Anterior shoulder dislocation

STEVEN CUTTS, MARK PREMPEH, STEVEN DREW

Department of Orthopaedics and Trauma Surgery, University Hospitals of Coventry and Warwickshire, UK

ABSTRACT

INTRODUCTION Anterior dislocation of the shoulder is commonly seen in accident and emergency (A&E) and trauma clinics. In this article, we review the existing literature on the injury and the recent trends in management.

MATERIALS AND METHODS We have discussed this condition with our colleagues and performed a Medline search ('anterior shoulder dislocation') of the relevant papers. We also describe key historical publications and recent developments regarding immobilisation of the joint.

RESULTS Management decisions regarding this condition continue to vary between units, especially for recurrent and posterior dislocation. This paper lays some emphasis on the choice of analgesic agent when attempting shoulder reduction in the A&E setting. A summary of the data from our own department has provided a graphical representation of the classical age and sex distribution for this condition.

CONCLUSIONS Shoulder dislocation is a common injury. Delays in diagnosis remain the single biggest obstacle to optimum results in this group of patients. A significant proportion will require eventual surgery and up to a third of these patients will go on to develop long-term shoulder arthritis. Even patients who have experienced a single episode of dislocation may go on to develop long-term sequelae.

KEYWORDS

Anterior shoulder dislocation – Management – Analgesia

CORRESPONDENCE TO

Steven Cutts, 3 Watchets Green, Lyppard, Habington, Worcester WR4 0RT, UK
E: stevenfrcs@hotmail.com

The glenohumeral joint of the shoulder is the most commonly dislocated joint in the human body. Acute dislocation is a surgical emergency and demands urgent relocation. Failure to reduce a dislocated shoulder successfully within

the first 24 hours carries the risk that it will be impossible to achieve a stable closed reduction.¹

Broadly speaking, anterior shoulder dislocation shows a bimodal age distribution (Fig. 1). The first, and by far the

Figure 1 An analysis of the age spectrum of patients admitted to Walsgrave A&E Department with shoulder dislocation over the last 3 years. The bulk of the patients are young adults. In spite of the depletion of the older cohort, there is an apparent second peak beyond the age of 60 years. Male patients clearly out-number women in the younger age group.

largest group are young adult men who have sustained high-energy injuries to the shoulder. The second group are older patients who have been injured with a much lower level of violence. In older patients, the dislocation usually proves to be an isolated event. Management priorities in this second, older-age group include both early reduction and early mobilisation to avoid the risk of long-term stiffness.

In the younger-age group, the risk of recurrence correlates strongly to the violence of the initial injury and the age of the patient at the time of presentation with the 16–30-year-old group being at particularly high risk.¹ Management priorities in the younger-age group remain contentious with individual surgeons debating both the indications and timing of initial surgery.

In this paper we focus on traumatic anterior dislocation in the younger patient, reviewing the existing literature in the field and discussing current controversies on diagnosis and management of the condition.

The mechanism of anterior dislocation

Over 95% of glenohumeral dislocations are anterior. Violent external rotation in abduction levers the head of the humerus out of the glenoid socket, avulsing anterior bony and soft tissue structures in the process (the Bankart lesion).² As the final, posterior part of the humeral head exits the joint, it often collides with the anterior rim of the glenoid, creating a bony indentation at the back of the humeral head (the Hill Sachs lesion).^{1,5}

Presentation

The experienced trauma physician can recognise an anterior shoulder dislocation at sight. The arm is usually held in an abducted and externally rotated position. There is loss of the normal contour of the deltoid and the acromion is prominent posteriorly and laterally. The humeral head itself may well be palpable anteriorly.

On more detailed examination, there may be specific damage to the bone, vascular and nervous structures of the region. It is important to record neurovascular status before reduction is attempted. In the longer term, injury to the rotator cuff may also emerge. Each of these defects will be considered in turn.

Bone injury

A plain anteroposterior X-ray is mandatory before attempting to reduce the shoulder, as an associated humeral fracture will make it both impossible and dangerous to manipulate the humeral head by holding the shaft. A second, axillary view confirms the diagnosis and determines the direction of dislocation.

In a large series of patients under the age of 40 years, Hovelius *et al.*¹ reported that 54% of anterior dislocations were associated with a Hill Sachs lesion. The presence of a Hill Sachs lesion increases the risk of recurrent dislocation.

The presence of an associated greater tuberosity fracture is more common in the older patient. Sparks *et al.*⁴ have also reported a strong correlation between vascular injury in shoulder dislocation and a fracture of the greater tuberosity with only 1% of arterial injuries being associated with dislocation without fracture.

Vascular injury

Stayner *et al.*⁵ reported two cases of axillary artery injury in 95 cases of shoulder dislocation. Given that the shoulder is the most commonly dislocated joint in the body, this represents an extremely infrequent complication (1–2%) and demands considerable vigilance on the part of the physician to detect. The axillary artery has less elasticity in older patients who tend to suffer from atherosclerosis and vascular injury is more common in this group.⁶ It is particularly rare in the younger patient.

When axillary artery injury does occur, the pathognomonic triad consists of anterior shoulder dislocation, absent or diminished distal pulses and protruding axillary haematoma.⁷ However, the upper limb has an excellent collateral circulation and it is possible for a major arterial injury to co-exist with good peripheral capillary filling and a palpable radial pulse.⁷ Any suggestion of reduced pulse pressure and even transient coolness in the hand demands urgent angiography. Not all these cases are complicated by a formal intimal tear. Sparks *et al.*⁴ reported arterial spasm in 18 out of 30 cases of upper limb ischaemia after dislocation. Only angiography can distinguish transient spasm (which will resolve with conservative management) from a tear (which requires surgery).

When vascular injury is present, it is often further complicated by neurological injury.

Nerve injury

Peripheral nerve injuries following anterior dislocation are common,⁸ with about 10% patients suffering injury to the axillary nerve. More sensitive studies using electromyography have reported a much higher rate of injury than this.⁹

Brachial plexus injuries are more unusual with the site of the injury often being related to the position of the arm during dislocation.¹⁰ With the arm in full abduction and internal rotation there is tension on all major cords of the plexus. Extension of the elbow and wrist distracts the medial cord. With the elbow flexed, the posterior and medical cords are under tension.

The brachial plexus injury associated with shoulder dislocation are typically postganglionic, infraclavicular and in continuity. Since the injury is usually neuropraxia or axonotmesis, the prognosis is usually excellent.^{11,12}

McManus¹⁵ was the first to comment on the association between greater tuberosity fracture, dislocation and brachial plexus injury. Volpin *et al.*¹⁴ described complete axillary artery and brachial plexus palsy in conjunction with shoulder dislocation.

Paley *et al.*¹⁵ reported a case of bilateral anterior shoulder dislocations associated with bilateral brachial plexus and axillary artery injury. Interestingly, this patient was 60 years old.

Rotator cuff tears

Between 14–63% of anterior dislocations are also associated with rotator cuff tears with the incidence of this complication again increasing in older patients. Many authors recommend ultrasound screening of patients with first-time dislocations over the age of 40 years.¹⁶

Reducing the dislocated joint: analgesia and sedation in the emergency situation

There is no consensus on the optimum technique for reduction of the dislocated shoulder. Success of any one technique is likely to be dependent on the familiarity of the surgeon and the choice of analgesia.¹⁷

Ideally, all dislocated joints would be reduced under general anaesthetic with adequate analgesia and muscle relaxation. In practise, most units attempt initial reduction in the accident and emergency department.

Controversy exists as to the optimum type of analgesia and anaesthesia to use in this environment. Using the Kocher manoeuvre, Uglow¹⁸ was able to perform a successful reduction in 80.9% of patients using Entonox alone and in 100% of those patients sedated intravenously. This study showed that, in clinical practise, the majority of relocations can be performed without the need for intravenous sedation.

In Australia, Taylor *et al.*¹⁹ compared the effectiveness of propofol to midazolam as a sedating agent for shoulder reduction. The authors concluded that propofol appeared to be as effective as midazolam/fentanyl and was associated with better muscle relaxation and fewer reduction manoeuvres. However, the advantage of shorter waking times associated with propofol should be weighed against the possibility of adverse events, particularly respiratory depression and vomiting.

Working in the US, Kosnik *et al.*²⁰ compared the effectiveness of reducing dislocated shoulders using intra-articular lidocaine versus intravenous analgesia and sedation. They concluded that intravenous agents are preferred by patients, and had marginally better success rates. An appreciation of the potential for intra-articular analgesia should exist in the emergency room staff for use in those cases where sedation would be considered risky.

In a similar study, Miller *et al.*²¹ found intra-articular local anaesthetic agent to be associated with significantly reduced time spent in the emergency room and dramatically reduced economic cost. The effectiveness of the reduction manoeuvre was equal in sedated and intra-articular local anaesthetic groups.

Gleeson *et al.*²² compared the use of supra-scapular nerve blocks with intra-articular lignocaine and concluded that intra-articular lidocaine was the technically easier procedure to perform and also more effective as a means of pain relief.

In a later paper, Gleeson *et al.*²³ compared the effectiveness of Entonox to intra-articular local anaesthetic during shoulder reduction and concluded that Entonox alone was the more effective pain relieving agent of the two.

Post reduction management

After the dislocated shoulder has been reduced there is controversy as to how it should be managed. Traditionally, the shoulder has been immobilised in a sling in a position of internal rotation. However, during the last decade, this tradition has been challenged.

In 1996, Hovelius *et al.*¹ described a large, 10-year follow-up study that appeared to suggest that the risk of re-dislocation was not influenced by the form of immobilisation used. Patients who were asked to wear a simple sling until they were comfortable had a similar long-term result to those treated with more formal immobilisation.

In 2001, Itoi *et al.*²⁴ described a magnetic resonance imaging (MRI) study of dislocated shoulder patients showing that the separation of the torn labrum is significantly less in external rotation than in internal rotation. This suggested that immobilisation in a sling that held the arm in an externally rotated position would better approximate the Bankart lesion in the glenoid neck.

Then in 2003, Itoi and his collaborators²⁵ published a second paper describing the actual clinical outcome of just such a policy. In a randomised, prospective study, a series of 40 patients were divided between internal rotation and external rotation groups. There was a 30% recurrence of dislocation in the internal rotation group versus 0% re-dislocation in the external rotation group.

However, these results were brought into question by a later cadaveric study showing that the force present at the site of the labral tear is minimum in neutral rotation and actually increases with external rotation.²⁶

In clinical practise, real patients find it difficult to function with their arm immobilised in external rotation and, whilst the Japanese work is interesting, this new policy has yet to achieve general acceptance.

If initial dislocation is followed by episodes of recurrent subluxation, then avoidance of high-risk activity and a programme of muscle strengthening may still be effective.

Table 1 Recurrent dislocation

Age at dislocation (years)	Risk of recurrence
< 20	Up to 95% (66% Simonet)
20–25	50–75%
< 25	< 50% (Sinomet 40% of the 20–40 years old group)
> 40	< 15% (0% Sinomet)

After the initial period of immobilisation, the patient begins supervised physiotherapy exercises to prevent glenohumeral joint contracture followed by dynamic exercises to develop dynamic stabilisers of the shoulder and improve proprioception in the joint.

Recurrent dislocation

Even with optimum management, many patients will go on to develop recurrent dislocation and these must be investigated and treated appropriately (Table 1).²⁸

In their classic paper published in 1996, Hovelius *et al.*¹ found that the risk of re-dislocation varied inversely with the age at the time of primary dislocation with over a third of patients under the age of 20 years requiring eventual surgery.

Simonet *et al.*,²⁷ in 1984, described a similar recurrence rate. Both age and athletic activity were shown to be important to the risk of recurrence.

Patients who do not experience repeat dislocation may well suffer from recurrent subluxation of the joint that limits their overall activity levels.

The on-going high rate of recurrent shoulder dislocation, especially in the very young, athletic population, has led some surgeons to suggest that this group should be referred to a shoulder specialist for arthroscopic assessment at an early stage.

The pathology of recurrent dislocation

The problem of recurrent dislocation has long been recognised. During the 1930s,^{2,3} many workers pursued what was believed to be the essential lesion in recurrent shoulder dislocation. Then, in a landmark paper in 1938, the British surgeon Bankart² described the lesion that still bears his name. Bankart's 'essential lesion' is an avulsion of labrum from the anterior inferior glenoid with an associated tear in the labrum. Bankart went on to describe his own operation for repairing the shoulder in recurrent dislocation.

Bankart's essential lesion remains the most commonly observed abnormality at shoulder arthroscopy. However,

capsular laxity in the absence of a Bankart lesion is also well recognised.²⁹

Modern biomechanical studies have demonstrated that the creation of a Bankart lesion in itself is insufficient to permit shoulder dislocation. More recent cadaveric, arthroscopic and MRI studies have shown that many patients have sustained injury to several structures in the shoulder. In particular, there has been recognition of the inferior glenohumeral ligament³⁰ with more modern surgeons choosing to repair each of the damaged structures at the time of initial surgery.

Investigations

In those patients who suffer recurrent dislocation, arthroscopic visualisation of the shoulder joint would now be regarded as the gold standard diagnostic technique. This procedure does, however, require a general anaesthetic, specialist equipment and a degree of technical skill. The procedure also carries a small risk of complications.

In recent years, the increasing availability of MRI scanning has offered an alternative non-invasive investigation for shoulder injury.^{31,32} Most modern shoulder surgeons would obtain an MRI of the joint before attempting definitive surgical repair. A pre-operative assessment of the degree of glenoid bone loss is particularly useful.

Unenhanced MRI scanning has an overall accuracy of 95% for glenoid injuries.³³ Intra-articular gadolinium marginally improves accuracy.

Aliprandi *et al.*³⁴ showed comparable results using computed tomography (CT) and MRI; CT is a viable alternative in patients in whom MRI is contra-indicated.

Surgical treatment of the initial anterior dislocation

Many surgeons prefer a minimal access approach to the injured shoulder.³⁵ However, it should be remembered that this kind of arthroscopic shoulder repair requires expensive equipment and is technically demanding.

Whilst minimal access surgery is in vogue, some authors have questioned its efficacy. Freedman *et al.*³⁶ published a meta-analysis comparing open Bankart repair with arthroscopic repair and concluded that arthroscopic repair is associated with a higher failure rate.

Early attempts at arthroscopic reconstruction relied heavily on staples but this resulted in a high complication rate and has been largely abandoned.³⁷ Similarly, attempts to fix antero-inferior labral tears through any approach using bio-absorbable tacks have met with varying success.³⁸

More recently, thermal capsular shrinkage has been used in an attempt to augment the stabilisation. Again, the results are variable. Chen *et al.*,³⁹ in 2004, reported that arthroscopic thermal capsulorrhaphy made no difference to the outcome of

arthroscopic labral repair with biodegradable tacks in patients with primary recurrent anterior shoulder instability.

D'Alessandro *et al.*⁴⁰ also reported poor follow-up results from this technique. This non-randomised, prospective study evaluated the indications and results of thermal capsulorrhaphy in 84 shoulders with an average follow-up of 38 months. Results were classified as being unsatisfactory in 37% of cases. In a lengthy review article in 2004, Levine *et al.*⁴¹ concluded that the initial wave of enthusiasm for thermal capsulorrhaphy had subsided.

Complications of this technique include the obliteration or attenuation of capsular tissue, axillary nerve injury, and chondrolysis.

Papers published in 2006 suggest that early arthroscopic results are comparable with those achieved using open surgery but data beyond 5 years have yet to emerge.

Open surgical repair

Open surgical repair involves a substantial incision with slower recovery times than arthroscopic repair. Historically, the open repair has been associated with a 95% reduction in re-dislocation and it remains the gold standard treatment against which other results are measured.¹ Early techniques reduced external rotation and the results were disabling for the performance athlete. Modern modifications permit repair of damaged tissue with less restriction of external rotation. Where bone has been lost from the glenoid, open surgery is essential.

Return to sport

In a systematic review of the literature, Kuhn¹⁷ was unable to find any hard evidence to support any one programme of remobilisation. There is level 4 case series and level 5 expert opinion to suggest that a return to sport is permissible when range of motion and strength are near normal but recurrence is likely.

Long-term prognosis

In 1996, Hovelius *et al.*¹ reported moderate or severe osteoarthritis in 8.7% of shoulders in patients who had sustained their first dislocation under the age of 40 years. These authors found that moderate-to-severe osteoarthritis occurred regardless of how the patient had been treated or whether recurrence had occurred.

In 2006, Ogawa *et al.*⁴² reported a high incidence of osteoarthritis in patients with traumatic anterior instability for whom surgery was planned. Plain X-ray in this series revealed osteoarthritis in 11% of cases whereas CT scan revealed osteoarthritis in 31% of cases. The ability of CT to detect osteoarthritic changes missed on plain X-ray sug-

gests that some earlier studies may have underestimated the rate of post dislocation osteoarthritis.

It would appear that osteoarthritis is a common long-term sequela to anterior shoulder dislocation.

Muscle patterning

In recent years, there has been increased interest in the influence of muscle patterning on recurrent dislocation. Inappropriate recruitment of torque-producing muscles around the shoulder are believed to create uncontrolled movements at the glenohumeral joint. These patients have a muscle recruitment sequencing problem and rehabilitation is directed at normalising muscle patterning. Supporters of this concept believe that surgery should be delayed in these patients until the muscle patterning problem has been addressed by physiotherapy.⁴³

The voluntary dislocator

A small proportion of patients are able to dislocate their shoulders at will. For some patients this is little more than a party trick and the shoulder can be similarly relocated by the patient. It is more common in the young and often associated with generalised ligamentous laxity. Surgery is to be avoided in this group.⁴⁴

Conclusions

Shoulder dislocation is a common injury. Delays in diagnosis remain the single biggest obstacle to optimum results in this group of patients. A significant proportion will require eventual surgery and up to a third of these patients will go on to develop long-term shoulder arthritis. Even patients who have experienced a single episode of dislocation may go on to develop long-term sequelae.

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