Management of shoulder instability

Anthony T Gough
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Abstract

Shoulder instability can severely limit the function of patients and is the cause for multiple emergency healthcare presentations. Understanding the cause of the instability and the mechanism of injury are vital. There are a variety of conservative and surgical treatment options available often leading to a bespoke individual treatment pathway. This article discusses the presentation patterns, treatment options and current literature available to help guide a clinician in the management of shoulder instability.

Keywords Arthroscopic Bankart; Latarjet; open capsular shift; shoulder dislocation; shoulder instability

Introduction

The shoulder is the most commonly dislocated joint in the UK with an incidence of 21.9 per 100,000 per year with a male to female ratio is 2.55:1. There is a bimodal distribution with peaks at 15–24 years and then over 65 years of age.[1] Most shoulder dislocations (96%) are caused by a traumatic incident and almost half (48%) of shoulder dislocations occur during sports.[1] Shoulder instability is twice as high in athletes than the general population and there is a higher re-dislocation rates in younger patients (Table 1) with half of all reported dislocations in patients aged between 15 and 30 years of age.[2] Hovelius et al.[3] reported a recurrence rate of 27% in patients older than 30 years but a 72% recurrence rate in those younger than 23 years. Risk factors for a second dislocation are younger age, males, general ligamentous laxity, participation in sport and participation to a higher level of sport, returning to contact sports within the first year after injury return to full activity or work at six weeks, nerve injury or not having an associated greater tuberosity fracture with the initial dislocation.[2]

Definitions of instability

A shoulder dislocation occurs when there is complete loss of congruency between the glenoid and humeral head. Laxity, subluxation and instability are all further terms when describing the congruency of the shoulder joint. Laxity is an asymptomatic translation within the glenohumeral joint in a normal physiological range.[4] Subluxation is when there remains an element of congruency between the glenoid and humerus. Instability describes an abnormal shoulder movement leading to pain, subluxation or a dislocation.[4] The Stanmore Triangle classification of shoulder instability describes three polar types of instability, although this is best used as a spectrum as rarely do patients fit definitively into only one category of instability (Figure 1).[4] Type 1 instability is traumatic and structural in nature. It is usually unilateral and occurs after significant trauma causing a structural defect but with no abnormal muscle patterning. Type 2 instability is atraumatic and can be bilateral. There is no history of trauma but there is capsular dysfunction causing structural damage with no muscle patterning. Type 3 instability is non-structural muscle patterning instability. There is no history of trauma and no structural abnormalities triggering the dislocation. It is usually bilateral with capsular dysfunction and abnormal muscle patterning.

Shoulder stability is maintained by static (labrum, glenohumeral ligaments, bony structures) and dynamic stabalizers (rotator cuff muscles, long head of biceps, scapular rotator muscles) acting across the glenohumeral joint. During a traumatic dislocation, damage occurs to either the dynamic or static stabilizers leading to structural change and shoulder instability. The usual mechanism of injury for type 1 instability is a fall on an outstretched hand or an event causing the arm to be forced into an abducted and externally rotated position. Common structural injury patterns include a bankart lesion (avulsion of the anterior labrum off the anterior glenoid), a tear or injury to the

Age and sex specific estimated probability of recurrent instability within the first two years after primary glenohumeral dislocation[2]

Age (years)	Male	Female
15	0.86	0.54
16	0.84	0.51
17	0.81	0.48
18	0.78	0.45
19	0.75	0.42
20	0.72	0.40
21	0.69	0.37
22	0.66	0.34
23	0.62	0.32
24	0.59	0.30
25	0.56	0.28
26	0.53	0.26
27	0.50	0.24
28	0.47	0.22
29	0.43	0.20
30	0.41	0.19
31	0.39	0.17
32	0.36	0.16
33	0.34	0.15
34	0.31	0.14
35	0.29	0.13

Table 1

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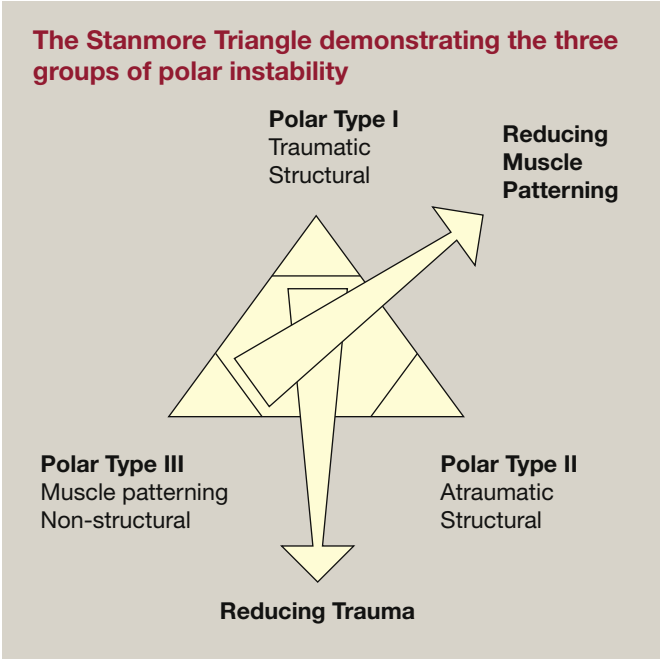

Figure 1

surrounding inferior capsule and a Hill-Sachs lesion (impaction fracture of the humeral head). Other structural injuries that can occur are a humeral glenohumeral ligament avulsion (HAGL), anterior labral periosteal sleeve avulsion (ALPSA) and a glenoid rim fracture or erosion (suggestive of chronic recurrent instability). Defining the type of instability determines how best to manage the shoulder long term and the surgical intervention best suited to managing structural deficiencies.

Clinical history, examination and investigation

Clinical history

Clinical history should focus on covering all the high-risk factors for re-dislocation and recurrent instability. These include the sex of the patient (males have a higher re-dislocation risk), age at the time of the first dislocation (the risk of recurrent dislocation is inversely proportional with the age of the patient and the number of dislocations),[15] the mechanism of injury (to help determine the polar instability type), standard and type of sport involvement (collision sports players are more at risk of further dislocations), and hand dominance and occupation (overhead occupations rely on shoulder stability).

Examination

Examination focuses on assessing clinical apprehension and instability. Performing the apprehension and relocation test together with checking the neurovascular status of the limb are the essential initial examinations. There is a risk of axillary nerve injury at the time of shoulder dislocation as well as during attempted reduction and possible future surgical procedures. Clinically apparent neurological injury occurs in approximately 13.5% of dislocations with axillary nerve injury accounting for two-thirds of these.[2] The movement of the shoulder joint should be assessed and compared to the contralateral side, specifically focusing on the coupled scapular humeral movement and positioning of the scapular during combined flexion. Documenting any evidence of muscular wasting and assessing the power and function of the rotator cuff is imperative particularly in the over 40 age group due to the high risk of associated rotator cuff tears.[5] The presence of a sulcus superior to the humeral head and calculating a high Beighnton score demonstrates a pre-existing capsular laxity.

Investigations

Initial investigations are AP and axillary X-ray views which are essential and legally required to ensure that the shoulder is relocated. In addition, it can demonstrate bony pathology — glenoid fractures, Hill Sachs lesions (impaction fractures of the humeral head) and greater tuberosity fractures. If greater tuberosity fractures are displaced they require operative management to ensure the rotator cuff function is maintained.

If the patient is a first-time dislocator then their age determines the most appropriate investigation as over the age of 40 patients are more like to have sustained rotator cuff damage. Therefore, either an ultrasound scan or magnetic resonance imaging (MRI) scan should be performed to assess their rotator cuff integrity.

Patients under the age of 40 with recurrent instability could have either a magnetic resonance arthrogram (MRA) or an MRI scan performed to assess for soft tissue lesions. A MRA has sensitivity of 88% and Specificity of 91% in picking up pathology in dislocated shoulders.[7] MRI scans can assess for bony pathology such as glenoid bone loss, but CT scan is the best modality to specifically assess bony architecture damage. However, it should be remembered that most traumatic dislocations do not always require these investigations. They are usually only requested if they aid the surgeon and patient in confirming pathology or determining what type of surgery is required.

Treatment options

Emergent management of shoulder dislocation is relocation which will most frequently be performed in the controlled environment of the emergency department ensuring that any further damage is minimalized. Immobilization in a standard polysling after relocation for pain relief should last no longer than a week with recurrence rates not improving with prolonged immobilization of more time than this. Rehabilitation supervised by a physiotherapist can from this point begin and routinely last up to 12 weeks. Forty-three per cent of first-time dislocators under the age of 40 years of age do not re-dislocate.[3] There are, however, certain risk factors that might, when working in partnership with the patient, lead to a decision of surgical intervention.

Recurrent dislocators with a structural cause for their dislocations can benefit from surgery to stabilize their shoulder. Risk factors in first-time dislocators that will potentially lead to a discussion about the merits of surgery are being a young male who either plays contact sports or regularly performs overhead activities.[15] In the past, many surgical procedures have been described for the treatment of recurrent anterior glenohumeral instability: Bankart repair, DuToit staple capsulorrhaphy, Putti-Platt procedure, Magnuson-Stack procedure to name a few soft tissue procedures. In addition, examples of bone block

procedures performed include the Eden-Hybbinette procedure, Oudard procedure and the Latarjet procedure. Finally, osteotomy procedures include proximal humerus osteotomy or a Glenoid osteotomy.

The operations commonly performed today can be broadly split into two categories: anatomical repairs (arthroscopic or open Bankart repair) and non-anatomical reconstructions (Latarjet or Eden-Hybbinette procedures). These along with their complications will be described in detail below.

Anatomical repairs

The objective of an anatomic repair for traumatic instability is the reconstruction of the avulsed capsule and labrum at the glenoid rim, often referred to as a Bankart repair. Bankart first performed the operation in 1923 on one of his former house surgeons.[6]

Arthroscopic Bankart repair surgical technique

A patient is placed into a beach chair position on a shoulder table. A standard 30-degree arthroscope is inserted into the glenohumeral joint via a posterior portal utilizing a balanced inflow/outflow arthroscopic pump and monitor system. A mid rotator interval portal is then fashioned and a cannula placed just above the mid-point of the subscapularis tendon. The anterior labral–capsule complex is then freed from the anterior glenoid using liberating arthroscopic instruments. The anterior glenoid chondral rim is freshened with rasps and an arthroscopic shaver to achieve bleeding bone. Two to three bone anchors are then inserted into the glenoid rim from 3 to 5 o'clock in a right shoulder stabilization and 7–9 o'clock in a left. The sutures are then passed through the capsule and labrum and tied in order to repair the labrum back to its anatomical position and to achieve an effective retensioning of the inferior capsular (Figure 2).

Complications specific to having shoulder stabilization surgery performed relate to re-dislocation rates and recurrent instability following the procedures. Following an arthroscopic Bankart repair up to 22% recurrent instability[7] and up to 10% re-dislocation rates have been reported after surgery.[8]

Open stabilization and Bankart repair surgical technique

With the patient in a beach chair position on a shoulder table a delto-pectoral approach is performed. The rotator interval is identified and the top two-thirds (i.e. the tendinous part of the subscapularis) is reflected from the joint capsule. A blunt retractor is placed in the interval between subscapularis and the joint capsule around the inferior margin of the glenoid to protect the axillary nerve. A humeral insertion capsulotomy is undertaken from the anterior margin of the bicipital groove past the 5 (left shoulder) or 7 (right shoulder) o'clock position on the glenoid 'clock face'. The anterior labrum is inspected and repaired using bone anchors as described above if found to be detached. The capsule is repaired with a provisional capsulorrhaphy (capsular advancement) to reduce passive external rotation by approximately 50%. Once the correct capsule tension is achieved definitive repair is undertaken in the chosen position using absorbable sutures (Figure 3). Subscapularis is repaired in the anatomical position and the wound is closed in layers.

Complications in this procedure are similar to an arthroscopic Bankart repair. Infection (1%) risk is higher than the arthroscopic repair and nerve injury is also a higher risk — both due to the open nature of the procedure. Otherwise recurrent instability and re-dislocation and reduced range of external rotation movement risks are similar to the arthroscopic Bankart procedure.

Non-anatomical reconstructions

Latarjet and Eden-Hybbinette surgical techniques

For more complex instability involving glenoid surface bone loss of more than 20% a non-anatomical procedure can be considered. The Latarjet procedure involves the transfer of the coracoid process with the short head of biceps and coracobrachialis tendons to the antero-inferior aspect of the neck of the scapula. The coracoid is laid flat on the neck of the scapula and held in place with two screws. First, the coracoid bone block increases the anterior posterior diameter of the inferior portion of the glenoid fossa, making it more difficult for the humeral head to sublux or dislocate. Second, the conjoined tendon acts as a sling reinforcing the inferior capsular ligamentous complex and the inferior portion of the subscapularis. Finally, repair of the inferior capsular ligamentous complex to the stump of the coracoacromiai ligament reconstructs the capsulolabral anatomy[9].

The Eden-Hybbinette procedure differs from the Laterjet by using an iliac crest bone graft instead of the coracoid process.

Latarjet surgical technique

In the beach chair position an 8-cm incision is made and a delto-pectoral approach performed. The coraco-acromial ligament is released from the lateral border of the coracoid and the pectoralis minor tendon is released from the medial border. A coracoid osteotomy is made as close as possible to its base at its insertion into the scapular neck. Two 3.5 mm holes are drilled at the mid-point of the harvested coracoid from deep to superficial surfaces. The coracoid with the attached conjoined tendon is mobilized allowing a tension-free transfer. Subscapularis tendon is divided horizontally between the superior one-third and inferior two-thirds, taking capsule and tendon in the same layer by sharp dissection. The capsule is incised horizontally in the line of the subscapularis tenotomy. Using the 'clock face' terminology, the labrum and capsule between 3 and 6 o'clock are resected. All soft tissue and periosteum is removed from the anterior aspect of the scapular neck leaving a bleeding bony bed. The prepared coracoid is laid flat on the anterior aspect of the scapular neck so that the lateral border of the coracoid sits flush with the anterior aspect of the glenoid rim. With the graft in situ, a 2.5mm drill bit is placed through the previously drilled 3.5mm holes in the coracoid to prepare the holes in the scapular neck. Two 3.5 mm screws are inserted to secure the coracoid in position. The lateral part of the subscapularis split is closed with one absorbable suture and the wound closed in layers (Figure 4).

There are more complications associated with both procedures being open and also involving metalwork. Complications include; nerve injury (most commonly a resolving musculocutaneous nerve neuropraxia), a coronoid fracture in the Latarjet (1–2%), metalwork failure (0–6.5%),[10] non-union of the bone block (up to 30% although this remains asymptomatic

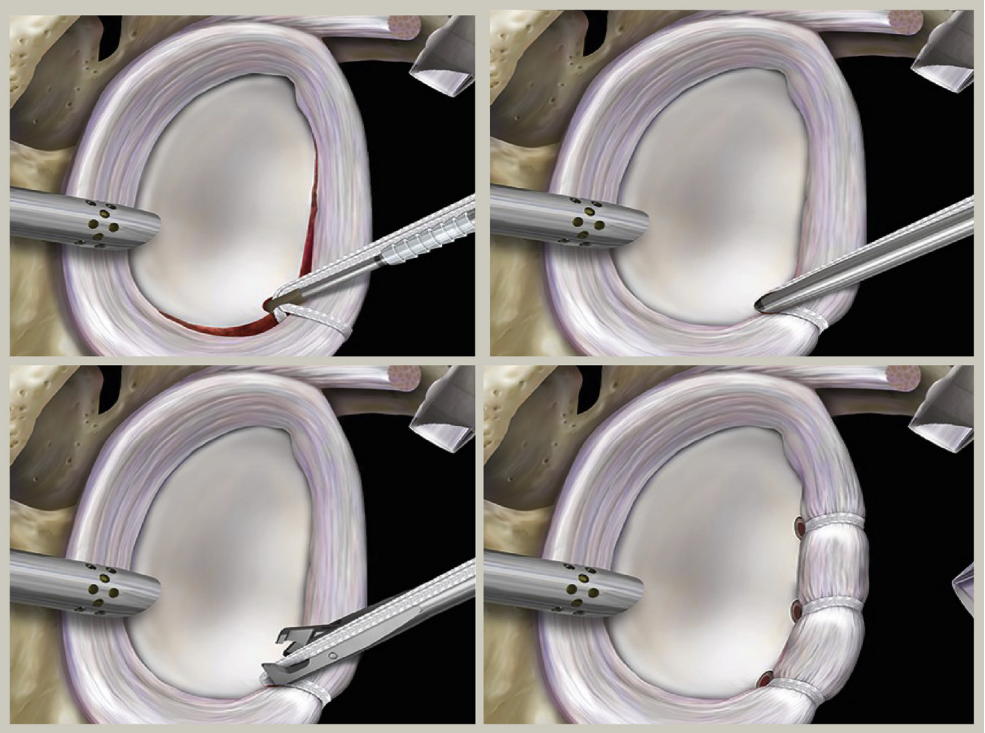

Figure 2 Demonstration of an arthroscopic Bankart repair. (Copyright of Arthrex push lock knotless instability repair, 2016. Reproduced with permission.)

with good functional results),[11] secondary osteoarthritis (6%),[12] recurrent instability (10%)[7] and re-dislocation (0–5%).[8] There is also debate about secondary osteoarthritis being caused by bone block procedures. If the coracoid is placed too laterally on the glenoid neck creating "over hang" it has been argued there is an increased risk of arthritis (6%).[12] However, 8.4% of non-operated shoulders have either mild to moderate arthropathy changes that maybe part of degeneration relating to initial dislocation and injury.[13]

Due to the open nature of the procedures future surgery can be compromised with limited salvage procedures and scarring around nerve making revision surgeries harder and hazardous. The musculocutaneous nerve runs as a single or multipartite structure obliquely through the coracobrachialis, a variable distance distal to the coracoid process. In this location, it may be injured by dissection to free up the coracoid process, retraction, or inclusion in a suture. The axillary nerve may also be injured in dissection and suture of the inferior capsule and subscapularis.[14] Overall the complication rate for large series of patients having a Latarjet procedure is 5%.[15]

Discussion

The management of a shoulder dislocation needs to be bespoke for each patient involving shared decision making between the

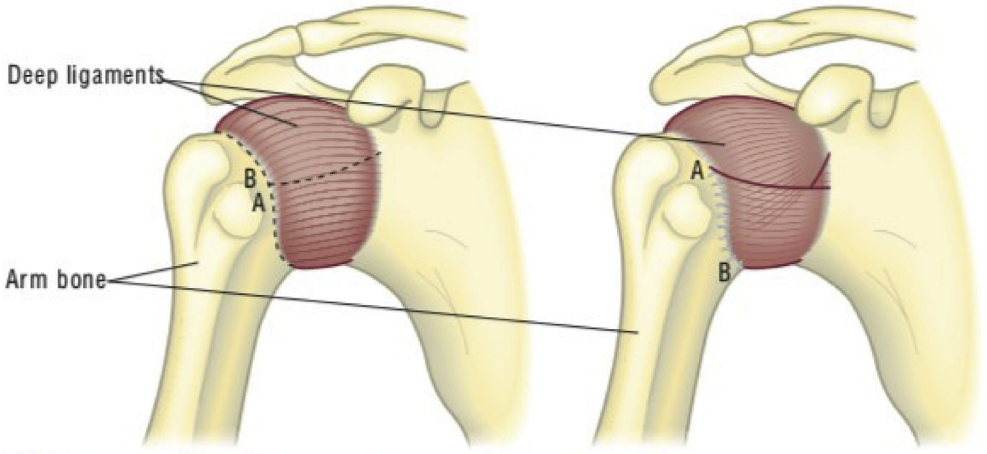

Figure 3 Schematic demonstration of an open shoulder stabilization technique. (With kind permission from The Nuffield Orthopaedic Centre, Oxford, 2007).

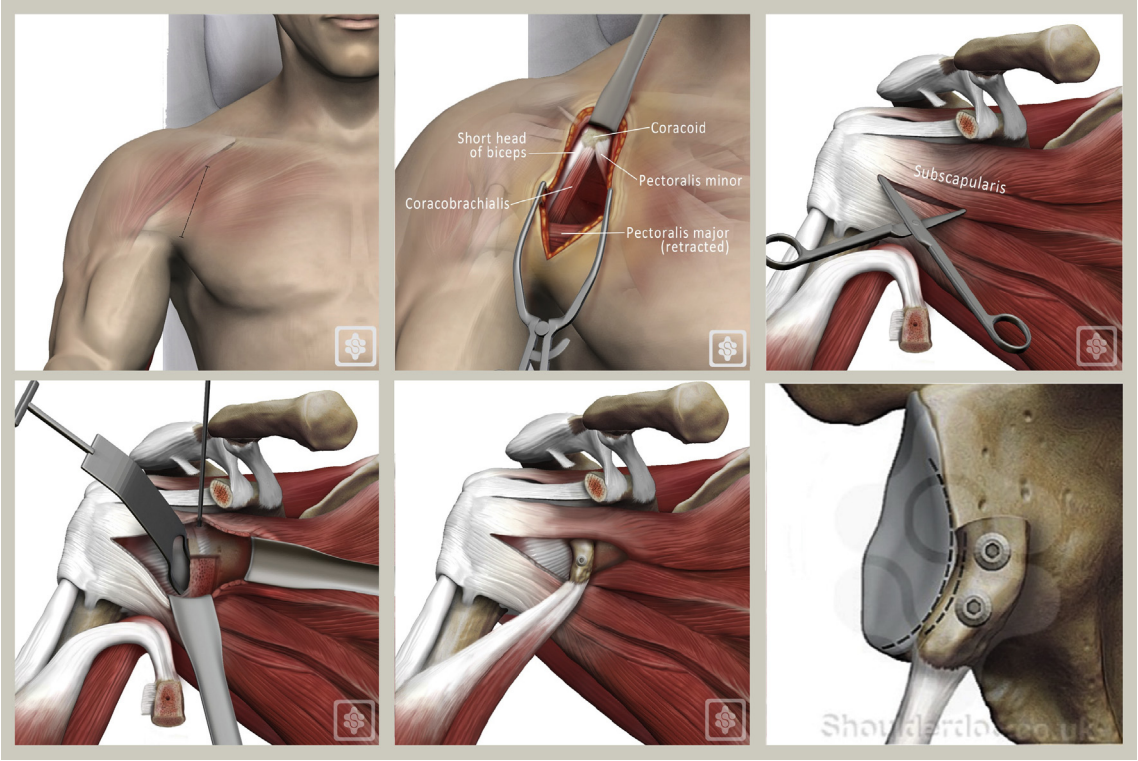

Figure 4 The Latarjet procedure. (Reproduced with kind permission of Shoulderdoc. www.shoulderdoc.co.uk).

patient and surgeon in order to tailor a treatment programme. The British Elbow and Shoulder Society (BESS) consensus group have produced clear treatment pathways and considerations for patients presenting with dislocated shoulders (Figure 5).

Recurrently unstable shoulders provide the easiest management pathway agreement between surgeons and patients with the timing of surgery being determined by the patients' symptoms and functional needs. First-time dislocators, however, provide a more complex treatment challenge. It is argued that the time to surgical intervention from the initial dislocation increases the risk of recurrent instability after an arthroscopic Bankart procedure. However, treating all patients who are first-time dislocators potentially subjects 43% of patients who dislocate their shoulder to an operation that is potentially not required — the number who would not dislocate if treated conservatively.[3] Prospectively following up patients for 25 years after their first dislocations 43% had not re-dislocated, 7% had only dislocated once further and 15% had become stable. Patients included in the study were specifically under 40 years of age — the highest risk age group for re-dislocation. Robinson et al.[2] demonstrated similar figures, instability developing in 67% of first-time dislocators by 5 years after their first dislocation but also detected a measurable functional impairment at 2 years in all patients. Being young and male were the significant risk factors of predicting future instability. There are other recognized risk factors for future instability — collision sports and overhead working, which combined may lead to a discussion about earlier operative intervention in a first-time dislocator.[5] But there may be an argument that if all patients do suffer with a measurable functional impairment after a first dislocation that surgery could benefit everyone.[2]

Any surgical procedure discussed with a patient will be determined either by the structural pathology expected to be found or what is revealed on imaging. Unless there is glenoid bone loss of greater than 20%, then surgery will usually be in the form of an anatomical repair. Surgeons and the literature are split on whether an arthroscopic Bankart procedure or open repair should be performed. Both have a similar re-dislocation rate of up to 10% and instability rates of 21%.[5] However, more recently the majority of UK surgeons seem to be preforming an arthroscopic procedure rather than an open one. The difference between the procedures is the delto-pectoral approach in the open repair used to access the glenohumeral joint. It is argued that axillary nerve injuries are therefore more common during dissection, suturing of the inferior capsule and subscapularis either during surgery or in future revision procedures.[14] The nerve becomes tethered by scar tissue and thus is more difficult to mobilize, something not encountered in revision surgery after an arthroscopic procedure.

Furthermore, in cases of bone loss greater than 20% the surgical procedure may take the form of a non-anatomical bone block procedure should the patient wish to pursue surgical stabilization.

Bone block procedures do provide greater postoperative stability than anatomical repairs but change the shoulder biomechanics as a consequence. Instability rates have been quoted as high as 10%[7] with re-dislocation rates varying between 0% and 5%[5] and overall complication rates as low as 5%.[15] There is debate if the non-anatomical nature of the procedure can predispose patients to secondary osteoarthritis. Several long-term studies have picked up arthritis in shoulders with bone block

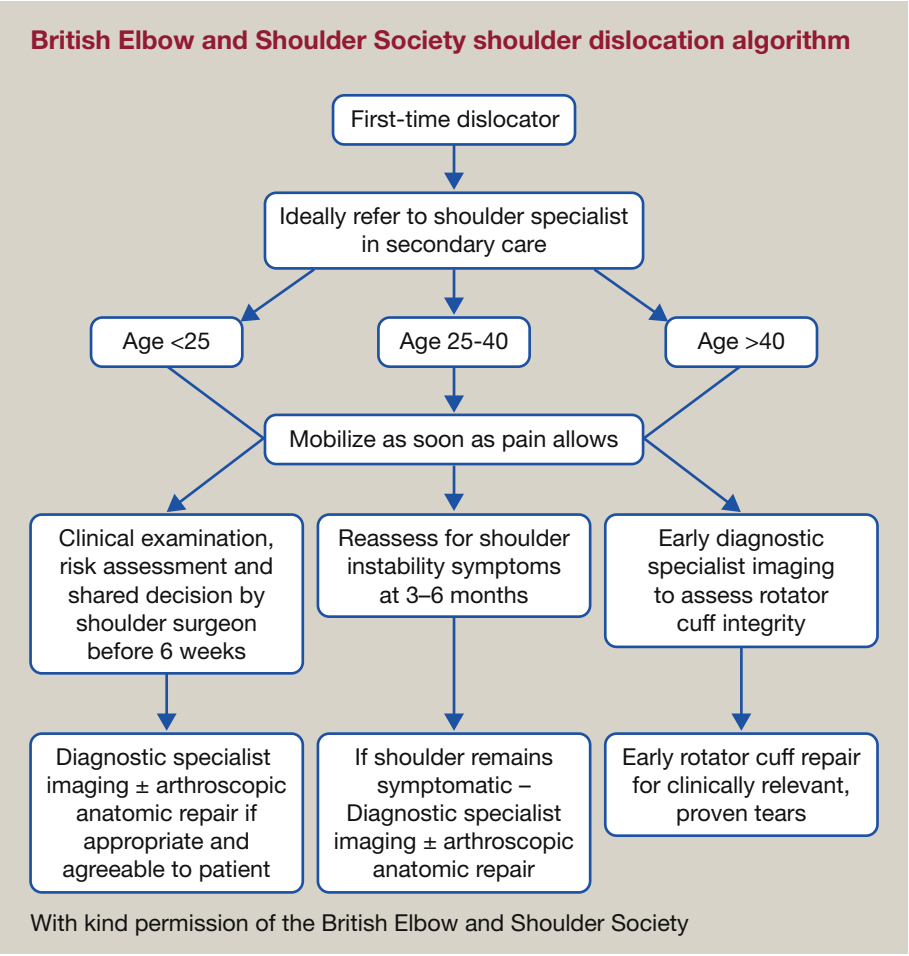

Figure 5

procedures, ranging from 6% to 19%.[6,12] However, similar figures of dislocation arthropathy have been found in non-operatively managed shoulders, 8.4%.[3] This therefore might be a naturally occurring phenomenon relating to the dislocations as opposed to the non-anatomical procedure, but currently this is unclear.

In contrast to the soft tissue procedures, bone block procedures are difficult and hazardous to revise: the subscapularis, musculocutaneous nerve and axillary nerve are scarred in abnormal positions; and the axillary artery may also be displaced in scar tissue. All cases provide a complex approach in any future operations. Currently there are no salvage operations or techniques for revising a bone block procedure if a structural complication occurs. Although extremely rare it is something that needs to be covered in discussions with patients.

In summary, each patient suffering from shoulder instability requires a detailed history including mechanism of injury and associated risk factors in addition to a thorough examination with targeted imaging if required. This will help determine whether and what type of surgical intervention is required. Bespoke treatment plans should then be developed for patients based on the recommended treatment algorithm by the British Elbow and Shoulder Society (BESS) consensus group (Figure 5). ◆

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