs.²¹

Conclusion

This case report documented the physiotherapy management of frozen shoulder in a 52-year-old man with type 2 diabetes mellitus, right postischemic stroke hemiparesis, and a full thickness supraspinatus tear. A total of 12 physiotherapy sessions were identified, consisting of three directly assessed sessions and nine subsequent visits reviewed retrospectively from medical records. The most consistent documented change was a reduction in pain, with VAS scores decreasing from 8 to 5 at rest, from 10 to 8 during movement, and from 8 to 6 for tenderness. No change in shoulder ROM, MMT, or special test findings was documented during the three directly assessed sessions, and later changes in these outcomes could not be determined because objective reassessment was incomplete. The multimodal program was tailored to pain tolerance, motor capacity, and the presence of a supraspinatus tear, but the contribution of individual modalities cannot be separated. These findings should therefore be interpreted as a descriptive clinical response rather than evidence of causal effectiveness. Prospective studies with standardized functional outcomes, complete longitudinal assessment, and more explicit intervention progression are needed to clarify physiotherapy management in frozen shoulder with complex comorbidities.

Patient Perspective

The patient reported that pain decreased after treatment, the shoulder felt better, and pain before subsequent sessions was less severe than at the beginning of therapy. This perspective was obtained from clinical documentation and was not measured using a standardized patient-reported outcome instrument.

Author Contribution

Rahdiah Idarwati: Investigation; Data curation; Writing, original draft.

Yery Mustari: Methodology; Supervision; Writing, review and editing.

Nindrahayu: Clinical supervision; Resources; Writing, review and editing.

Acknowledgments

The authors acknowledge the Professional Physiotherapy Study Program, Hasanuddin University, and Hasanuddin University Teaching Hospital for academic and clinical support during case documentation. The authors also acknowledge the clinical supervisors who supported the case management process.

Conflict of Interest Statement

The authors declare no conflict of interest.

Funding Sources

This study received no external funding.

Ethics Statement

Written informed consent for the use of clinical information and publication of this case was obtained from the patient, and identifying information was anonymized.

References

1. de Sire A, Agostini F, Bernetti A, Mangone M, Ruggiero M, Dinatale S, et al. Non-surgical and rehabilitative interventions in patients with frozen shoulder: umbrella review of systematic reviews. *J Pain Res.* 2022;15:2449-2464.
2. Shinde SB, Dhane SB, Jain PP, Mishra SD, Kumbhar VK, Thorat KA, et al. Evidence-based physiotherapy for adhesive capsulitis-current evidences, challenges, and future directions. *DPU J Ayurved Homeop Allied Health Sci.* 2022;1(2):79-87.
3. Sundaramoorthi K. An early functional outcome of arthroscopic stiff shoulder release in adhesive capsulitis. 2016.
4. Dyer BP, Rathod-Mistry T, Burton C, van der Windt D, Bucknall M. Diabetes as a risk factor for the onset of frozen shoulder: a systematic review and meta-analysis. *BMJ Open.* 2023;13(1):e062377.
5. Dyer BP, Burton C, Rathod-Mistry T, Blagojevic-Bucknall M, van der Windt DA. Are patients with newly diagnosed frozen shoulder more likely to be diagnosed with type 2 diabetes? A cohort study in UK electronic health records. *Diabetes Obes Metab.* 2024;26(12):5915-5921.
6. de la Serna D, Navarro-Ledesma S, Alayón F, López E, Pruimboom L. A comprehensive view of frozen shoulder: a mystery syndrome. *Front Med (Lausanne).* 2021;8:663703.
7. Navarro-Ledesma S, Hamed-Hamed D, Pruimboom L. A new perspective of frozen shoulder pathology: the interplay between the brain and the immune system. *Front Physiol.* 2024;15:1248612.
8. Mertens MG, Meert L, Struyf F, Schwank A, Meeus M. Exercise therapy is effective for improvement in range of motion, function, and pain in patients with frozen shoulder: a systematic review and meta-analysis. *Arch Phys Med Rehabil.* 2022;103(5):998-1012.e14.
9. Kirker K, O'Connell M, Bradley L, Torres-Panchame RE, Masaracchio M. Manual therapy and exercise for adhesive capsulitis: a systematic review with meta-analysis. *J Man Manip Ther.* 2023;31(5):311-327.
10. Lv X, Hu Z, Liang F, Liu S, Gong H, Du J, et al. Causal relationship between ischemic stroke and its subtypes and frozen shoulder: a two-sample Mendelian randomization analysis. *Front Neurol.* 2023;14:1178051.
11. de Sire A, Moggio L, Demeco A, Fortunato F, Spanò R, Aiello V, et al. Efficacy of rehabilitative techniques in reducing hemiplegic shoulder pain in stroke: systematic review and meta-analysis. *Ann Phys Rehabil Med.* 2022;65(5):101602.
12. Kumar P, Christodoulou A, Loizou M. Assessment approaches for hemiplegic shoulder pain in people living with stroke: a scoping review. *Disabil Rehabil.* 2025;47(7):1677-1687.
13. Chang HH, Yoon TH, Lim JR, Chun YM. Concomitant rotator cuff tear with frozen shoulder: a contemplation on the necessity and legitimacy of magnetic resonance imaging stratified by age. *Clin Orthop Surg.* 2025;17(3):453-459.

14. Song W, Guo X, Wang X, Yu J, Jiang W, Wei C, et al. A multi-center, single-blinded, randomized, parallel-group, superiority study to compare the efficacy of manipulation under anesthesia versus intra-articular steroid injection in the treatment of patients with frozen shoulder and a diagnosis of rotator cuff injury or tear by MRI: study protocol for a randomized controlled trial. *Trials*. 2023;24(1):765.
15. Lowry V, Lavigne P, Zidarov D, Matifat E, Cormier AA, Desmeules F. A systematic review of clinical practice guidelines on the diagnosis and management of various shoulder disorders. *Arch Phys Med Rehabil*. 2024;105(2):411-426.
16. Sung JH, Lee JM, Kim JH. The effectiveness of ultrasound deep heat therapy for adhesive capsulitis: a systematic review and meta-analysis. *Int J Environ Res Public Health*. 2022;19(3):1859.
17. Uysal B, Özkuk K, Şahin N, Ökmen BM, Sezer R, Ateş Z. Comparison of the effectiveness of high-intensity laser and ultrasound therapies in adhesive capsulitis: a randomized controlled study. *J Back Musculoskelet Rehabil*. 2023;36(1):227-236.
18. Guan H, Wu Y, Wang X, Liu B, Yan T, Abedi-Firouzjah R. Ultrasound therapy for pain reduction in musculoskeletal disorders: a systematic review and meta-analysis. *Ther Adv Chronic Dis*. 2024;15:20406223241267217.
19. DeJesus BM, Rodrigues IKL, Azevedo-Santos IF, DeSantana JM. Effect of transcutaneous electrical nerve stimulation on pain-related quantitative sensory tests in chronic musculoskeletal pain and acute experimental pain: systematic review and meta-analysis. *J Pain*. 2023;24(8):1337-1382.
20. Shahzad A, Azhar M, Zafar H, Khan MA, Shakir S. Therapeutic effects of mobilization in alleviating pain and improving shoulder mobility in adhesive capsulitis: a systematic review. *J Musculoskelet Surg Res*. 2024;8:97.
21. Hoffmann TC, Glasziou PP, Boutron I, Milne R, Perera R, Moher D, et al. Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. *BMJ*. 2014;348:g1687.