Frozen Shoulder - A Review of the Literature with Clinical Commentary

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Definition

Adhesive capsulitis, better known as frozen shoulder (FS), is characterised by the spontaneous onset of shoulder pain, and progressive reduction in both active and passive range of motion in at least two directions (3,5,11). The most significant loss of movement is in external rotation (11). While this is the accepted definition, some experts also describe 'global restriction', with loss of range in every direction. In reality, patients with true FS do have global restriction. The condition is often over-diagnosed. A 1991 arthroscopic study found that of 150 patients referred with a diagnosis of FS, only 37 had 'true' adhesive capsulitis (18). Under-diagnosis is also common, particularly in the early stages when pain is a greater feature than stiffness, and the presentation of the condition is similar to subacromial impingement. The pain in the early periods is often severe and disturbs sleep (3). FS typically affects people between the ages of 40 and 65 years (1,8,9,11,18,16), with younger cases reported but quite rare. In a systematic review covering 476 patients in four separate studies, the maximum age of FS sufferers was 56 years, and the minimum age was 47 years (11). In a 1991 arthroscopic study of 37 patients, the age ranges were between 40 & 70 (18). In a 2003 study with 106 subjects, the average age was 53 years (1).

The natural time-course of the condition is recovery in one to three years (2), but it is not uncommon for patients to have ongoing restriction beyond this time. Up to 40% to 50% of sufferers will have ongoing symptoms past three years (8), and 15% will have persistent long-term disability (2,3,14). FS has three distinct phases (some authors describe four). Phase I is the inflammatory stage, characterised by pain and progressive stiffness. This can last between two to nine months (3,7,11,19). Pain that disturbs sleep is common. Phase II is the 'frozen' stage, with pain easing, but the patient being left with generalised restriction of movement in all directions. Pain is usually present at the end of available range. This phase can last from four to twenty months (3,7). Phase III is the 'thawing' phase, with gradual recovery of movement. This can last from five to 26 months (3,7,11). One study suggested Phase III can span 12 to 42 months (19).

Incidence

The literature consistently reports the incidence of FS as being between 2% to 5% in the general population (2,3,7,8,9,11,12,14,16,19). The incidence of people presenting to general practitioners in Holland was 2.4 per 1000 per year (3), and similarly around one in every 400 patients attending a GP in England (10). In patients with Types I or II diabetes the prevalence increases to between 10% to 38% (7,8,12,14.19). A relationship of the side affected to handedness has been suggested, but these is limited evidence. In a study involving 106 patients, there were almost equal numbers of left and right shoulders affected (1). However in a separate study involving 56 patients, Watson et al felt that the non-dominant shoulder was more likely to be affected (17). Neviaser et al agreed (9). Between 20% to 34% of patients will experience FS in their opposite shoulder (8,9,12,16). Simultaneous involvement of both shoulders occurs in up to 14% of sufferers (8). Few studies discussed the possibility of recurrence within the same shoulder, but this was thought to be highly unlikely (19).

Associated Factors

The cause of FS is still unclear, however it is known to be more common in certain individuals. While

trauma has been suggested as a common precipitating event (7,9,18), it is possible that the trauma arises because the shoulder is already more vulnerable due to the disease. Clinical experience shows that trauma is rarely described by patients with true FS. Females are said to be affected slightly more than males (3,7,9), although across four reviewed studies, the incidence of female FS sufferers ranged from 38 to 67% (11). There is a strong association with diabetes, possibly more so in type I. Delayed and less satisfactory recovery has also been reported in patients with diabetes (1,8). Other factors which have been implicated in contributing to FS include prolonged immobilisation* (7,12), those being treated for breast cancer (9), those with thyroid disease (7,8,9,12), autoimmune diseases (7,9), scleroderma (12), Dupuytren's contracture (12), and after myocardial infarction (7,8,9) and stroke (7,9).

*Clinical wisdom tells us that while immobilisation and significant post-surgical shoulder stiffness is not uncommon, and is often diagnosed as FS, in most cases this is not true FS. This secondary FS generally does not have three distinct phases, night pain is not a common feature, and these shoulders tend to respond gradually to mobilisation and stretching. This is not the case with primary idiopathic FS.

Pathology

The theory behind the onset of FS is that inflammation occurs (2,3), particularly in the axillary fold (3), and in the synovial membrane (5,18), followed by adhesions & fibrosis of the synovial lining and capsular ligaments (2). Patients with FS have been found to have both inflammatory cells and fibroblast cells indicating both an inflammatory process and scarring (8). The term 'adhesive capsulitis' was coined in 1945 because of the suggestion of adhesions forming between the capsule and humeral head. However this is not generally found on arthroscopic investigation (5,18). "Patchy vascular synovial collections" were noted, particularly in the region of the anterosuperior capsule between the subscapularis and biceps tendons (18,19). This may help to explain why external rotation range is the most restricted movement (8). As fibrosis develops, and the majority of the joint capsule contracts (8,9), the volume of joint fluid becomes greatly reduced.

Examination

The diagnosis of FS is a clinical one, and imaging is not usually required. Plain X-ray and ultrasound are of no use for assisting the diagnosis of FS. However X-ray is sometimes requested to exclude the differential diagnosis of glenohumeral osteoarthritis, which can also cause generalised loss of shoulder range of motion. History, the pattern of restriction, and the 'feel' of the joint during passive movement should help in differentiating the two conditions. Arthrography or MR arthrogram are the tests ordered when the diagnosis is unclear. This in rarely necessary. When the patient is examined, the findings will depend on the stage of the condition. In the early stages, there may be pain with certain movements, but range may not be significantly restricted. As the disease becomes established, stiffness becomes the key feature, with pain present at end of available range. Typically, there is no weakness on muscle testing (9). If weakness is detected, this may be unrelated to the FS, and indicate the presence of a pre-existing rotator cuff injury.

In true FS, external rotation range will be affected more than other movements. The normal 70° to 90° range may be restricted to between 10° to 30°. Forward elevation may be restricted to between 90° to 120°. Hand-behind-back range will also be moderately to severely affected. To confirm 'global restriction', I also test horizontal adduction, and external and internal rotation at 90° abduction.

Management

Several treatments have been proposed for FS, and there is no clear consensus regarding the effectiveness of many of these treatments. Complicating the picture is that the response to treatment may vary depending on the stage of the condition. In many of the studies reviewed, it was not always clear at what stage of FS the treatment was provided.

Physiotherapy

While many patients are initially referred for physiotherapy, as a stand-alone treatment this is generally not effective during phase I or II of the disease (9). A gentle home exercise programme can be helpful in relieving symptoms (8), and a physiotherapist can assist with prescription of these exercises. In comparison with steroid injection alone, physiotherapy was found to be less effective (2,5,8).

There is evidence that physiotherapy, when performed after intra-articular corticosteroid injection, is more effective than either intervention alone in improving pain and range of motion (2,5,9,17). The fact that range of motion improved more in the combination group suggests that physiotherapy is effective for FS when performed after steroid injection.

Physiotherapy management approaches described in the literature include transcutaneous electrical nerve stimulation (5,8), joint mobilisation techniques (5,6,8), active and assisted range of motion exercises (5), gentle stretching (8), ice (5), scapular muscle control exercises (6), and isometric strengthening (5).

Corticosteroid Injection

Injection of corticosteroid into the joint capsule has been claimed to provide quick pain reduction and to help restore movement. Some clinicians recommend this as the first-line treatment for FS in an attempt to settle symptoms quickly (2,6). While a powerful anti-inflammatory agent, corticosteroids are also known to be very effective in reducing pain. Considering the anti-inflammatory effect, it is possible that the injection will be most effective if performed in the early, inflammatory stage of the condition (2,9). A 2011 review of the literature confirmed that improved pain and range of motion could be demonstrated in the short-term, but not the long-term (5,7). This has been a fairly consistent finding, and is not surprising considering that FS usually improves over time, even with no treatment. It is the short-term improvement in pain that provides an attractive treatment option, particularly in the early stages when pain is a significant factor. Intra-articular injection has been consistently shown to be effective in reducing pain during this stage (5,7,10), and some studies have found an improvement in range of motion compared to control groups (5,7,10). In a systematic review covering 476 patients over four studies, the consensus was that steroid injection had a positive effect on the symptoms of FS in the short-term (11). Short-term was defined as 6 to 16 weeks. A recent study showed significant pain relief, and improved range of motion, up to 12 weeks, but not after 26 weeks following injection (10). As the most painful phase of FS generally lasts less than 9 months, corticosteroid injection may offer important symptomatic relief during a significant period of this phase. It was suggested that up to three injections may be beneficial, and there was limited evidence that any more than this would provide additional benefit (11). There is evidence that injections carried out under imaging (usually fluoroscopic control) are more effective, and that up to 60% of 'blind' injections are inaccurate (2,5,11). If accurately performed, clinical experience suggests that one injection is often sufficient. In the long-term (6-12 months) physiotherapy was more beneficial than multiple injections (11).

Injection combined with Physiotherapy

There is consistent evidence that the combination of corticosteroid injection and physiotherapy is more effective than injection or physiotherapy alone (2,5,6,9,10,17). Supervised physiotherapy after injection demonstrated quicker functional improvement compared to placebo (5).

Hydrodilitation

In this procedure, a volume of fluid is injected into the shoulder joint capsule, with the aim to stretch or even rupture the capsule. This is performed under local anaesthetic, and takes approximately 15 minutes. Some authors report that there is often transient pain during the procedure, and sometimes for a short time afterwards, but otherwise it is considered to be a safe procedure (1,3). However a recent review concluded the procedure was frequently poorly tolerated due to the peri-procedural pain experienced (16). Rest is advocated for two days, followed by return to normal activities (1). A home exercise programme & / or physiotherapy is often recommended in the weeks following the procedure.

Hydrodilitation has been found to be superior to placebo, but only up to six weeks (16). Importantly, it has not been found to be any more effective than intra-articular corticosteroid injection (16). There is potential overlap between steroid injection and hydrodilitation that makes it difficult to compare the two procedures. On the one hand, it has been argued that the benefits of hydrodilitation may be largely due to the anti-inflammatory effect of the steroid, which is included as part of the injected medium (2,15,17). On the other hand, it has been shown that a contracted capsule in a person with FS can rupture with only small volumes of injected fluid (15). The normal volume of the shoulder joint may be reduced to less than 10ml in FS (11), meaning that there may often be a combination effect of distension and anti-inflammatory. Interestingly, in a review of the literature into corticosteroid injection, it was found that the more effective interventions may have been the ones where greater volumes were injected, even up to 40ml (2). In one study the injected volume of intra-articular steroid was 50ml (11). It is possible that smaller doses may lead to capsular distension & / or rupture. Possible benefits of the procedure include disrupting adhesions within the joint (3), and an improvement in symptoms by reducing the stretch on pain receptors within the capsule (17). Repeat procedures are advocated when results are less than ideal (14). Good results have been reported, particularly for reducing pain. However there are few quality studies of hydrodilitation for FS, and in most studies a control group was not used (1,14,15,17). Therefore, while encouraging results have been reported, it is impossible to determine if the results were due to the procedure, or due to time and natural recovery. There is no good evidence at this time that hydrodilitation offers superior results to other available treatments, particularly for helping with earlier return of range of motion (6,9,16). A study which compared hydrodilitation to cortisone injection alone found no significant differences between the two groups (15). The authors did not refer their subjects for physiotherapy post-intervention, and speculated that had they done so, this may have provided further benefit. In recalcitrant cases, where recovery is slow, or full movement is not regained over time, hydrodilitation may be an effective procedure to promote further recovery (6), however this requires further investigation.

Oral Steroids

According to literature reviews, there is moderate evidence for the 'mild' benefit of oral steroids to help with the pain of FS up to 6 weeks, but no evidence that the benefit lasted beyond 6 weeks (4,16). A separate study reported oral steroids were as effective as steroid injection in improving

range, pain and subjective feelings of dysfunction (7). However, with the known systemic side-effects of oral steroids, most practitioners opt for injection rather than oral medication.

Non-steroidal anti-inflammatory medication

While these medications are commonly prescribed for FS, there is no evidence that they provide any benefit other than temporary pain relief (6,9).

Manipulation under Anaesthesia

This procedure involves administration of a general anaesthetic, followed by forceful manipulation into the stiff range, in order to break adhesions within and around the joint. It is usually reserved for those cases where the shoulder remains restricted even after the expected recovery time.
This procedure has been compared to intra-articular steroid injection, and both were found to be equally effective (7). In a comparison with hydrodilitation, it was found to be less effective (7). In a more recent review of the available literature, the results of this procedure were described as "equivocal at best" (16). As manipulation involves potential risks from both the general anaesthetic and the procedure, and with no documented benefit over alternative treatments, there is a strong argument against its use as a first-line procedure.

Arthroscopic capsular release

This procedure is described as involving release of the rotator interval followed by release of the anterior and superior capsule, and the posterior and / or inferior capsule if indicated (16). Until recently, there were no good quality studies examining the effectiveness of this technique. While several studies have shown benefits in the immediate post-operative period, the majority did not include a control group for comparison (16). A recent randomised controlled trial compared stretching alone, with intervention involving arthroscopic release, manipulation under anaesthesia and a home stretching programme (13). There were no differences between the two groups in any of the measured variables. With the information currently available, there is no evidence to support the use of capsular release for treatment during the natural course of frozen shoulder. There are studies claiming benefits for this technique in recalcitrant cases (9).

Summary

The cause of primary frozen shoulder is still unknown. It is a self-limiting condition that in the majority of cases will resolve within 12 to 36 months, although for some patients recovery may be less than complete. Pain is a significant feature in the early stages, and is the main reason patients seek treatment. Clinical experience suggests that if the patient can be provided with effective pain relief, they will learn to accept the inconvenience of the longer-term shoulder restriction. Intra-articular cortisone injection during the painful stage is often very effective in providing medium-term pain-relief. In particular, patients usually experience relief of their night pain, the symptom that the majority describe as the most difficult to cope with. In the weeks after injection, a physiotherapy guided stretching programme will improve range-of-motion for some patients. For those who do not gain improvement, a home maintenance exercise programme is recommended. Once the patient reaches the (Phase III) 'thawing' stage, a mobilisation and stretching programme can be introduced. This will usually be effective in providing more rapid recovery of normal range of motion, and restoration of strength and function.

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