



CLINICAL REVIEW

Management of the unstable shoulder

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The shoulder is the most commonly dislocated joint in the human body. The incidence of shoulder dislocation is increasing.¹ Recurrence is common and occurs in as many as 67% of cases.² Patients often mention a painful, weak arm and a shoulder that readily dislocates with trivial movements. These disabling symptoms can lead to multiple hospital admissions, decreased ability to participate in high level activities, fewer employment opportunities, and a reduction in overall health.³ The “unstable shoulder” has therefore become a relatively common problem seen in primary healthcare, with a reported incidence rate of 2.8%.⁴

The aim of this review is to provide a simple framework for the clinical assessment, investigation, and treatment of the unstable shoulder for non-specialists and to highlight key patient groups that benefit from early specialist input.

How does a shoulder become unstable?

When a shoulder joint is dislocated by external force (a traumatic dislocation), the structures that normally provide stability stretch, tear, or detach from the glenoid or the humeral head, or both (box 1). These structures either heal in a non-anatomical position or fail to heal. This increases the risk of future episodes and further damage to these structures.⁵

Several classification systems have been developed for shoulder instability, but a lack of supporting evidence has prevented any one of them from being adopted universally. As over 90% of dislocations are due to external trauma,⁶ most patients are recognised to have traumatic structural instability. However, a group of people have inherently lax joints, which spontaneously, or when subject to trivial injuries, become unstable as a result of microtrauma—that is, tissue damage is seen at the microscopic level.⁶ Such people are classed as having atraumatic structural instabilities. A small number of joints become unstable as a consequence of abnormal neurological control of movement, even in the absence of structural changes. These are termed muscle patterning instabilities. Box 2 summarises the definitions.⁷

What are the risk factors for an unstable shoulder?

In a large epidemiological study of 8940 shoulder dislocations, males were over 2.5 times more likely to experience a dislocation, and when the incidence rates were calculated according to age the results illustrated a bimodal distribution, peaking in the third and ninth decades of life.¹ More recently, a case series of 31 patients with shoulder dislocation found deregulated expression of collagen genes across the joint capsule suggesting a genetic role in instability.⁸ Box 3 illustrates other independent risk factors for an unstable shoulder.¹⁻¹¹

How should a shoulder that keeps dislocating be clinically assessed?

History and examination remains the cornerstone for assessing people with an unstable shoulder. Eliciting the risk factors described in box 3 will also predict who will go on to develop ongoing instability after an initial dislocation or subluxation.

The following four questions should be asked when taking a history:

Was your first dislocation caused by a specific injury? This differentiates between patients with type 1 and type 2 instability.

How old were you when you first dislocated your shoulder? Younger patients are more likely to develop recurrence.¹²

How many times has your shoulder dislocated? Any previous dislocation is a risk factor for recurrence.¹⁰

In which direction does your shoulder dislocate? Anterior ($\geq 90\%$ of cases), posterior, or multidirectional.⁶ Patients often know which way their shoulder dislocates.

These questions will be sufficient to reach a working diagnosis, after which referral to a secondary care service may be needed. Community based physiotherapists are often able to manage patients from this point.

The bottom line

- Shoulder instability is characterised by abnormal movement of the humeral head resulting in pain, subluxation, or dislocation
- Three types of shoulder instability exist: traumatic, atraumatic, and muscle patterning, but they can occur together, in combination, or sequentially over time
- Treatment is specific to the type of instability—non-operative management is indicated for all those with a muscle patterning component to their instability, even in the presence of a structural lesion, and surgical stabilisation is indicated when instability is either purely structural or persists despite physiotherapy
- Arthritis, a common long term sequela of an unstable shoulder, may be indicated by a painful, stiff shoulder many years after the instability has been treated

Sources and selection criteria

We searched Medline and the Cochrane library using the terms "shoulder instability", "shoulder dislocation", "clinical assessment of shoulder instability", and "treatment of shoulder instability". Only articles published in English were included. Data were primarily collated from observational studies, case series, and randomised controlled trials.

Box 1 Important definitions

- *Dislocation*—complete loss of contact between joint surfaces that requires a reduction manoeuvre to restore normal anatomy. This may be acute (first time), recurrent (any subsequent event), or persistent (locked)
- *Subluxation*—partial loss of contact between joint surfaces
- *Shoulder instability*—abnormal movement of the humeral head resulting in subluxation or dislocation from the glenoid cavity. This may be associated with varying degrees of pain
- *Shoulder joint laxity*—asymptomatic movement of the humeral head on the glenoid cavity at the upper end of the normal physiological range

Box 2 Types of shoulder instability⁷*Type 1*

- *Traumatic structural*—patients give a definitive history of injury and sustain structural damage within the shoulder joint

Type 2

- *Atraumatic structural*—patients have structural damage within the shoulder joint but without a history of trauma

Type 3

- *Muscle patterning*—in contrast with patients experiencing type 1 and 2 instability, those with type 3 instability have no structural defect but rather exhibit unbalanced muscle recruitment around the shoulder (muscle patterning)

Box 3 Independent risk factors for shoulder instability¹⁻¹¹

- Male sex
- Age (bimodal distribution)
- Genetic predisposition (family history)
- Abnormal position of glenoid cavity (developmental)
- Hypermobility syndrome
- Taking part in contact sports
- Previous dislocations
- Hill-Sachs lesion—posterolateral depression of the humeral head resulting from impaction against the anterior rim of the glenoid

Examination*Inspection*

Anterior dislocation "squares off" the normal, smooth rounded contour of the shoulder, whereas a bulge at the back of the shoulder usually characterises posterior dislocation. Atrophy of the deltoid occurs if the axillary nerve has been injured, and atrophy of the rotator cuff muscles suggests either a nerve injury or detachment of the muscle from the humerus (atrophy of the infraspinatus is most readily seen at the back of the shoulder beneath the prominent scapula spine). Poor posture is a predisposing factor to muscle patterning disorders (type 3 instability): if patients have abnormally lax joints and cannot easily stand on one or both legs then poor postural control may

be a contributing factor. People with lax joints require specialised physiotherapy and not surgery. Abnormally lax joints can be assessed using the Beighton's score (see box 5).

Special tests

Few physical tests used to diagnose shoulder instability have proved clinical utility (table 1). In a prospective study of 52 males with a first time shoulder dislocation, a positive supine apprehension test (see special tests in box 6) was found to help predict the risk of recurrent instability.¹³

In a prospective cohort study of 169 consecutive patients with shoulder problems, a positive result on the release (surprise) test (see special tests in box 6) was found to be an independent

risk factor for diagnosis of traumatic anterior shoulder instability.⁵ A meta-analysis also showed that the release test exhibited the strongest sensitivity and would most likely rule out anterior instability when the result was negative.¹⁴

Rotator cuff tendon tears and neurological injury

Failure to diagnose tears in tendons of the rotator cuff (box 4) and neurological injury around the shoulder lead to delays in management, persistent symptoms, and disability. If there is both a rotator cuff tear and a neurological injury then a vascular injury is also possible and should be sought. Bruising on the inside of the arm from the axilla downwards indicates either a rupture of the vessels close to the capsule of the joint or a fracture of the shoulder associated with the dislocation. In both instances injury to the axillary nerve (next to the vessels and close to the site of fracture) is present until proved otherwise.

Neurovascular examination of the arm and assessment of joint hypermobility (box 5) complete any assessment in shoulder instability.¹⁵ Box 6 provides more detail on an orthopaedic “look, feel, and move” approach to the assessment of patients with unstable shoulder.

What investigations can be performed in a non-specialist setting?

Standard radiography of the shoulder (anterior-posterior and axillary views) should be undertaken when instability is suspected. Radiographs are useful for identifying defects of the glenoid and humeral head. The Hill-Sachs lesion is a posterolateral depression of the humeral head that arises from impaction against the anterior rim of the glenoid (fig 5).⁷ During a posterior dislocation, the defect occurs on the opposite anteromedial aspect of the humeral head and has therefore been coined the reverse Hill-Sachs lesion. These bony lesions are important to identify because they are risk factors for recurrent instability and can affect the type of surgery undertaken.¹¹

If the shoulder appears to be located and there is a history of recurrent instability, particularly if patients are familiar with the behaviour of their shoulder after relocation, then repeated radiography is not necessary. Radiographs should be repeated if there has been a different mechanism of dislocation suggesting the possibility of fracture, or if there are signs of a rotator cuff injury or nerve or vascular injury. Under these circumstances, patients require urgent referral to a specialist.

What investigations are performed in a specialist setting?

Several investigations can be used to determine the need for surgery and the type of procedure required and should be reserved for the specialist setting:

- *Computed tomography scanning*—accurately evaluates the extent of bone loss¹¹
- *Magnetic resonance imaging and magnetic resonance arthrography*—provide detailed assessment of concomitant soft tissue damage such as of the rotator cuff, glenoid labrum, and glenohumeral ligaments.^{16 17} The labrum is an important stabilising structure that may be avulsed from the antero-inferior glenoid rim, resulting in a Bankart lesion. When this lesion was surgically treated in a cohort study of 65 participants, only two further dislocations occurred at four years’ follow-up¹⁸

- *Electromyography*—examines scapulothoracic muscle movement, which is an important contributor to normal shoulder stability
- *Arthroscopy* (“keyhole examination”)—only in those cases where doubt remains about the structural diagnosis, there is concern about the type of management required, or previous intervention has failed should arthroscopy be done because this technique assesses subtle damage within the shoulder that can be missed by conventional imaging.¹⁹

What treatment is recommended for recurrent dislocation?

Non-surgical management

Non-surgical management is indicated for all those with a muscle patterning component. These patients are often characterised by a normal appearance of the internal architecture of the shoulder joint at arthroscopy; thus the instability is due to abnormal muscle activity around the shoulder joint and scapula. Surgery is only indicated in these cases if the shoulder remains unstable despite correction of the muscle patterning problem by physiotherapy. Treatment entails prolonged physiotherapy, and avoidance of provocative positions that incite instability and can be initiated and monitored in the community.

Physiotherapy facilitates the careful maintenance of a relocated joint so that remodelling of tissues occurs in a functionally appropriate direction. It also strengthens the healed tissues and promotes proprioceptive reintegration of the joint capsule and rotator cuff, which are essential for maintenance of stability. Referral for a surgical opinion is recommended at three months if sufficient progress has not been made during a rehabilitation programme (box 7).

Surgical management

Surgical stabilisation is indicated when instability is either purely structural or persists despite physiotherapy. The two main surgical strategies available are soft tissue repairs and bone blocks. Soft tissue procedures tighten loose structures and repair those that are damaged (Bankart repair). Bone blocks work by providing a physical blockade to excursion of the humeral head and thus dislocation (fig 6). In a retrospective comparative study of 93 participants undergoing a bone block procedure and 93 undergoing a soft tissue repair, the rate of redislocation was lower in the bone block group.²⁰ This stability comes at a cost though. In one of the few long term studies of bone block surgery, arthritis and a restricted range of movement were common long term complications.²¹ Further randomised trials are therefore required to determine which surgical strategy is most effective. There is considerable controversy about whether surgery should be offered through an open or keyhole approach. In a prospective randomised controlled trial comparing the two methods, the risk of recurrent dislocations was significantly lower after open repair.³ This conclusion was not supported in a recent systematic review.²²

Despite conventional treatment, instability can sometimes persist. In this instance, shoulder fusion is a viable alternative. This provides a stable joint, albeit with a limited range of movement (fig 7).²³

Box 4 Examination of a concomitant rotator cuff tear

- The supraspinatus is best examined by asking patients to stand and gently lift the pertinent arm away from their side against a slight resistance from the examiner's hand
- The humeral head should move inwards and slightly downwards if the supraspinatus tendon is attached and working
- If the supraspinatus is torn, initiation of the lift will be accompanied by pain and the humeral head will rise upwards
- A suspected tear must lead to further investigation or referral

Box 5 Beighton scoring system for hypermobility

The Beighton scoring system for hypermobility consists of five clinical manoeuvres, which are performed bilaterally and scored dichotomously (0 or 1). The summation of these gives a score from 0 to 9 with ≥ 4 suggesting hypermobility

- Little finger—passive dorsiflexion $>90^\circ$
- Thumb—passive dorsiflexion to make contact with the flexor side of the forearm
- Elbow—hyperextension $>10^\circ$
- Knee—hyperextension $>10^\circ$
- Trunk—from a standing position, forward flexion with straight knees allows the palms of both hands to rest on the floor

Box 6 Orthopaedic “look, feel, and move” approach

Look (use contralateral shoulder as a reference)

- Muscle atrophy—deltoid, rotator cuff, and periscapular muscles
- Contour of the shoulder
- General posture—indication of type 3 (muscle patterning) instability
- Symmetry—note that 16% of cases of shoulder instability are bilateral³⁰

Feel

- Point tenderness—glenohumeral joint, acromioclavicular joint, sternoclavicular joint

Move

- Active and passive range of motion
- Special tests (see below)

Special tests

To prevent further injury, special tests should be performed without excessive force and always guided by patients' reactions

Joint laxity

- Sulcus testing—patients are seated, with arm hanging by their side. Downward traction is exerted on the arm, which causes the development of a sulcus (dimple in the skin) under the acromion if there is laxity
- Load and shift test—load: the humeral head is gently compressed against the centre of the glenoid. Shift: while the clavicle and scapula are held in one hand, an anteroposterior force is applied to the humeral head, with translation 25% or more of the humeral head diameter considered abnormal (fig 1[↓])

Anterior instability

- Supine apprehension test—patient is positioned supine and the shoulder is placed into 90° abduction and maximum external rotation. After an anteriorly directed force, patients experience a feeling of apprehension (fig 2[↓])
- Relocation test—at the point where the apprehension test was considered positive, a posteriorly directed force provides relief of the apprehension
- Release (surprise) test—this is carried out immediately after the relocation test. When the posteriorly directed force is released the patient experiences a sudden feeling of apprehension

Posterior instability

- Kim test—patients are seated and shoulder is abducted to 90° and then moved to 45° flexion while simultaneously applying a downward and posteriorly directed force to the upper arm and pushing the elbow towards the shoulder joint (fig 3[↓])
- Jerk test—in the seated position, the shoulder is flexed to 90° and internally rotated with the elbow flexed to 90° . The back of the shoulder is pushed forwards simultaneously as the elbow is pushed backwards, causing posterior translation of the humeral head. The shoulder is then abducted and if patients experience a sudden painful jerk as the humeral head relocates, the test result is positive (fig 4[↓])

Beighton scoring (see box 5 for details)

Box 7 Types of rehabilitation techniques that may be used by physiotherapists to treat unstable shoulder

- Deltoid and rotator cuff muscle strengthening exercises
- Neuromuscular training
- Scapular muscle strengthening exercises

What is the long term outcome for patients with an unstable shoulder?

Left untreated, an unstable shoulder will continue to dislocate. Even after surgery approximately 26% of patients will exhibit recurrent instability at 35 years.²¹ Arthritis of the shoulder joint occurs in 55% of patients at 25 years and is therefore a common long term sequela.²⁴ Box 8 provides specific indications for referral to a shoulder surgeon and box 9 outlines essential information that should be included in this referral.

Special cases

Shoulder dislocation in those with seizures

Epileptic seizures can cause shoulder dislocation and intractable instability.²³ Treatment is often fraught with complications because seizures exert massive stresses on surgical repairs. Immediate specialist referral is necessary as management is best provided in a multidisciplinary team that involves a surgeon, neurologist, and physiotherapist.

Patients experiencing a first time dislocation

Treatment of a first time dislocation remains controversial for both the method of immobilisation and the role of early surgery (box 10). Reports on the position of the arm in a sling from randomised controlled trials have been conflicting, with no evidence suggesting that immobilisation in external rotation is better than in the neutral position.^{25 26} By contrast, a significantly lower rate of recurrence (3% v 54%) was found in a randomised trial of 76 young active patients undergoing surgery for a first time dislocation.²⁷ Primary surgical repair has also been recognised to be more cost effective.^{28 29}

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Box 8 Indications for referral to a shoulder surgeon

- Young active patients after a first time dislocation
- All patients with painful recurrent dislocations or subluxations
- Patients with seizure related instability
- Complex cases characterised by associated injuries such as a rotator cuff tear or fracture
- Patients who fail to respond to comprehensive physiotherapy programmes
- Patients who have symptoms affecting their occupation and leisure activities

Box 9 Information that should be included when referring to a specialist*Patient related information*

- Age
- Medical history (including epilepsy and collagen disorders such as Ehlers-Danlos syndrome)

Shoulder related information

- Unilateral or bilateral
- Age at first dislocation
- Frequency of dislocations or subluxations
- Instigating factor (that is, traumatic versus non-traumatic)

Information that could be included

- Hand dominance
- Occupation and hobbies
- Direction of instability
- Details of previous treatments

Table

Table 1 | Clinical tests for shoulder instability^{14 35}

Test	Sensitivity (%)	Specificity (%)
Supine apprehension test	65.6	95.4
Relocation test	64.6	90.2
Release (surprise) test	81.8	86.1
Kim test	80	94
Jerk test	73	98

Box 10 Clinical assessment and management of an acute shoulder dislocation*Clinical assessment**Look*

- Anterior dislocation—arm is typically held in abduction and slight internal rotation
- Posterior dislocation—there is usually a posterior shoulder prominence with the arm held in internal rotation and against the chest wall (“the sling position”)
- Loss of normal contour of the shoulder
- Acromion may be palpable posteriorly and laterally

Feel

- The humeral head may be palpable anteriorly or posteriorly

Move

- Range of movement will be limited, so patients should be assessed with care

Vascular examination

- Examine hands for temperature and pallor
- Capillary refill time should be less than two seconds
- Radial and ulnar pulses—these can be normal even when there is an arterial injury, because of the rich collateral circulation present in the arm

Neurological examination

- Axillary nerve is most commonly affected, given its intimate relation to the shoulder joint
- The prognosis of a brachial plexus injury after a shoulder dislocation is usually good, with most patients recovering completely³¹

Investigation

Radiographs are essential before reduction to look for concomitant fractures of the humerus and glenoid cavity and to confirm the direction of dislocation. It is of paramount importance to document the state of perfusion and nerve function in the whole arm before attempting relocation of the shoulder

Pre-reduction analgesia

Adequate analgesia is essential before attempting to reduce a dislocated shoulder. Two equally effective techniques involve either an intra-articular injection of local anaesthetic or an intravenous sedation with analgesia³²

Methods of closed reduction

Several techniques of closed reduction have been described in the literature. The choice is at the discretion of the clinician performing the procedure, since familiarity with a particular manoeuvre will often result in success

Anterior dislocation

- Traction-countertraction (Matsen)—longitudinal traction to the arm with countertraction applied by a sheet around the chest wall. Gentle internal and external rotation achieves the reduction
- Leverage (Kocher)—this should not be carried out with traction because of the risk of iatrogenic fracture. With the arm adducted against the body, the arm is slowly externally rotated until resistance is felt. The shoulder is then flexed as much as it allows, and then internal rotation is applied to bring the hand to the opposite shoulder thus reducing the humeral head. Owing to the risk of iatrogenic fracture, this technique is being used less frequently in modern clinical practice
- Scapular manipulation—this focuses on manipulating the glenoid back on to the humeral head rather than the other way around. Patients are placed prone with their arm hanging over the edge of the bed in external rotation. Weights are applied to maintain traction. The inferior tip of the scapula is pushed medially while the upper part is pushed laterally to achieve reduction

Posterior dislocation

- The shoulder is flexed to 90° and then adduction and internal rotation disengages the humeral head. Reduction is achieved by simultaneously applying an external rotation force and traction on the arm with an anteriorly directed pressure on the posterior aspect of the shoulder

Post-reduction management

- After reduction, repeat clinical examination is necessary to assess any change in perfusion or nerve function in the arm
- Repeat radiographs will confirm reduction
- Immobilisation in a sling is usually needed for one week, after which physiotherapy should begin
- Patients should be monitored carefully since persistent pain 2-3 weeks after reduction can indicate a tear of the rotator cuff^{33 34}

Questions for future research

- What is the best way to classify shoulder instability?
- Which validated outcome tool should be used for assessing shoulder instability?
- Is surgery or conservative treatment more effective?
- What is the optimal timing of surgery?
- Which surgical strategy results in the lowest recurrence rate?
- What is the best way to treat people with a first time dislocation?
- Is it possible to predict those people who will experience dislocation before the first dislocation occurs?

Tips for non-specialists

- Always take a full history because this provides clues that will help to classify the type of instability and thus guide treatment
- Always reassess the neurovascular status after reducing an acute shoulder dislocation and confirm this with repeat radiographs
- Early referral at three months is necessary when conservative treatment does not alleviate symptoms
- People with epilepsy and those who experience a dislocation for the first time are challenging to manage but can still achieve a good outcome by being referred to specialist care

Additional educational resources*Resources for healthcare professionals*

Youm T, Takemoto R, Park BK. Acute management of shoulder dislocations. *J Am Acad Orthop Surg* 2014;22:761-71—gives an overview of the management of an acute shoulder dislocation and is pertinent to medical students, surgical trainees, and those working in emergency departments

Handoll HHG, Al-Maiyah MA. Surgical versus non-surgical treatment for acute anterior shoulder dislocation. *Cochrane Database Syst Rev* 2004;1:CD004325—a comprehensive Cochrane review examining the evidence for surgical and non-surgical management of an acute shoulder dislocation (a contentious issue, but the article provides some useful guidelines)

Shoulderdoc.co.uk (www.shoulderdoc.co.uk)—focuses on elective and traumatic conditions affecting the shoulder and provides an evidence based approach to management (free, no registration required)

Resources for patients

Johns Hopkins. Orthopaedic surgery (www.hopkinsortho.org)—directed towards patients who would like to find out more about orthopaedic conditions (free, no registration required)

eOrthopod. Orthopedic information (www.eorthopod.com)—useful resource on regional orthopaedics, with a patient's guide to shoulder dislocation (free, no registration required)

Figures

Fig 1 Load and shift test for joint laxity



Fig 2 Supine apprehension test for anterior instability



Fig 3 Kim's test for posterior instability



Fig 4 Jerk test for posterior instability



Fig 5 Computed tomogram in 29 year old woman showing a large posterolateral (Hill-Sachs) defect on the right humeral head



Fig 6 Anteroposterior radiograph of right shoulder in a 26 year old man 14 years after a bone block procedure for anterior shoulder instability. A screw can be seen securing a piece of bone to the anterior aspect of the glenoid to deepen the joint cavity



Fig 7 Anteroposterior radiograph of left shoulder in a 27 year old man four months after a shoulder fusion. The humeral head has become fixed to the glenoid thereby preventing any substantial movements that may result in dislocation or subluxation