Frozen shoulder is a common disorder which is characterised by pain and loss of movement. Its cause is poorly understood and its management is disputed because of lack of supporting evidence.

Duplay, in 1872, used the term “peri-arthritis scapulo-humerale” to describe the condition. In 1934, Codman introduced the term frozen shoulder and set certain criteria for diagnosis and management. Neviaser used the term adhesive capsulitis to reflect his findings at surgery and at post-mortem. Zuckerman and Cuomo defined the condition as one of uncertain aetiology characterised by substantial restriction of both active and passive movement in the shoulder occurring in the absence of a known intrinsic disorder of the shoulder. The aetiology remains unknown, although some aspects of the pathophysiology have recently been documented. The symptoms are generally self-limiting over one to three years. The role of treatment which includes physiotherapy, analgesics, injection of cortisone, manipulation and surgical release, must be assessed in the context of a tendency to self-resolution. This review examines the evidence to support interventional procedures in treating this painful and often debilitating condition.

Epidemiology

Hannafin and Chiaia found the prevalence to be slightly greater than 2% in the general population. It is more common in women and between the ages of 40 and 60 years. Recurrence is unusual and both shoulders are affected in between 6% and 34% of cases.

Classification

This condition may be primary or secondary. Zuckerman and Cuomo have separated secondary into intrinsic, extrinsic and systemic categories. Table I highlights the known conditions or associations with this disease.

Natural history

The pattern is one of eventual recovery through three symptom-related phases. The initial phase is associated with an insidious onset of pain increasing in severity over a period ranging from a few weeks to nine months. During this ‘freezing’ phase, the shoulder loses active and passive movement. The second ‘frozen’ phase may last from four to nine months, during which the pain begins to abate leaving global stiffness of the shoulder. The final ‘thawing’ phase sees the return of movement towards normal over a period of five to 26 months. Codman stated that recovery, even in severe cases, occurred in about two years and this view is supported by the study by Grey in 1978, who reported that 24 of 25 patients treated conservatively returned to normal within a maximum of two years. Miller, Wirth and Rockwood found that there was return of movement and minimal residual pain in most of their 50 patients treated by a home rehabilitation programme. However, residual symptoms have been widely documented. Some 28 years ago, Reeves reported a prospective study of 49 patients with...
idiopathic frozen shoulder, of whom 41 were available for follow-up after five to ten years. The mean duration of the condition was 30.1 months, but 61% had slight restriction of movement, although in only 6% was it felt to be a handicap. A prospective study of 40 patients in Cambridge using various treatments failed to show any difference from a control group over an eight-month period.32 Long-term follow-up showed little functional impairment at a mean of 44 months, although 40% had some restriction of movement of the shoulder.33 However, there were three treatment groups and a control group which considerably reduced the power of the study. Shaffer, Tibone and Kerlan34 also described a group of patients treated non-operatively with 50% having some pain or stiffness when seen at a mean follow-up of seven years. These objective findings did not relate to any significant functional disability. All these studies involved patients who had been referred to orthopaedic departments. Undoubtedly, there may be many who suffer a mild form of the condition but recover quickly and do not seek medical attention. Figure 1 gives the natural history from the information available in the literature.

Pathogenesis and cellular investigations

The aetiology remains unknown. There are associations with many medical conditions as seen in Table I, the strongest being that with diabetes in which the incidence is reported as being between two and four times higher than that in the normal population. Indeed, several authors have suggested that frozen shoulder may be an algoneurodystrophic process.35-39 The condition has only rarely been recorded in other joints including the wrist, hip, and ankle.40-44 There is one possible case reported in childhood.45

The macroscopic pathological changes are of capsular contracture. Neviaser3 described four stages of the disease and these have been correlated with changes in the histological appearance.5 The disease process has also been shown to include contracture of the coracohumeral ligament.46,47 Microscopically, both inflammatory3,10,48 and fibrotic49 processes have been described. However, the specific cellular basis for the pathology seen in frozen shoulder has not been identified. A dense matrix of type-I and type-III collagen laid down by fibroblasts and myofibroblasts is seen. Lundberg50 showed that there was an increase in glycosaminoglycans and a decrease in glycoproteins, specifically hyaluronic acid. Rodeo et al48 studied cytokines and their receptors by immunolocalisation. Their results suggested that transforming growth factor beta and platelet-derived growth factor may be involved and act as a continual stimulus in the inflammatory and fibrotic process. Bunker et al51 examined the expression of growth factors, cytokines and matrix metalloproteinases (MMPs) in patients with frozen shoulder and compared this with Dupuytren’s tissue and a control group. They recorded an imbalance between aggressive healing, scarring, contracture and a failure of remodelling which may lead to the protracted course of the disease. Immunological studies have failed to identify successfully a link with HLA-B27 or any specific autoimmune or arthritic process.10,52-54 Interestingly, patients treated with metalloproteinase inhibitors are reported to be prone to develop frozen shoulder and Dupuytren’s contracture.51

Management of frozen shoulder

Conservative. Since the accepted prognosis is one of eventual resolution, a conservative approach is often followed. ‘Supervised neglect’ with analgesia, as required, was the basis of the early management and has given the only data concerning the natural history. Simple exercise programmes together with relatively non-invasive procedures, such as intra-articular injections, nerve blockade and hydrodistension have been introduced more recently and several studies are now available for review.

Miller et al51 reviewed retrospectively 50 patients (39 idiopathic) at a mean of three months after the onset of symptoms. An ‘orthotherapy’ rehabilitation programme was instigated. Functional movement (defined as painless movement to within 20˚ of the normal side) returned at a mean of 14 months (3 to 36). There appeared to be a bimodal distribution of recovery with one group achieving this within 12 months and the other between 15 and 24 months. There were, however, no true associations with the variables in the
patients’ data. Griggs, Ahn and Green also used a shoulder stretching exercise programme for phase-II idiopathic adhesive capsulitis in 75 consecutive patients. The mean duration of shoulder pain before evaluation was 9.2 months (1.3 to 47) and follow-up was for 22 months (12 to 41). A satisfactory outcome was seen in 90% of patients, with five of the seven who were unsatisfied undergoing manipulation under anaesthesia (MUA) and/or arthroscopic release. Both of these studies report follow-up within the range of recovery for the natural history documented by Reeves. While these regimes of treatment showed no detrimental effects, the conclusion as to whether treatment was beneficial, has to be somewhat speculative since there were no control groups in either study. In 1992, Shaffer et al reported that in a series of 62 patients from an initial cohort of 183, 50% had pain or stiffness at a mean of seven years and 60% had restriction of movement. They had all undergone shoulder rehabilitation exercises supplemented by various treatment regimes, including subacromial injection (84%) and MUA (6.2%). The pain and stiffness were never more than mild and the restriction was “unrelated to subjective symptoms, infrequently affected the activities of daily living and caused little functional disability”.

Nerve blocks and distension. Blockade of the suprascapular nerve using various techniques and pharmaceutical agents has been advocated to reduce pain and aid functional recovery. Several studies describe the use of physiotherapy and home exercise as successful methods of treatment. Intra-articular distension with or without steroid has also been suggested. Jacobs et al found no difference in outcome between three groups in which either distension with local anaesthetic alone or steroid alone or distension and steroid were given. The follow-up was only for four months and therefore a comparison of treatment with the natural history is difficult.

Interventional (non-surgical) management. Table summarises the studies in which frozen shoulder was treated by either physiotherapy techniques under analgesia or by MUA with or without other methods of treatment. All reported satisfactory results in most patients. They did not establish, however, whether any of these techniques changed the natural outcome of the disease. Meta-analysis is impossible because of the variable designs of study and treatment protocols.

Surgical management. Surgical intervention, either open or arthroscopic, aims to release the contracted tissue to gain movement and relieve pain. Table summarises the studies in the recent literature reporting the surgical management of frozen shoulder. Ozaki et al in 1989, in the first of two articles, reported the results of an open procedure for recalcitrant frozen shoulder. Open release of the coracohumeral ligament and rotator interval was carried out in 17 patients who were followed for a mean of 6.8 years. All had had failed conservative measures for a mean of 10.8 months.
months. The results showed that 94% of patients had relief from pain and complete range of movement and 100% had normal strength. This number represented only a small fraction of the total number of patients with frozen shoulder who were reviewed (4.7%). They had all had an MUA as part of the procedure. A further study in 199697 had a larger number of patients (43) but a reduced mean follow-up for five years and produced similar results. Omari and Bunker85 used the same surgical approach on 25 patients and reported good to excellent outcomes in 20 and fair in three. The two failures were associated with severe diabetes and Dupuytren’s disease. Several authors have documented arthroscopic treatment for patients who have had failed conservative measures. Segmuller et al86 described release of the inferior and middle glenohumeral ligaments with a follow-up of 13.5 months in 24 patients (26 shoulders); 88% were satisfied and 76% had normal function. These patients were put into full abduction during the procedure and steroid was placed into the joint and subacromial space at the end. Ogilvie-Harris et al87 attempted to compare MUA with arthroscopic release in a prospective cohort of 40 patients. The release included removal of synovium from the rotator interval, release of the anterior glenohumeral ligament and the intra-articular portion of the subscapularis tendon, and finally, division of the anterior half of the inferior capsule. Their results after a follow-up of between two and five years showed a similar range of movement, but the release had a better outcome in terms of pain and function. The overall outcome was excellent in 15 of 20 patients in the arthroscopic group but in only seven of 18 in the MUA group.

Warner et al88 in 1996 studied 23 patients from an original series of 81 with frozen shoulder. All had an anteroinferior release combined with an MUA; six also had subacromial decompression. They then had inpatient physiotherapy for 48 hours under interscalene local anaesthetic blockade. The mean improvement in the Constant score was 48 points (13 to 77) with a significant improvement in the range of movement. Beaufils et al89 in a French multicentre study, reviewed 26 patients after arthroscopic release of the capsule at the glenoid rim at a mean follow-up of 21 months. Although 69% were either very satisfied or satisfied, they concluded that there was no reduction in the time to recovery. They felt, however, that an increase in the range of movement during the recovery period was beneficial.

Pearsall et al90 performed arthroscopic release of the anteroinferior capsule, the intra-articular portion of the tendon of subscapularis, the superior and middle glenohumeral ligaments and the coracohumeral ligament in patients who had had failed conservative treatment. A telephone survey of 35 patients at a mean of 22 months after...
surgery reported that 83% had normal or only mildly symptomatic shoulders. These patients also had a reducing 21-day course of oral prednisolone. Watson et al91 reviewed 73 patients for up to one year after arthroscopic selective capsulotomy. They reported that pain took a mean of 2.24 weeks to decrease and that the range of movement improved to within 10% of the other side by 5.5 weeks. However, 37% required a further injection of steroid and 11% had a recurrence of pain during the follow-up period.

Gerber et al92 reviewed 45 patients after an arthroscopic 360° and rotator interval release with a mean follow-up of 26 months. In addition, all had an MUA. Nine had a primary frozen shoulder, 21 a postoperative frozen shoulder and in 15 the condition followed an injury. The primary patients had a better outcome than the postoperative patients and the trauma patients had the least favourable results. The gains within these groups were not significant and the outcome was dependent on the initial disability. The view that different types of frozen shoulder have a different behaviour and outcome was supported by Bennett,94 and more recently by Nicholson95 in a report of 68 patients undergoing arthroscopic release.

Massoud et al96 reviewed the management of a subgroup of diabetic patients and concluded that a satisfactory outcome was achieved in both insulin- and non-insulin-dependent patients. Arthroscopic release, however, was required more often than in other non-diabetic studies. They admitted the limitations of the study in terms of a control group, lack of randomisation and that the investigators had not been blinded to treatment.

The reports of surgery for frozen shoulder mainly consider the release of the anteroinferior capsular structures. Most include MUA, which may address the other directional restrictions. It is impossible to compare or even accumulate the results in these published series since they all differ in surgical technique, length of follow-up and in the outcome measures used. All describe the need for conservative treatment initially. The timing of surgery varies, ranging from six weeks to one year from the onset of symptoms. There are no data concerning the outcome of early surgical intervention.

The most prominent omission is the lack of a control group which might allow comparison with the underlying natural progression of recovery. The duration of the follow-up in most studies is within the time period when a satisfactory outcome would be expected from the available data on the natural history. The data presented do not reveal if any of the treatments change the stiffness/time ‘curve’ or pain/time ‘curve’ of the condition. There are no true randomised control trials available which compare surgery with a control group.

In summary, several series report good to excellent results with either open or arthroscopic surgical release in a small number of patients who have had failed conservative treatment. Specific protocols of management of the condition seem to vary and depend upon prevalence in the population and the constraints of the waiting list. Surgery should be in the armamentarium of orthopaedic surgeons, but there is limited evidence to show that it will truly change the natural course of this disabling condition.

References