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 condition appears more like "subacromial impingement" or "rotator cuff tendinitis". 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 people to have ongoing restriction beyond this time. Up to 40% to 50% of sufferers will have ongoing symptoms past three years (8), and 15% have persistent long-term disability (2,3,14). FS has three distinct phases (some authors describe four). Phase I is the inflammatory or 'freezing' stage, characterised by pain and progressive stiffness. This can last between two to nine months (3,7,11). 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).

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). 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 insulin dependent diabetes mellitus the prevalence increases to between 10% to 38% (7,8,12,14). Whether the side affected is related to handedness is unclear. In a study involving 106 patients, there were almost exactly 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 ooccurs in up to 14% of sufferers (8).

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, particularly type I (insulin dependent diabetes). 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 (heart attack)(7,8,9) and stroke (7,9).

*Clinical wisdom tells us that while immobilisation and 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 follow the three phases, night pain is not a feature, and these cases usually respond early 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 (the capsule of the 'arm-pit') (3), and in the synovial membrane (5,18) – the inner-lining of the joint, followed by adhesions & fibrosis (scarring) of the synovial lining and capsular ligaments (2). Patients with FS have been found to have both inflammatory cells and fibroblast cells (fibrosis = scarring) indicating both an inflammatory process and scarring (8). FS was 1st described in 1934 (16), and the term adhesive capsulitis was coined in 1945 because of the suggestion of adhesions forming between the capsule and bone of the humeral head. However this is not generally found on arthroscopic investigation (keyhole surgery) (5,18). "Patchy vascular synovial collections" were noted, particularly around the subscapularis and biceps tendons (18). This is in the front of the shoulder, in the region known as the 'rotator interval', and may help to explain why external rotation range tends to be the most affected movement (8). As a result of capsular fibrosis, the joint capsule contracts (8,9) (somewhat like 'shrink-wrap'), and fluid is squeezed out of the joint.

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 diagnosis of FS. 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 movement 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.

The examiner will assess a few key movements. 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 (arm across the body) and external and internal rotation at 90° abduction. Other conditions, including osteoarthritis, can cause restrictions similar to FS, so the expert clinician needs to differentiate the true cause of the stiffness.

Management

Many different treatments have been described 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 given.

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 effective in relieving symptoms (8), and a physiotherapist can help 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).

Cortisone 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). Corticosteroids are a powerful anti-inflammatory agent, and are also known to be 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. In the short-term, intra-articular injection has been consistently shown to be effective in reducing pain (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 injections 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).

Hydrodilatation

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 procedure is performed under local anaesthetic, takes approximately 15 minutes, and the person goes home immediately afterwards. 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 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.

Hydrodilatation 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 hydrodilatation that makes it difficult to compare the two procedures. On the one hand, it has been argued that the benefits of hydrodilatation may be largely due to the anti-inflammatory effect of the steroid, which is generally used at the same time (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 even small doses may lead to capsular distension & / or rupture. Possible benefits of the procedure include disrupting adhesions (scar tissue) within the joint (3), and an improvement in pain 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 hydrodilatation 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 hydrodilatation offers superior results to other available treatments, particularly for helping with earlier return of range of motion (6,9,16). A study which compared hydrodilatation 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, hydrodilatation may be an effective procedure to promote further recovery (6).

Oral Steroids

According to extensive literature reviews, there is moderate evidence for the 'mild' benefit of oral steroids to help with the pain of FS, however there was no evidence that the benefit lasted beyond 6 weeks (4,16). Another study reported oral steroids were as effective as steroid injection in improving range, pain and subjective feelings of dysfunction (7). However oral steroids are known to have several potential systemic side effects. For this reason 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 placing the patient under a general anaesthetic so that all muscles around the shoulder are relaxed. The joint is forcefully manipulated 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 hydrodilatation, it was found to be less effective (7). In a 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 release of the joint capsule
This procedure involves 'keyhole' release of the 'rotator interval' (the upper 1/3 of the front of the shoulder capsule), followed by release of the capsule at the front and top of the shoulder (16). Depending on the pattern of capsular restriction, posterior and / or inferior release may be included (16). This procedure has gained popularity in recent years (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 study compared arthroscopic release and manipulation under anaesthesia followed by a home stretching programme, with stretching alone (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 arthroscopic release for treatment during the natural course of frozen shoulder. There are studies claiming benefits of this technique in recalcitrant cases (9).

Summary
The cause of frozen shoulder is still unknown. It is a self-limiting condition that in the majority of cases will resolve within 12 to 36 months. However pain is a significant feature in the early stages, and is the main reason people seek treatment. Clinical experience shows that if the patient can be provided with effective pain relief, they will learn to accept the inconvenience of the longer-term but self-limiting shoulder restriction. Intra-articular cortisone injection during the painful stage (Phase I) 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 find 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. It will usually be effective in providing more rapid recovery of normal range of motion, and restoration of strength and function.

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