



CLINICAL UPDATE

Frozen shoulder

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What you need to know

- Patients with diabetes are at higher risk of developing frozen shoulder and having bilateral symptoms than the general population
- Recovery times vary, but can be years, and some patients are left with residual pain or functional impairment
- Physiotherapy is the most commonly used intervention and can be supplemented by intra-articular steroid injections
- Treatments offered in secondary care include joint manipulation under anaesthesia, arthroscopic capsular release, and hydrodilatation
- The UK FROST trial compared manipulation under anaesthetic, arthroscopic capsular release, and early structured physiotherapy with intra-articular corticosteroid injections, and found that none of the interventions were clinically superior

Frozen shoulder is a common and often debilitating condition that lacks a clear consensus on management, partly owing to a lack of high quality evidence on the various treatments options. In this clinical update, we offer an overview of the latest evidence on management of frozen shoulder, incorporating the clinical implications of recently published research, including the UK FROST study—the largest randomised controlled trial in this field to date, which compares surgical treatments with early structured physiotherapy and intra-articular corticosteroid injections.

What is frozen shoulder?

Frozen shoulder is a condition that results in development of thickened, fibrosed joint capsule, contraction of the joint, and reduced intra-articular volume.¹ The exact cause of these changes is unknown, with several possible processes suggested in the literature.¹ Over the years, uncertainty has surrounded the definition and classification of this condition, leading to inconsistencies in both clinical practice and scientific studies.² This is partially owing to the wide spectrum of clinical presentations, with patients experiencing different levels and combinations of symptoms. This also means their lives can be affected in many different ways, depending on the severity of the condition and their daily activities.

Who gets it?

The age of onset is usually in the fifth decade of life, with peak incidence between the ages of 40 and 60.³ Women are more commonly affected than men, with one study reporting the incidence as 3.38 and 2.36 per 1000 person years, respectively.⁴

Patients with diabetes have a 10% to 20% lifetime risk of developing frozen shoulder,^{5 6} and are more likely to have bilateral shoulder involvement than the general population.⁷ Frozen shoulder has been linked to conditions such as hypothyroidism, hypercholesterolaemia, and heart disease, although evidence is insufficient to determine whether these associations are independent.⁸

How is it diagnosed?

Frozen shoulder is primarily a clinical diagnosis (box 1). Patients can present with a range of symptoms related to the shoulder, although pain is often the initial trigger for presentation. Three distinct phases are commonly described,¹¹ with each phase typically lasting several months:

Box 1: Diagnosis of frozen shoulder⁹

- History—insidious onset of shoulder pain, often anterolateral initially; pain at night; sometimes minimal trauma associated around time of onset
- Examination—painful movement restriction, passive external rotation less than 30°, passive elevation less than 100°; cases where the disease affects the posterior capsule more than the anterior can present with reduction in internal rotation
- Investigations—plain radiographs are useful to check for arthritic changes in the glenohumeral joint and are recommended by the British Elbow and Shoulder Society¹⁰; ultrasound and magnetic resonance imaging may be considered depending on the clinical features and differential diagnoses

- Freezing/proliferative phase—stiffness with progressively worsening pain (usually constant but exacerbated by movement)
- Frozen/adhesive phase—ongoing stiffness with improved pain levels, reduction in range of motion, in particular on external rotation
- Thawing/resolution phase—gradual improvement in range of motion.

The clinical course can be variable² and not all people with frozen shoulder will experience all three of these stages. Pain at night is a common feature, often causing considerable disruption to sleep. Patients can also experience sudden jerking movements associated with pain.² Diagnostic pointers for frozen shoulder are summarised in box 2, and differential diagnoses are listed in table 1.

Box 2: When to refer to secondary care

British Elbow and Shoulder Society guidelines¹⁰ advise to refer:

- Cases of atypical presentation or marked functional limitation
- Persistence of pain despite primary care interventions beyond three months

American Family Physician guidelines recommend referral to a shoulder specialist if no improvement is seen with physiotherapy and corticosteroid injections after three months¹²

Table 1 | Differential diagnoses

Differential	Clinical features/diagnostic clues
Septic arthritis	Rapid onset, single swollen joint with restricted movement—both active and passive. Patient may be systemically unwell
Shoulder dislocation	Usually traumatic onset. Typically associated with visible deformity
Glenohumeral osteoarthritis	Insidious onset, pain and limited passive range of motion with degenerative changes at the glenohumeral joint on plain radiographs
Rotator cuff pathology and subacromial impingement	Insidious onset shoulder pain with preserved passive external rotation
Inflammatory arthritis	Usually multiple joint involvement, can be associated with joint warmth and redness, patients can experience systemic symptoms such as fatigue or weight loss. Consider systemic inflammation including polymyalgia rheumatica in bilateral shoulder pain

What is the clinical course of frozen shoulder?

Frozen shoulder is often described in literature as a “self-limiting” condition, and patients typically experience resolution of symptoms without or regardless of any treatment.¹³ Most people with the condition make a full recovery, although recovery time tends to be slow—between one and three years.^{14 15} Some experience residual symptoms: the original prospective study on frozen shoulder from 1975 found that half of patients had residual clinical restriction in range of movement after 5-10 years, and 7% had ongoing functional limitation.¹¹ Similar rates were reported in more recent literature, with one study⁶ of patients under the care of a specialist shoulder clinic followed up at average 52 months finding that 41% reported residual symptoms. Recurrence of primary frozen shoulder after

the initial resolution of symptoms is poorly reported in literature, but in our experience is rare. Up to 20% of patients can develop the condition on the opposite side.⁵ Patients with diabetes generally have poorer response to treatment and, with interventions such as manipulation under anaesthetic, are at higher risk of requiring further procedures.¹⁶

How is frozen shoulder managed?

After establishing a clinical diagnosis of frozen shoulder, explain the typical progression of the condition. Discuss the range of available management options and the risks associated with each intervention (table 2). An individual approach involving exploring the extent of functional limitation and establishing treatment goals can aid in deciding the appropriate treatment.

Table 2 | Summary of treatment options

Treatment	Advantages	Disadvantages
Supportive management	Can be effective for some patients, owing to the self-limiting nature of frozen shoulder	Full resolution can take more than three years, with resultant lack of function during that time
Structured physiotherapy	Shown to be superior to home exercises alone for improved shoulder function	Access to formal physiotherapy can be difficult owing to limited resources, pain can limit patient engagement
Corticosteroid injections	Associated with improved short term range of motion and pain scores; easy to access in primary or secondary care	Mild adverse effects; can affect glycaemic control in patients with diabetes
Hydrodilatation	May improve pain and functional scores compared with supportive treatment	May not be available in some settings; paucity of evidence with further studies in progress
Manipulation under anaesthetic	Low rates of adverse events compared with ACR; cost effective compared with ACR and structured physiotherapy with corticosteroid injection	Reported adverse effects include worsening of pain symptoms, residual stiffness, and nerve pain
Arthroscopic capsular release	Can be associated with shorter recovery compared with natural progression of disease; some evidence showing improved shoulder function scores compared with hydrodilatation	Most invasive option associated with highest complication rates

Advise patients to continue to use the arm as pain allows.⁹ Over-the-counter or prescription painkillers can help to alleviate pain, which is often the most debilitating symptom experienced in the early stages and can limit engagement with physiotherapy. Sleeping on the unaffected side or using pillows for support in bed can help with night time pain. Heat or ice packs over the affected area can be used for additional pain relief. Shoulder stiffness can lead to other musculoskeletal symptoms, most commonly neck and lower back pain, which can also be targeted with physiotherapy. In the early stages, we recommend patients try simple home

exercises such as placing things higher up to encourage reaching, gentle stretching, and pendulum exercises.¹⁷

Physiotherapy

The main role of physiotherapy is in the frozen/adhesive phase (when the initial symptoms of pain have subsided) with stretches and strengthening exercises. This should be sustained with additional resistance based exercises in the thawing/resolution phase.¹⁸ Structured approaches include group or individual physiotherapy, with formal range of motion exercises, soft tissue

massage, and trigger point release.¹⁹ The recommended initial treatment course is six to 12 weeks.⁵

Corticosteroid injections

Corticosteroid injections can help in reducing pain and improving range of movement, particularly in the early stages of the condition and when combined with physiotherapy. A 2020 systematic review and meta-analysis on the management of frozen shoulder assessed the effectiveness of available treatment strategies across 65 studies with 4097 patients.²⁰ The authors found that intra-articular (IA) corticosteroid injections were associated with short term improvement in external rotation and pain compared with no treatment or placebo. IA corticosteroid injections with physiotherapy were found to be superior to IA corticosteroid injections alone for early range of motion only. Physiotherapy with IA corticosteroid injections was found to be superior to physiotherapy alone for short term outcomes using several symptom and functional scoring systems, but not for range of motion or medium term function.

IA steroid injections are associated with better pain relief compared with subacromial injections.²¹ Interestingly, a 2021 clinical trial found that, even though ultrasound guided IA injections were associated with greater accuracy than blind IA injections, no difference was seen between them in pain and functional outcome scores.²²

Corticosteroid injections are generally considered safe and are associated with mild side effects only. In one study, three of 58 patients (5.2%) reported mild self-limiting nausea and dizziness.²³ Another reported that, of 133 participants, one patient (0.7%) experienced prolonged pain at the injection site, and three patients (2.3%) developed transient facial flushing.²⁴ Steroid injections can affect blood glucose control in patients with diabetes, particularly in the first day after the intervention.²⁵

Surgical options—arthroscopic capsular release and manipulation under anaesthetic

Arthroscopic capsular release (ACR) is a surgical procedure carried out under general or regional anaesthesia. The shoulder capsule is divided using arthroscopic instruments and the shoulder is re-examined to confirm optimal release. Manipulation under anaesthetic (MUA) is a procedure where the shoulder is manipulated by the surgeon to stretch and tear the joint capsule. It is carried out under general or regional anaesthesia.

The recently published UK FROST study compared ACR, MUA, and early structured physiotherapy with intra-articular corticosteroid injection.²⁶ The study is the largest randomised controlled trial of these interventions to date, with 503 participants recruited across 35 UK hospitals. In UK FROST, short term outcomes of ACR at three months were overall worse compared with physiotherapy with corticosteroid injection or MUA. However, at 12 months ACR was found to be associated with better functional scores (Oxford Shoulder Score, OSS) compared with both MUA and physiotherapy (OSS difference 2.01 and 3.06, respectively), although this was less than the clinically important effect size of 4–5 OSS points. The study authors concluded that none of the three interventions was clinically superior, but that ACR carried higher risks (3.9% in this cohort had a serious adverse event compared with 1% of those who had MUA), and MUA was the most cost effective intervention.

One weakness of UK FROST is that it was unable to determine to what extent the improvements in outcomes were the result of the interventions rather than the natural course of the condition. A randomised controlled trial of 125 patients in Finland¹⁷ comparing MUA with supportive treatment (home exercises) found no difference

in terms of pain levels or functional ability between the two groups at 12 month follow-up; minimal differences were noted in range of motion in favour of the MUA group. Another smaller RCT comparing ACR with supportive care did not find any significant differences between the two in functional outcome scores.²⁷

MUA is generally associated with low rates of adverse events—UK FROST²⁶ recorded two serious (1%) and 15 non-serious (7.5%) adverse events for 201 patients. These were largely minor reactions such as residual stiffness, nerve pain, and paraesthesia. One case (0.5%) of septic joint arthritis was recorded, and three patients (1.5%) experienced postoperative worsening of shoulder pain. MUA was found to be cost effective as functional improvement was seen sooner, meaning less need for prolonged physiotherapy and follow-up.

Hydrodilatation

Hydrodilatation involves injecting fluid into the shoulder joint to disrupt the capsular adhesions, and is usually performed in a clinic setting. Solutions used and volumes injected vary in literature, but most clinicians use normal saline with local anaesthetic and corticosteroid.²⁸ Hydrodilatation was not included in the UK-FROST study as it was not widely available until recently. It has since become a common management option alongside MUA and ACR in many UK secondary care centres.

A 2008 Cochrane review²⁹ noted hydrodilatation was associated with short term improvement in pain, function, and range of motion. However, a more recent 2018 systematic review and meta-analysis²⁸ found that the procedure had an overall insignificant effect on clinical outcomes—the authors noted minimal improvement in pain and range of motion (number needed to treat of 12) with no significant improvement in disability. One small randomised controlled trial³⁰ comparing MUA and hydrodilatation found that functional scores were significantly better in the hydrodilatation cohort with higher patient satisfaction rates, although the study was conducted in a small patient cohort (38 joints in total). At present, comparisons with surgical treatments are difficult owing to a lack of high quality evidence. A Delphi study³¹ backed by the British Elbow and Shoulder Society is under way to help inform future directions of research. Adverse events reported with the use of hydrodilatation include pain, flushing, syncopal episodes, and one case of glenohumeral joint infection.²⁸

Education into practice

- How might you explain the different stages of frozen shoulder to a patient first presenting with the condition?
- What strategies could be used in the community to widen the access to physiotherapy for patients?

How patients were involved in the creation of this article

A patient with experience of the condition reviewed a draft of the manuscript. In response to their feedback, we developed the section on management to include more detail about analgesia and adjuncts to physiotherapy.

How this article was created

We conducted a Medline search using the terms “frozen shoulder” and “adhesive capsulitis” to identify the relevant references and review the latest published evidence. We also searched the Cochrane library and consulted the British Elbow and Shoulder Society website for current guidelines.

Information resources for patients

- **British Elbow & Shoulder Society Website:** advice on common shoulder conditions, when to seek medical advice, and recommended self-care measures: <https://bess.ac.uk>
- **Patient.info:** information about the condition and management: <https://patient.info/bones-joints-muscles/frozen-shoulder-leaflet>
- **American Academy of Orthopaedic Surgeons:** resource outlining treatment options and home exercises: <https://orthoinfo.aaos.org/en/diseases--conditions/frozen-shoulder/>
- **The Chartered Society of Physiotherapy:** information on managing shoulder pain and recommended exercises: <https://www.csp.org.uk/publications/shoulder-pain-exercises>

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- Lewis J. Frozen shoulder contracture syndrome - Aetiology, diagnosis and management. *Man Ther* 2015;20:2-9. doi: 10.1016/j.math.2014.07.006 pmid: 25107826
- Bunker T. Time for a new name for frozen shoulder—contracture of the shoulder. *Shoulder Elbow* 2009;1:4-9doi: 10.1111/j.1758-5740.2009.00007.x.
- Cohen C, Eijnisman B. Epidemiology of frozen shoulder. In: *Shoulder stiffness*. Springer, 2015: 21-30doi: 10.1007/978-3-662-46370-3_2.
- White D, Choi H, Peloquin C, Zhu Y, Zhang Y. Secular trend of adhesive capsulitis. *Arthritis Care Res (Hoboken)* 2011;63:1571-5. doi: 10.1002/acr.20590 pmid: 22034118
- Robinson CM, Seah KT, Chee YH, Hindle P, Murray IR. Frozen shoulder. *J Bone Joint Surg Br* 2012;94:1-9. doi: 10.1302/0301-620X.94B1.27093 pmid: 22219239
- Hand C, Clipsham K, Rees JL, Carr AJ. Long-term outcome of frozen shoulder. *J Shoulder Elbow Surg* 2008;17:231-6. doi: 10.1016/j.jse.2007.05.009 pmid: 17993282
- Bridgman JF. Periarthritis of the shoulder and diabetes mellitus. *Ann Rheum Dis* 1972;31:69-71. doi: 10.1136/ard.31.1.69 pmid: 5008469
- Smith CD, White WJ, Bunker TD. The associations of frozen shoulder in patients requiring arthroscopic capsular release. *Shoulder Elbow* 2012;4:87-9doi: 10.1111/j.1758-5740.2011.00169.x.
- Guyver PM, Bruce DJ, Rees JL. Frozen shoulder - A stiff problem that requires a flexible approach. *Maturitas* 2014;78:11-6. doi: 10.1016/j.maturitas.2014.02.009 pmid: 24636964
- Rangan A, Goodchild L, Gibson J, Brownson P, Thomas M, Rees J. BESS/BOA patient care pathways. *Shoulder Elbow* 2015;7:299-307. doi: 10.1177/1758573215601779 pmid: 27582992
- Reeves B. The natural history of the frozen shoulder syndrome. *Scand J Rheumatol* 1975;4:193-6. doi: 10.3109/03009747509165255 pmid: 1198072
- Siegel LB, Cohen NJ, Gall EP. Adhesive capsulitis: a sticky issue. *Am Fam Physician* 1999;59:1843-52.pmid: 10208704
- Eljabu W, Klinger HM, von Knoch M. Prognostic factors and therapeutic options for treatment of frozen shoulder: a systematic review. *Arch Orthop Trauma Surg* 2016;136:1-7. doi: 10.1007/s00402-015-2341-4 pmid: 26476720
- Levine WN, Kashyap CP, Bak SF, Ahmad CS, Blaine TA, Bigliani LU. Nonoperative management of idiopathic adhesive capsulitis. *J Shoulder Elbow Surg* 2007;16:569-73. doi: 10.1016/j.jse.2006.12.007 pmid: 17531513
- Nagy MT, Macfarlane RJ, Khan Y, Waseem M. The frozen shoulder: myths and realities. *Open Orthop J* 2013;7(suppl 3):352-5. doi: 10.2174/1874325001307010352 pmid: 24082974
- Woods DA, Loganathan K. Recurrence of frozen shoulder after manipulation under anaesthetic (MUA): the results of repeating the MUA. *Bone Joint J* 2017;99-B:812-7. doi: 10.1302/0301-620X.99B6.BJJ-2016-1133.R1 pmid: 28566402
- Kivimäki J, Pohjolainen T, Malmivaara A, et al. Manipulation under anesthesia with home exercises versus home exercises alone in the treatment of frozen shoulder: a randomized, controlled trial with 125 patients. *J Shoulder Elbow Surg* 2007;16:722-6. doi: 10.1016/j.jse.2007.02.125 pmid: 17931902
- Chan HBY, Pua PY, How CH. Physical therapy in the management of frozen shoulder. *Singapore Med J* 2017;58:685-9. doi: 10.11622/smedj.2017107 pmid: 29242941
- Russell S, Jariwala A, Conlon R, Selve J, Richards J, Walton M. A blinded, randomized, controlled trial assessing conservative management strategies for frozen shoulder. *J Shoulder Elbow Surg* 2014;23:500-7. doi: 10.1016/j.jse.2013.12.026 pmid: 24630545
- Challoumas D, Biddle M, McLean M, Millar NL. Comparison of treatments for frozen shoulder: a systematic review and meta-analysis. *JAMA Netw Open* 2020;3:e2029581. doi: 10.1001/jamanetworkopen.2020.29581 pmid: 33326025
- Chen R, Jiang C, Huang G. Comparison of intra-articular and subacromial corticosteroid injection in frozen shoulder: A meta-analysis of randomized controlled trials. *Int J Surg* 2019;68:92-103. doi: 10.1016/j.ijsu.2019.06.008 pmid: 31255719
- Cho CH, Min BW, Bae KC, Lee KJ, Kim DH. A prospective double-blind randomized trial on ultrasound-guided versus blind intra-articular corticosteroid injections for primary frozen shoulder. *Bone Joint J* 2021;103-B:353-9. doi: 10.1302/0301-620X.103B2.BJJ-2020-0755.R1 pmid: 33517741
- Yoon JP, Chung SW, Kim JE, et al. Intra-articular injection, subacromial injection, and hydrodilatation for primary frozen shoulder: a randomized clinical trial. *J Shoulder Elbow Surg* 2016;25:376-83. doi: 10.1016/j.jse.2015.11.009 pmid: 26927433
- Oh JH, Oh CH, Choi JA, Kim SH, Kim JH, Yoon JP. Comparison of glenohumeral and subacromial steroid injection in primary frozen shoulder: a prospective, randomized short-term comparison study. *J Shoulder Elbow Surg* 2011;20:1034-40. doi: 10.1016/j.jse.2011.04.029 pmid: 21816628
- Shin WY, An MJ, Im NG, et al. Changes in blood glucose level after steroid injection for musculoskeletal pain in patients with diabetes. *Ann Rehabil Med* 2020;44:117-24. doi: 10.5535/arm.2020.44.2.117 pmid: 32392650
- Rangan A, Brealey SD, Keding A, et al. UK FROST Study Group. Management of adults with primary frozen shoulder in secondary care (UK FROST): a multicentre, pragmatic, three-arm, superiority randomised clinical trial. *Lancet* 2020;396:977-89. doi: 10.1016/S0140-6736(20)31965-6 pmid: 33010843
- Smitherman JA, Struk AM, Cricchio M, et al. Arthroscopy and manipulation versus home therapy program in treatment of adhesive capsulitis of the shoulder: a prospective randomized study. *J Surg Orthop Adv* 2015;24:69-74.pmid: 25830267
- Saltychev M, Laimi K, Virolainen P, Fredericson M. Effectiveness of hydrodilatation in adhesive capsulitis of shoulder: a systematic review and meta-analysis. *Scand J Surg* 2018;107:285-93. doi: 10.1177/1457496918772367 pmid: 29764307
- Buchbinder R, Green S, Youd JM, Johnston RV, Cumpston M. Arthrographic distension for adhesive capsulitis (frozen shoulder). *Cochrane Database Syst Rev* 2008;1:CD007005. doi: 10.1002/14651858.CD007005 pmid: 18254123
- Quraishi NA, Johnston P, Bayer J, Crowe M, Chakrabarti AJ. Thawing the frozen shoulder. A randomised trial comparing manipulation under anaesthesia with hydrodilatation. *J Bone Joint Surg Br* 2007;89:1197-200. doi: 10.1302/0301-620X.89B9.18863 pmid: 17905957
- Rangan A, Brealey S, Keding A, Corbacho B. Frozen shoulder - Authors' reply. *Lancet* 2021;397:372-3. doi: 10.1016/S0140-6736(20)32398-9 pmid: 33516337

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