Traumatic anterior shoulder instability: current concepts in management

This review will give an overview of the current management practice and ethos of recurrent anterior shoulder instability, a condition which continues to puzzle and intrigue the shoulder surgeon.

Traumatic anterior shoulder instability remains a perennial problem for contemporary medicine. The first post-war edition of the *Journal of Bone and Joint Surgery* in February 1948 contained a series of articles on recurrent shoulder instability from a number of respected orthopaedic surgeons. Sixty years on, the unstable shoulder continues to fascinate, thwart and vex the shoulder surgeon.

When seeking a satisfactory outcome to treatment, the following concepts should provoke thought:

- Understanding the nature of the instability
- Predicting the likelihood of recurrence
- Determining the indications for surgical management, and the relative merits of open and arthroscopic surgery
- Managing the high-level contact athlete
- Approaching a failed surgical stabilization.

Types of instability

Shoulder instability has been traditionally divided into traumatic and atraumatic variants, which could be further sub-classified on degree of instability, frequency and direction. There are several classification systems based on this approach. Thomas and Matsen (1989) coined the acronyms TUBS (traumatic, unilateral, bankart lesion, surgical repair) and AMBRI (atraumatic, multidirectional, bilateral, rehabilitation, inferior capsular shift) to assist in the management of these patients. More recently there is a greater understanding that these patients do not sit wholly in one diagnostic group but lie somewhere within a spectrum of disease.

Bayley and colleagues (Lewis et al, 2004) added to this a third group of patients which did not fit into either group. These patients were identified as having habitual non-structural instability; they did not demonstrate an identifiable structural problem but displayed instability while attempting certain normal movements. They considered these patients to have a muscle patterning disorder, or abnormal muscle firing patterns. This led to a more comprehensive classification system, based around the Stanmore triangle. At the apices are the three main polar groups and patients might lie somewhere within the triangle, depending on the main pathology and the contributing factors (*Figure 1*).

Historical background

The association between recurrent anterior shoulder dislocation and structural injury (capsulolabral detachment from the anterior glenoid) (*Figure 2*) was shown in 1890, but it was not until Blundell Bankart popularized the idea that it was accepted. Before this, operations had aimed to restrict external rotation by tightening structures anteriorly. Two procedures were devised by Sir

Figure 1. Stanmore triangle for classification of traumatic anterior shoulder instability. From Lewis et al (2004).

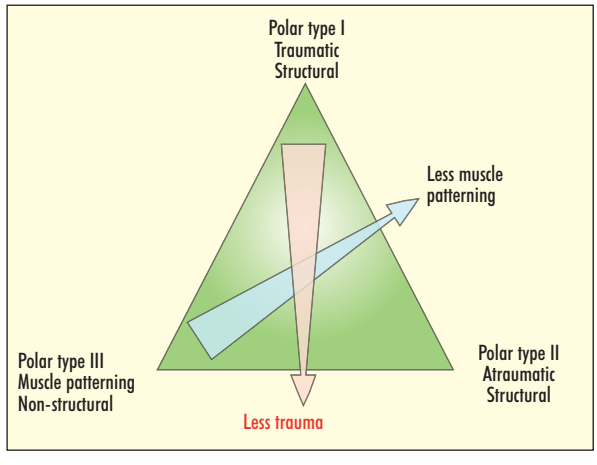
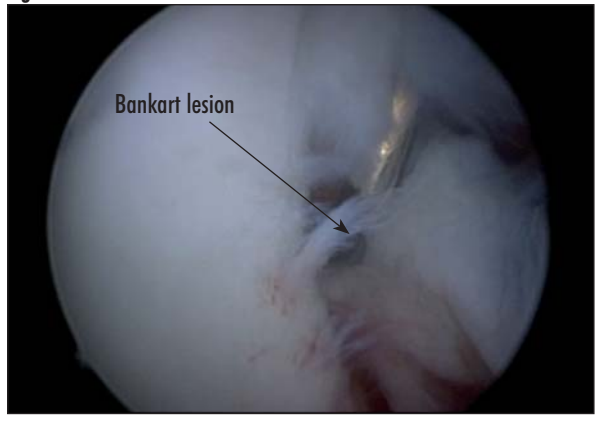


Figure 2. Bankart lesion.



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Harry Platt and Putti, and Osmond-Clark (1948) combined them to create the Putti–Platt procedure.

Bankart (1923, 1938; Bankart et al, 1948) brought to the fore the concept of a detached labrum as the cause of recurrent dislocation and advocated reattachment of the labrum to the glenoid rim. In a published discussion (Bankart et al, 1948) Bankart fervently stated that his operation was 'foolproof' with no recurrence if done correctly, while not affecting shoulder function or movement. This was unfortunately not supported by any data. Watson-Jones commented that the success of the Bankart operation was reliant on the anterior scarring from the approach instead of the repair of the labral detachment. A number of open operations for stabilizing the shoulder were described as well as the Bankart operation such as the Nicola procedure (transplantation of the biceps tendon) and the fascial repair among others. Bernard Pain, in the same discussion, presented data showing relatively high recurrence rates with both the Nicola and fascial repair procedures in a small patient sample, and Osmond-Clarke highlighted the need for a procedure to produce a bone block at the anterior glenoid to prevent the humeral head defect engaging with the glenoid rim.

Crawford Adams (1948) reviewed the three types of soft tissue reconstruction performed from 1940–45, showing a failure rate of 36% for the Nicola procedure and <5% for the Bankart and Putti–Platt procedures. He also looked at the average postoperative range of motion for all three operations. He found no significant difference in abduction with any of the operations but a significantly different range of external rotation: Nicola 73°, Bankart 51° and Putti–Platt 40°.

At the same time the Scandinavians were approaching this from a different surgical perspective by using a bone block anteriorly to prevent dislocation. Palmer and Widen highlighted the procedure developed by Hybbinette and Eden and presented results with a recurrence rate of 6.3% in 128 patients.

Over the following 60 years the techniques and equipment have changed but the basic premises remained the same. The one significant change has been the development of arthroscopic approaches.

In the 1960s and 70s Hovelius et al (1979) looked at the results of Bankart and Putti–Platt procedures and found one of 46 (2%) Bankart recurrences, as opposed to 13 of 68 (19%) recurrences in the Putti–Platt group. They did note a greater reduction of external rotation in the Bankart group (16° compared with 6°). They concluded that the greater success of the Bankart procedure was the result of greater restriction of external rotation.

Risk of recurrence

Rowe (1956) looked at the risk of recurrence of shoulder dislocation and reviewed the outcome of 500 dislocations including 214 patients aged 10–40 years who had been treated with immobilization for 3 weeks. He had expected to find immobilization reducing the risk of redislocation but this was not the case. Despite this, the recommendations were to keep the shoulder immobilized for a minimum of 3 weeks post-dislocation.

Hovelius et al (1983a) performed a prospective, randomized multicentre comparative study in Sweden looking at the risk of recurrence after initial anterior shoulder dislocation. A total of 257 patients (226 after exclusions) were placed in a treatment protocol of either strict immobilization with the arm secured to the body for a minimum of 21 days or a sling with unrestricted mobilization. A third group comprised those who failed to complete the strict immobilization protocol and those who required special treatment. All patients were followed for 2 years. The treatment protocol had little effect on the risk of recurrence, with age being the main determinant. Those aged <23 years had a recurrence rate of between 44 and 49%, aged 23–29 years a rate of 26–33% and aged 30–40 years a rate of 11–15%. There were 32 patients with an associated greater tuberosity fracture and none of these had a further dislocation within 2 years.

Hovelius (1987) subsequently published the 5-year data on these patients. In the 257 shoulders (254 patients) that had been initially treated with 3 weeks of immobilization, two or more recurrences occurred in 55% of those of aged 22 years or younger, 37% aged 23–29 years and 12% aged 30–40 years. Recurrence rates were not affected by the length of time of immobilization.

Hovelius et al (1996) also published 10-year data for these patients. There were no further dislocations in 52% of patients. Recurrent dislocation leading to operative intervention developed in 58 shoulders: 34% of those aged 12–22 years, 28% of those aged 23–29 years and 9% of those aged 30–40 years. No further dislocations occurred in 22% of those who had suffered two or more redislocations at 2- or 5-year review. The type and duration of initial treatment did not affect recurrence rate.

Lill et al (2001) looked at the prognosis for conservatively managed anterior shoulder dislocation with particular reference to the patient's age. They placed 175 patients into two groups either <30 years old or 30 years and over. They found a redislocation rate significantly higher in the <30 year old group (89% *vs* 26% in the older age group), but they did not specify their conservative management protocol.

Robinson et al (2006) prospectively followed a cohort of 252 patients aged 15–35 years with primary anterior shoulder dislocation, treated with sling immobilization followed by rehabilitation. They found a recurrent instability rate of 55.7% at 2 years and 66.8% at 5 years, with young males at the greatest risk of recurrence.

Itoi et al (2001, 2003) looked at the conservative management of these patients and subsequent risk of redislocation, focusing on the position of immobilization of the arm that had been traditionally in internal

rotation. They initially performed a cadaveric and magnetic resonance image study and found that with the arm in external rotation there was a more anatomical positioning of the anterior capsulolabral complex to the glenoid. This was followed up with a study looking at the outcome of patients following initial dislocation who were randomized into treatment by conventional sling with arm in internal rotation or an external rotation (10°) splint for 3 weeks, and found a recurrence rate of 30% with the traditional method and 0% in the external rotation splint group at a minimum of 15.5 months. This option is appealing but very reliant on patient compliance in wearing the external rotation splint.

Two Cochrane reviews have covered shoulder instability. Handoll et al (2006) looked at conservative management and found a lack of level 1 evidence to provide informed outcome data on any method of conservative treatment. A second review (Handoll and Al-Maiyah, 2004) looked at the outcome of surgical and non-surgical treatment. Again they found a relative lack of level 1 evidence, but concluded that there is limited evidence to support primary surgery in young adults with high physical demand activities but no evidence to inform on other groups. Both reviews conclude that further level 1 studies need to be undertaken to provide further information.

The evidence suggests that traumatic anterior shoulder dislocations in young people have a high risk of recurrence and early intervention would benefit these patients.

Figure 3. a. T1 sagittal magnetic resonance image demonstrating Hill–Sachs lesion. b. T1 axial magnetic resonance image demonstrating bony Bankart lesion.

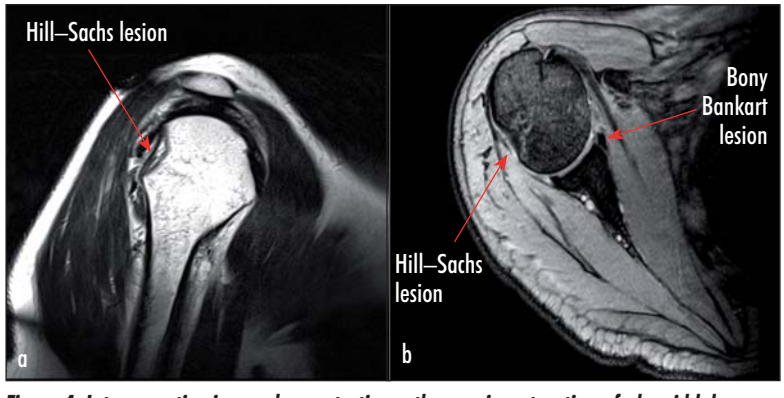
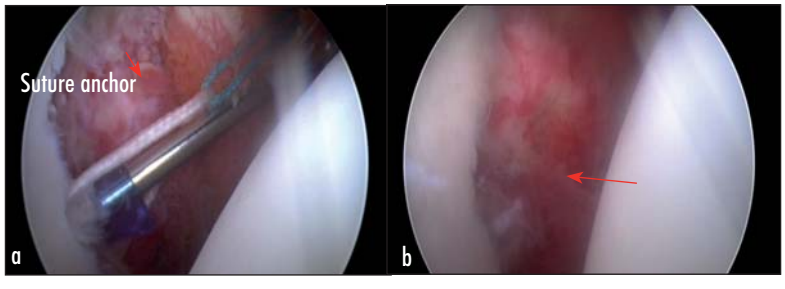


Figure 4. Intraoperative image demonstrating arthroscopic restoration of glenoid labrum. a. Suture anchor being placed in glenoid. b. Labrum (arrow) restored to anatomical position.



Surgical options

A number of surgical interventions are available; either soft tissue or bony and arthroscopic or open. Choice of surgery is lead by pathology present (*Figure 3*). The most common procedures are outlined in *Table 1*.

Arthroscopic *vs* open stabilization

Whichever technique is used, the goals of surgery remain the same – closure of the Bankart lesion, restoration of the appropriate resting length of the glenohumeral ligaments and recreation of the anterior labral bumper (Ryu, 2003).

Open stabilization procedures have been the gold standard with excellent results compared with conservative management in young patients. Jakobsen et al (2007) showed a long-term maintained benefit of open repair over conservative, with a redislocation rate of 2.7% in stabilized patients as opposed to 54% treated conservatively (a relative risk reduction of 95%) at 2 years. These results were maintained at 10 years with a redislocation rate of 8.3% in the stabilized group compared with 62% treated conservatively (a relative risk reduction of 86%).

Arthroscopic stabilization has been gaining in popularity, with its perceived benefits of lesser surgical insult to the patient and less restriction in range of motion. Cole and Warner (2000) looked to address the debate as to which treatment should be used. They reviewed a few comparative studies which were performed in the 1990s all of which favoured the open procedure as a more reliable outcome to prevent redislocation. Recurrence rates varied from 8–43% with arthroscopic *vs* 0–8% for open techniques. The studies had relatively low numbers and were using older techniques.

Larrain et al (2006) looked at the medium- to long-term outcome of arthroscopic stabilization with suture anchors in Argentine rugby players from 1996 to 2001. They had 204 patients of which 40 cases were acute instability and 158 were cases of recurrent instability. Patients with articular humeral head deficiency >25%, bony glenoid deficiency >25%, humeral avulsion of glenohumeral ligaments or capsular laxity with poor tissue quality underwent open stabilization. They performed arthroscopic suture anchor (Arthrex Fastak) in 39 acute cases and 121 recurrent cases. There were over

Table 1. Surgical options for traumatic anterior shoulder instability

Open	Soft tissue procedures	Bankart repairs
		Putti–Platt procedure
	Bony procedures	Latarjet or Bristow procedure
Arthroscopic	Joint lavage	
	Labral repair (*Figure 4*)	
	(? Bony procedures)	

90% good or excellent results in both groups. Redislocation occurred in 5% of acute cases and 8.3% of recurrent cases. All but two of the redislocations occurred during participation in rugby, showing very good results for the arthroscopic technique for high impact sports participants.

Similar results were found by Bacilla et al (1997) who had three of 40 (7%) patients suffer redislocation following arthroscopic stabilization with non-absorbable sutures and anchors. Carreira et al (2006) also had similar results with seven of 72 (~10%) patients having recurrent instability and only two of 18 collision athletes suffering a redislocation, again using a suture anchor technique.

Mohtadi et al (2005) performed a meta-analysis on studies comparing open and arthroscopic stabilization of traumatic anterior shoulder instability published up to October 2003. They found 11 studies suitable for inclusion and calculated a Mantel–Haenzel pooled odds ratio for recurrent instability of 2.04 in favour of open repair. However, only three studies were categorized as level 1 evidence, being randomized controlled trials, and only a further four were level 2 evidence. This clearly makes the findings subject to a degree of error as the quality of the meta-analysis is only as good as the studies it includes.

Kim et al (2002) looked at the results of open *vs* arthroscopic Bankart procedures in a case control study. They looked at patient outcomes in terms of Rowe and UCLA scores as well as recurrent instability. There was no significant difference in the outcome of the two methods with 26 of 30 open procedures (86.6%) and 54 of 59 arthroscopic procedures (91.5%) having good or excellent results. Redislocation occurred in two patients from each group, all from sporting endeavours and when a degree of apprehension was assessed there was a similar outcome for residual instability for the two methods (open 10%, arthroscopic 10.2%).

Metcalf et al's (2002) meta-analysis on this compared 1946 patients from 45 arthroscopic series with 724 patients from 14 open series and found no statistically significant difference in terms of rate of recurrence, but greater external rotation with the arthroscopic patients.

Baker et al (1990) looked at the results of arthroscopic assessment of the joint within 10 days of first dislocation. In 45 patients (average age 21 years) they found three groups of patients: group 1 had no labral lesion and minimal haemarthrosis, group 2 had capsular tears, partial labral detachment and moderate haemarthrosis, and group 3 had labral detachments with large haemarthrosis.

Wintzell et al (1999a,b) looked at acute arthroscopic joint lavage without stabilization as a treatment option. In their randomized multicentre study patients either had conventional conservative treatment or an arthroscopic lavage within 10 days of dislocation, all subsequent management was identical. They included 60 patients aged 16–30 years, 30 in each group and found, at 1 year, a redislocation rate of 13% in the lavage group compared with 43% in the conservative group, which was a statistically significant difference. For the 2-year follow up they had 15 patients in each group and had a redislocation rate of 20% in the lavage group compared with 60% in the conservative group, again a significant difference. They concluded that acute arthroscopic lavage was superior to conservative management. However, there was still a relatively high recurrence rate.

More recently, Robinson et al (2008) performed a randomized, double blind trial looking at the outcome of arthroscopic lavage with and without stabilization with a Bankart repair. There were 42 patients in each group and the risk reduction for both frank redislocation and all forms of instability of 76% and 82% respectively for Bankart repair *vs* washout alone at 2 years postoperatively. This well-designed study thus demonstrates the additional benefits of acute stabilization over arthroscopic lavage only.

Managing the contact athlete

The management of high impact sports participants is of concern as these patients put themselves in positions where their shoulders will undergo significantly greater stresses than the normal and have therefore higher potential risk for redislocation. Traditionally an open procedure was felt to be more appropriate for these patients.

Douoguih (2005) found opposing results from various groups, ranging from those who found high recurrence rates in contact sports to those who found that with the appropriate patients, arthroscopic surgery can have results as good as open operations.

Pagnani and Dome (2002) reviewed 58 young American football players who had all undergone open stabilization and had no redislocations and two patients experiencing postoperative subluxation, a recurrent instability rate of 3.4%. They felt that open procedures gave a more predictable outcome for the treatment of high impact players.

A very high rate of redislocation (~75%) in arthroscopic techniques used on Australian rules footballers has been reported. However, results of open Bankart repair augmented by a coracoid transfer has shown low dislocation rates with most returning to top level competition.

Uhorchak et al (2000) looked at military athletes in contact sports and found a redislocation rate of 3% after open surgery but when subluxation was included the risk of recurrence became 23%. These results are in contrast to other authors and it may be that if open operations are looked at in a similarly critical way as arthroscopic techniques have been, then overall recurrence rates in this population may well be fairly similar.

Evidence supports early stabilization in these patients as delay may lead to a worse outcome. Kirkley et al (1999) found a redislocation rate of 15.9% with immediate stabilization as opposed to 47% in the delayed group (all underwent an arthroscopic procedure).

Salvage for failed soft tissue reconstruction?

In some primary situations and more often in revision situations there may be significant bony damage or deficient anterior soft tissue that prevents a successful Bankart operation and other options need to be considered.

Although these patients may not be able to be definitively treated by arthroscopic means, arthroscopy can be a valuable tool in their management, as it can help assess glenoid bone loss, extent of Hill–Sachs lesions and positions of its engagement, as well as associated soft tissue pathology.

Latarjet described his operation of a coracoid transfer in 1954 and many authors have reported good results. Burkhart and De Beer (2000) published results of a modified Latarjet procedure in patients with an inverted pear glenoid (at least 25% bone loss of width of inferior glenoid), having previously published poor outcomes with 67% redislocation with an arthroscopic stabilization in these patients. They found a 4.9% recurrence rate at a mean of 59 months post-operation.

Hovelius et al (1983) reported on the importance of correct positioning of the coracoid bone block. In 112 patients who had undergone the Bristow-Latarjet procedure there was a 6% redislocation rate with a further 7% experiencing episodes of subluxation. They reviewed subsequent radiographs of 106 patients to look at osseous healing and block position. In the 40 patients who showed evidence of bony or fibrous union and blocks placed inferior to glenoid equator and <1 cm medial to its rim there was a 0% redislocation rate. Blocks not in the correct position demonstrated a significantly higher redislocation rate.

Nourissat et al (2006) looked at methods of arthroscopically assisting the Latarjet procedure to improve the correct positioning of the coracoid bone block with work on cadavers. Lafosse et al (2007) have published a technique for performing this surgery arthroscopically and the results of this technique are awaited.

Successfully stabilizing the shoulder may not deal with all of the patient's potential problems as a proportion of patients will develop dislocation arthropathy. Hovelius et al (2006) looked at the evolution of dislocation arthropathy after Bristow–Latarjet procedures and found evidence of arthropathy on anteroposterior radiographs at 15 years postoperatively in 46 of 115 patients (39 mild, five moderate and two severe). The incidence of arthropathy was significantly lower when the first dislocation was sustained before the age of 23 years than with those older than 23 years.

KEY POINTS

- Level 1 evidence on the management of traumatic shoulder instability is sparse.
- Young, especially male, first time traumatic anterior dislocators are at high risk of recurrent instability and should be considered for early stabilization.
- Soft tissue injuries require a soft tissue procedure which may be performed in an open or arthroscopic fashion.
- Bony problems such as bony Bankart and engaging Hill–Sachs lesions require a bone graft procedure.
- Knowledge of the patient and understanding the nature of the instability remains the key to successful treatment.

Conclusions

Despite the considerable amount published on shoulder instability, there remains little level 1 evidence. The literature does, however, offer certain guidance.

Young, especially male, first time traumatic anterior dislocators are at high risk of recurrent instability and should be considered for early stabilization. The primary surgical goal in most patients is restoration of the capsulolabral complex and repairing the Bankart lesion. The authors' preference would be to proceed to an arthroscopic labral repair. In the presence of a bony lesion such as a large bony Bankart or an engaging Hill–Sachs lesion an open bone graft procedure would be considered such as a Latarjet procedure. BJHM

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