Review article

Management of recent first-time anterior shoulder dislocations

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ABSTRACT

The management of a first episode of anterior shoulder dislocation starts with an analysis of the causative mechanism and a physical examination to establish the diagnosis. Based on the findings, the case can be classified as simple or accompanied with complications, most notably vascular or nerve injuries. Two radiographs perpendicular to each other should be obtained to confirm the diagnosis then repeated after the reduction manoeuvres. Additional imaging studies may be needed to assess concomitant bony lesions (impaction lesions or fractures). External reduction should always be attempted after premedication appropriate for the severity of the pain. General anaesthesia may be necessary. There is no consensus regarding the optimal reduction technique, although the need for gentle manoeuvres that do not cause pain is universally recognised. Immobilisation currently involves keeping the elbow by the side with the arm internally rotated for 3–6 weeks depending on patient age. Vessel and nerve injuries are rare but can cause major functional impairments. Follow-up evaluations are in order to check the recovery of normal function, which may be more difficult to achieve in patients with concomitant lesions; and to detect recurrent shoulder instability and rotator cuff lesions. At the acute phase, surgery is indicated only in patients with complications or after failure of the reduction manoeuvres. Shoulder immobilisation with the arm externally rotated and surgical treatment of the first episode are controversial strategies that are discussed herein.

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1. Introduction

Shoulder dislocation is a common reason for emergency room visits and accounts for about 45% of all dislocations. Traumatic shoulder dislocations are far more common than intentional and/or non-traumatic forms, which are managed by rehabilitation therapy and are not considered herein. Anterior shoulder dislocations contribute 96% to 98% of all shoulder dislocations. The incidence of first-time anterior shoulder dislocation ranges from 8 to 8.2/100,000 population/year and the prevalence is about 2% [1].

In 90% of cases, anterior shoulder dislocation affects young individuals, many of whom are athletes. The mechanism may be either direct or indirect with a forward impulse of the elevated and externally rotated arm (e.g., during a basketball smash) or a fall on the palm of the hand with the arm outstretched. The frequency of anterior dislocation exhibits two peaks, during the second and sixth decades, respectively. Men are affected 3 times more often than women, and 9 out of 10 patients are 21 to 30 years of age.

The traditional treatment for anterior shoulder dislocation is immobilisation with the arm in internal rotation for 3 to 6 weeks followed by rehabilitation therapy. The efficacy of this treatment remains unclear. The recurrence rate can reach 95% depending on the risk factors, particularly patient age at the first episode. Chronic shoulder instability can cause pain, which is often dependent on position; require a change in sporting activities or impair performance; and, more generally, adversely affect quality of life [1].

All the newly introduced techniques focus on preventing recurrences. Immobilisation with the arm in external rotation after the first episode has been suggested based on magnetic resonance imaging (MRI) studies showing that external rotation increases the amount of tension on the sub-scapularis muscle and maintains the labrum and capsule in close contact with the glenoid. Early arthroscopy has been advocated under the hypothesis that early repair of the glenoid labrum and joint capsule improves healing of these structures. The impact of these innovations on outcomes is uncertain.

The objective of this work was to identify the points of the management of anterior shoulder dislocation for which a consensus exists and to review recently suggested treatments.

2. Clinical diagnosis

Anterior shoulder dislocation usually occurs when abduction with external rotation of the arm produces a force that displaces
the humeral head anteriorly and downwards relative to the coracoid process (sub-coracoid dislocation). The other forms are less common (sub-glenoid, sub-clavicular [infra-coracoid] and intra-thoracic dislocations).

The patient supports the injured arm with the hand of the uninjured side. Signs that suggest anterior dislocation include a squared-off appearance of the shoulder with loss of the normal rounded contour, bulging of the acromion, and filling of the delto-pectoral groove. Palpation shows an empty glenoid and a bulge in the delto-pectoral groove. The arm is abducted and cannot be actively or passively moved into addition.

The initial examination should include testing for injury to the axillary nerve or brachial plexus (sensation from the point of the shoulder to the fingers and simple motor function testing) and blood vessels (temperature and colour of the skin over the fingers and palpation of the distal pulses).

The findings from the physical examination should be recorded in the patient’s medical chart.

3. Diagnostic investigations

Both an antero-posterior and a lateral radiographic view should be obtained. The lateral view is helpful in minimally displaced dislocations. It shows the direction of the dislocation and can help to detect concomitant lesions (fracture or impaction lesion). The axillary view and Y view require mobilisation of the shoulder and are therefore not appropriate. Lamy’s or Neer’s view can be obtained without mobilisation and show the direction of the dislocation while clearly delineating the base of the coracoid process and acromial vault. Garth’s view shows any postero-superior Hill–Sachs lesions and allows an evaluation of the anterior part of the glenoid. Obtaining additional investigations causes unnecessary delays in reducing the dislocation. Once reduction has been achieved, further investigations can be obtained on a case-by-case basis to look for concomitant lesions. Computed tomography (CT) offers the best accuracy and sensitivity for detecting and evaluating a fracture and for assessing the extent of impaction damage.

4. Reduction

Reduction can be considered once the patient has received effective pain relief, as well as reassurance and information. The patient should be comfortably settled in a quiet place. The reduction manoeuvres should be gentle and gradual to minimise muscle spasm.

Reduction manoeuvres fall into two main categories, with many variants, according to whether counter support on the axilla is used. A full description of these manoeuvres is beyond the scope of this article. Details are available in an article by Cunningham [2].

Reduction methods without counter support include the Hippocratic method (simple traction along the axis of the arm); Kocher method (slight adduction, elbow flexed at 90°, gradually move the arm into external rotation then elevate the arm and rotate it medially), which is less painful; Stimson method (the patient is prone with the arm hanging down and a weight attached to the wrist); Milch method (with the patient’s hands behind the head), which may be very easy to perform even by inexperienced physicians; and scapular manipulation methods (Bosley and Miles), the Eskimo method, and self-reduction by having the patient lock the hands around the ipsilateral knee. Among methods that use counter support on the axilla, the most widely known are variants of the Hippocratic method, which use a sheet (Matsen method), the operator’s fist or foot (Oribase technique with the heel in the axilla, now discarded), or the back of a chair.

Reduction can be attempted without analgesia in patients with moderate pain. Otherwise, analgesics should be given to obtain muscle relaxation and good participation of the patient. Various analgesic protocols are used (inhaled or parenteral sedation or even opiates used alone subcutaneously or with titration). Intra-articular lidocaine injection has been reported to allow reduction in 81% of patients and to decrease the hospital stay length and complication rate compared to intravenous medication [3].

5. Post-reduction management

An antero-posterior radiograph should be obtained to confirm that complete reduction has been achieved and to look for concomitant lesions, whose evaluation is mandatory to ensure optimal treatment. In a study of lesions not seen on pre-reduction radiographs, Kahn et al. found that 37.5% of fractures were visible only on radiographs obtained after reduction [4].

A non-displaced fracture of the humeral head requires care during the reduction manoeuvre to avoid disimpaction. The greater tuberosity of the humerus or glenoid may be fractured. These fractures may require surgical fixation, either immediately or on a semi-emergent basis. The rest of the management strategy depends on whether complications are present.

5.1. Uncomplicated dislocation: conventional conservative treatment

After reduction, the patient should be re-evaluated for nerve and vessel injuries as described for the initial examination. The shoulder is usually immobilised in a swath with the elbow by the side and the arm in internal rotation. Simple analgesics and the local application of ice packs rapidly provide effective pain relief.

The final treatment strategy is determined based on the results of a follow-up evaluation 5 to 8 days after the reduction. The duration of immobilisation ranges from a few days in patients older than 40 years of age to 4 to 6 weeks in young patients experiencing their first dislocation episode. The patient should be advised about monitoring the shoulder and informed about the main complications (dominated by early recurrence despite immobilisation) [5].

5.2. Complicated dislocation

5.2.1. Neurologic complications

Neurologic complications are common but under-estimated. Neurapraxia is usually followed by a full recovery. Tearing of nerves is considerably less common (fewer than 4% of cases). The axillary and supra–scapular nerves are at greatest risk for tearing. In a study of 101 patients, De Laat et al. [6] found electromyographic evidence of nerve injury in 45% of cases (axillary nerve, n = 37; supra–scapular nerve, n = 29; radial nerve, n = 22; musculo-cutaneous nerve, n = 19; and ulnar nerve, n = 8). Other studies found nerve injuries in 21% to 36% of patients, with involvement of the plexus in 12% of cases and isolated axillary nerve injury in 8% of cases [7]. Robinson et al. [8] found neurologic deficits in 13.5% of 3633 patients. A concomitant rotator cuff tear or greater tuberosity fracture increases the risk of nerve injury (relative risk, 1.9), most notably among patients older than 60 years of age [6]. The “terrible triad” is the concomitant presence in an elderly patient of shoulder dislocation, rotator cuff tear, and brachial plexus damage. This presentation requires prompt MRI of the shoulder and cervical spine.

Severe nerve damage mandates close monitoring and specialised management, including a baseline electromyogram within the first 3 weeks and, if appropriate, MRI of the cervical spine to look for lesions of the plexus (or nerve root avulsions) in patients with very severe signs.
Most neurological abnormalities resolve spontaneously. However, residual impairments may require surgery. In particular, surgery is warranted in patients with complete and isolated loss of axillary nerve function that does not recover within 3 to 6 months. In a study of outcomes of 35 patients with isolated axillary nerve injuries, most of which were tears, only 20% of patients recovered spontaneously and the remaining 80% required surgical treatment [8]. Kosijatrakul et al. [10] reported that brachial plexus injuries recovered fully in two-thirds of patients. Spontaneous recovery was consistently good or excellent after 20 months, with the only residual impairments involving the intrinsic hand muscles, particularly in elderly patients.

5.2.2. Vascular complications
Fewer than 1% of patients experience vascular complications. The risk is greatest in fracture-dislocation of the humeral head and in elderly patients with pre-existing arterial disease. Arterial lesions include tears, thrombosis after dissection of the intima, and pseudo-aneurysm, often along the distal third of the axillary artery. Arterial spasm occurs in as many as 60% of patients and resolves once the compression is lifted.

Patients with distal ischaemia should be evaluated immediately by a vascular surgeon and scheduled for routine angiography, which should not delay the reduction. In patients with fracture-dislocations that may require open reduction, both an orthopaedic and a vascular surgical team should perform the procedure.

5.2.3. Concomitant fractures
A concomitant fracture complicates the management of shoulder dislocation by making the reduction manoeuvres more challenging to perform. Internal fixation may be required. The most common fracture sites are the humeral neck, greater tuberosity, and glenoid.

5.2.3.1. Fractures of the humeral neck. These fractures must be detected before reduction is performed. There may be a concomitant fracture of the greater tuberosity, which should draw attention, as described by Hersche et Gerber [11]. Disimpaction of the humeral head fracture is followed by avascular necrosis of the head. Although immediate open surgery with internal fixation before reduction of the dislocation has been advocated, the most widely recommended strategy is attempted, gentle, closed reduction under anaesthesia, followed by conversion to open surgery if the dislocation cannot be readily reduced. The strategy for treating the fracture is determined once reduction has been obtained, according to the degree of displacement and age of the patient.

5.2.3.2. Fracture of the greater tuberosity. It includes:

- non-displaced fracture: conservative treatment is in order, with radiographic monitoring to detect possible secondary displacement;
- displacement of 5 mm or more after reduction: internal fixation should be considered, particularly in patients who are young and/or have high functional demands [12,13], although some authors tolerate displacements of up to 10 mm;
- recurrent dislocation after reduction (intractable dislocation): internal fixation of the greater tuberosity is mandatory to stabilise the shoulder [14].

5.2.3.3. Fractures of the anterior glenoid. Anterior glenoid fractures are another cause of recurrent dislocation after reduction. CT provides an accurate evaluation [location and size of the detached fragment(s)]. Internal fixation may be required if irreducible dislocation and/or to restore normal glenoid anatomy via the deltopectoral approach, by screw implantation. Internal fixation of comminuted fractures may be challenging. Creation of an abutment anterior to the glenoid is rarely needed.

5.2.4. Irreducible dislocations
Few shoulder dislocations are irreducible after deep anaesthesia with full muscle relaxation. Open reduction is only very rarely required.

Causes of irreducibility include:

- incarceration of the humeral head in the glenoid rim;
- interposition of the torn sub-scapularis tendon [15];
- fracture of the greater tuberosity with incarceration [16];
- glenoid fracture with incarceration [17];
- interposition of the long biceps tendon, which passes behind the humeral head as a result of a greater tuberosity fracture and prevents the reduction; the tendon must be repositioned anterior to the humeral head and the greater tuberosity stabilized by internal fixation [18];
- a massive rotator cuff tear with incarceration [19].

5.3. Dislocation in patients older than 40 years
Shoulder dislocation in patients older than 40 years requires special attention because rotator cuff damage is common and increases with advancing age [20]. A careful evaluation for rotator cuff lesions is therefore mandatory. Early MRI has been recommended in patients older than 40 years, given the 35% prevalence of rotator cuff tears in this population, with an increase over time to over 80% after 60 years of age [21]. Whatever the case, persistent functional impairment after rehabilitation therapy in a patient without neurological abnormalities requires an evaluation of the rotator cuff, particularly in patients older than 40 years of age. The rotator cuff lesions vary widely. After a shoulder dislocation, anterior extension of a rotator cuff tear to the sub-scapularis tendon carries a very poor prognosis [22].

5.4. Results of conventional conservative treatment
Several case-series studies found high recurrence rates of up to 95% (Tables 1–4). Hovelius et al. evaluated a cohort of patients 25 years after treatment with immobilisation in internal rotation or no immobilisation and found that the shoulder was stable in only 43% of cases [23]. Surgical stabilisation was required in only 27% of cases, but the rate of moderate-to-severe osteoarthritis after 10 years was nearly 20%. The 60% rate of instability and 20% rate of osteoarthritis after 10 years call into question the validity of this treatment strategy. Furthermore, among patients who did not experience recurrent dislocation, the proportion with forgotten shoulder was not determined.

In all the available case-series studies, patient age at the first dislocation episode was the main risk factor for recurrence, most notably before 20 years of age (Tables 1–4). In patients younger than 18 years at the first episode, the risk of recurrence within 1 year is about 77%, and only 32% have a stable shoulder 10 years later [47]. Rowe and Sakellarides [48] reported that 87% of recurrences occurred within the first 2 years, particularly in younger patients.

In addition to young patients, those who engage in contact sports or athletic competitions are at high risk for recurrent shoulder dislocation [49]. Severe impaction damage during the dislocation is another risk factor.

Interestingly, 43% of patients in the case-series study by Hovelius et al. [23] had no recurrences. Thus, routine immediate surgical stabilisation after the first episode would have resulted in unnecessary surgery in 43% of cases.

However, absence of recurrent dislocation is not synonymous with forgotten shoulder. Many patients have low-level pain and
### Table 1

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### Table 3

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### Table 4

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instability with missed shoulder instability events. Furthermore, some patients experience residual apprehension that leads them to limit their sporting and recreational activities, resulting in subtle but meaningful functional impairment [1].

6. Immobilisation in external rotation

The concept of immobilisation with the arm in external rotation to treat first-time shoulder dislocation was developed in the late 1990s. External rotation is intended to put tension on the subscapularis, thereby keeping the joint capsule and labrum in close contact with the anterior aspect of the glenoid.

A study of ten fresh cadaver shoulders conducted by Itoi et al. and reported in 1999 showed that the edges of a simulated Bankart lesion were coapted when the arm was in external rotation [49]. In this position, the sub-scapularis muscle is under tension and applies a force that presses the joint capsule against the neck of the glenoid. Each shoulder was moved from internal rotation to external rotation in 10° steps. The force applying the labrum to the glenoid was greatest when the arm was in 45° of external rotation. However, opposite results were obtained in cadaver studies done to evaluate this conclusion [50]. The in vitro design is the major limitation of these studies and probably explains the contradictory results.

Reduction of the capsular lesion has been investigated in vivo using MRI [51]. The arm was positioned in internal rotation then in external rotation. Several studies demonstrated that the capsular detachment was less marked in external rotation [52].

Hart et al. [53] used arthroscopy to assess Bankart lesion reduction in 25 patients aged 15 to 57 years after a first episode of anterior shoulder dislocation. Reduction of the Bankart lesion was improved in external rotation in 92% of patients. However, reduction was usually incomplete and the labrum failed to recover a fully normal position.

Despite these somewhat promising observations, results in terms of the recurrence rate are controversial (Table 2). Some of the preliminary studies seem encouraging but others are far less so. These discrepancies may be ascribable to differences in the study populations (number of patients, mean age, nature and level of sporting activities, observation bias, and bias related to differences across shoulder immobilisers).

The recurrence rate increases over time and tends to become similar to that seen after conventional treatment [35]. Adherence is only fair and the position is poorly tolerated. Thus, no definitive conclusions can be drawn about potential benefits from immobilisation in external rotation. There is no consensus about the use of immobilisers that maintain the arm in pure external rotation or in external rotation and abduction, and the optimal degree of external rotation is debated [54,55]. Combined external rotation and abduction seems significantly less comfortable.

Conservative treatment remains widely used. In patients with recurrent dislocation, the duration of immobilisation is short and rehabilitation is started to prevent stiffness, particularly in elderly patients [40]. Immobilisation in internal rotation remains the reference standard; immobilisation in external rotation generated initial enthusiasm but has since then shown limitations. To date, there is no scientific proof that a specific immobilisation position or duration is better over the others.

Conservative treatment is always inadequate in younger patients, who are at greatest risk for recurrent dislocation occurring early after the first episode. Furthermore, although about 40% of patients experience no recurrences after a first episode of shoulder dislocation [23], many do not achieve the status of forgotten shoulder [1].

7. Surgery for first-time shoulder dislocation

The high risk of recurrence after conservative treatment has led to the suggestion that surgical treatment may be in order, particularly in young athletes. Numerous comparative studies support the efficacy of surgical treatment.

Arthroscopic lavage has been suggested to eliminate the haemarthrosis and promote normal positioning of the capsule–labral complex on the glenoid [56]. Although this procedure proved beneficial, the improvement was small and left a high risk of recurrence. Thus, arthroscopic lavage remains controversial.

The published data leave no room for doubt (Table 4): recurrence rates are significantly lower after open or arthroscopic surgical stabilisation than after any of the available conservative treatments. Despite these results, the increasingly common use of surgery for first-time dislocations has received criticism. It is worth recalling the findings by Hovellius et al. [23]:

- 43% of patients experienced no recurrences during a 25-year follow-up;
- in 14% of patients, the shoulder became stable over time, with two recurrences within the first 15 years then no further recurrences during the next 10 years;
- among patients managed non-surgically and younger than 25 years of age, half experienced no recurrences.

Thus, surgery would have been unnecessary in 30% of patients younger than 25 years. Routine surgery in patients with first-time shoulder dislocation therefore constitutes overtreatment, and surgeons must select patients who are good candidates for early surgery.

Although early surgery considerably diminishes the risk of recurrence compared to conventional conservative therapy, the outcomes are similar to those of surgery for chronic shoulder instability (Table 4). There is therefore no sound rationale for routinely performing immediate surgery in patients with first-time shoulder dislocation.

Kirkley et al. [1] raised the relevant issue of whether a patient can be left to suffer from residual symptoms after a first dislocation episode and offered stabilisation only in the event of a recurrence. An alternative would be immediate surgical stabilisation to prevent these “small” derangements, whose resolution would undoubtedly improve the functional outcomes of conservative treatment. Kirkley et al. evaluated short-term quality of life in two groups of patients, one treated conservatively and the other surgically. The Western Ontario Shoulder Instability (WOSI) index was 69% after conservative treatment and 86.3% after surgery. Early surgery decreased the recurrence rate and improved quality of life (WOSI). These data supporting early surgery deserve to be borne in mind.

The results of other studies [43] indicate that, in the absence of recurrent dislocation, the proportion of patients with residual apprehension is increased 6-fold after conservative treatment compared to surgical treatment and the proportion with good function is decreased 3-fold. Law et al. [44] reported a mean WOSI index of 83% after arthroscopic capsule–labral suturing for first-time shoulder dislocation. This improvement in quality of life is a major argument in favour of early surgical treatment.

Finally, whereas surgery is superior by far over conservative treatment, no difference has been found between conventional surgery and arthroscopic surgery [46].

These data explain that the results of a survey showing that 35% of British surgeons performed surgery to treat first-time shoulder dislocation in young individuals, with 16% of surgeons using the arthroscopic technique. A similar survey, done 7 years later, showed a 2-fold increase in the number of surgeons who were in

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favour of immediate surgical stabilisation, with a 4-fold increase in the use of arthroscopy [57].

8. Conclusion

Conservative treatment is extremely controversial. The traditional immobilisation method with the arm in internal rotation has well-documented limitations. Furthermore, the 3 to 6-week duration of immobilisation is not universally agreed on [29], and a trend towards shorter immobilisation is emerging [58,59]. In contrast, the need for early mobilisation in elderly patients to prevent stiffness is widely recognised [40].

The second major issue is the very high recurrence rate after a first episode of shoulder dislocation in young patients. The data on this point is consistent, with recurrences in up to 95% of patients. In addition, in the absence of recurrence, pain and apprehension are common and may lead to a change in athletic activities or even to discontinuation of all sports [1].

The early results of case-series studies of immobilisation with the arm in external rotation were promising. However, longer follow-ups showed an increase in the recurrence rate over time [31,32,35,49]. In addition to the decline in the quality of the results with increasing follow-up, treatment adherence was suboptimal, as the position induced discomfort.

The development of arthroscopic techniques has encouraged the use of surgical treatment [57]. Early surgery considerably decreases the recurrence rate and improves the functional outcomes. Thus, there is a current trend towards a broadening of the indications of early surgery, regardless of the technique used, most notably in young patients, who are at highest risk for recurrence and residual impairments, with a 20% rate of osteoarthritis after 10 years [29].

Whether early surgery should be offered to all patients after a first episode of anterior shoulder dislocation remains debated. Kim et al. reported that the proportion of patients with capsulolabral lesions visible by MRI was 66% in a cohort of patients with first-time shoulder dislocation and 98% in a cohort with recurrent dislocation [60]. The group with recurrences had a 3-fold increase in the rate of Bankart lesions and a greater number of Hill–Sachs lesions. Progression to chronicity was associated with a significant increase in the number and severity of impingement lesions. These findings support greater use of surgical treatment.

Decision tools are lacking to guide surgeons in their treatment decisions and to help patients understand the best treatment strategy. At present, the only option consists of informing the patient and family of the treatment issues and in helping them make their decision according to their academic or occupational commitments, desire to resume athletic activities and, when relevant, schedule of competitions [24].

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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