18 Multidirectional shoulder instability

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Introduction

Strategies in operative and non-operative treatment of shoulder instability have changed enormously in recent years. In addition to the aims of restoring stability and minimizing the rate of redislocation, treatment methods increasingly focus on improving postoperative strength and range of motion, especially in young and active patients. It has been recognized that this can be accomplished by an exact reconstruction of capsulolabral anatomy in open procedures such as Neer's capsular shift and Bankart repairs, or by the newer arthroscopic procedures.1

A more complex problem with respect to diagnosis and therapy, however, is that of non-unidirectional or multidirectional instability (MDI). As these conditions are relatively rare (2% of all forms of instability), mainly conservative management rather than operation has been advocated as their appropriate treatment. With the increasing identification of transitional forms between unidirectional and multidirectional instability, operative treatment has come more and more to the fore.2–12 Differentiation between 'laxity' and 'instability', and identification and classification of the different degrees of instability, are mandatory in order to determine the appropriate treatment.

Laxity and instability

Laxity is the degree of humeral head translation in the glenoid fossa without rotation, and can be assessed using the clinical 'shift and load' test. A certain amount of laxity is required for every shoulder to function in its large range of motion. By definition, instability means the lack of ability to retain the humeral head within the glenoid during normal and active shoulder function.6 Silliman and Hawkins described four degrees of laxity:13,14

0 no translation at all
1 the humeral head rides on the glenoid rim (translation of up to 1 cm)
2 subluxation with spontaneous reduction (translation of up to 2 cm)
3 complete dislocation (translation of more than 2 cm).

Pathological findings (instability) are mostly to be found among grades 2 and 3. Thus, differentiating between laxity and instability means that the diagnosis of instability can only be made clinically, not by test manoeuvres under anaesthesia.15,16 In particular, young and active athletes frequently have lax (subluxating, Hawkins 2) shoulder joints that are not necessarily unstable.

Classification of shoulder instability

In classifying shoulder instability four different criteria need to be focused on: aetiology, degree, frequency and direction. This classification also covers the complex types of instability including MDI. Moreover, it facilitates individual management for every patient.15

Aetiology

Five different aetiologies of shoulder instability can be distinguished: traumatic, atraumatic, repetitive microtrauma (overuse), congenital and neuromuscular. Thomas and Matsen used the terms 'TUBS' and 'AMBRI' to describe the two outermost points of the whole spectrum of instability.11 The term 'TUBS' describes the traumatic, unidirectional type of instability, often comprising a classic Bankart defect which is open to surgical management. The other extreme – AMBRI – is an atraumatic, mostly multidirectional (often bilateral) form of instability which should initially be treated conservatively, with surgical therapy (inferior capsular shift) only indicated if this treatment fails.8,9,17 However, these types only exemplify two clearly distinguishable types of instability and oversimplify the variety of all the other forms. Moreover, they do not take into account transitional forms with a hyperlaxity component. For example, the degree of capsuloligamentous hyperlaxity that is necessary for 'overhead' sports such as throwing, swimming and climbing, can – through repetitive microtrauma – lead to symptomatic instability.15,16–21

Congenital instability such as increased anteversion or
Degree of instability

The degree of instability can be divided into subluxation (spontaneous reduction of the humeral head back into the glenoid) and complete dislocation.

Frequency

The frequency of instability can be acute, chronic or recurrent. Acute instability occurs within 24 hours of the first dislocation; it is chronic if the time to humeral head dislocation is longer than that. Recurrent instability is the appropriate term if there is more than one occurrence of subluxation or dislocation. A special case is the form of dislocation in which closed reduction is impossible; these are called 'hooked' dislocations and often coincide with a large impression fracture of the humeral head (Hill–Sachs or reversed Hill–Sachs lesion).

Direction

Directions of instability can be anterior, inferior, posterior or superior, combinations of these, or multidirectional. Anterior instability is the most common form (95%). Superior instability has only recently been identified and is mostly found in young patients complaining about impingement pain. This kind of impingement is called secondary impingement and is predominantly produced by superior labral or biceps pathology such as superior labrum anterior to posterior (SLAP) lesions, or hyperlaxity. While SLAP lesions can be caused by macrotrauma, more often they result from repetitive microtrauma causing degeneration at the origin of the long head of the biceps tendon. Proper treatment for this kind of impingement is elimination of the instability originating from the unstable biceps insertion (arthroscopic refixation of SLAP), not a subacromial decompression.

Multidirectional instability

Multidirectional instability (MDI) is defined as a symptomatic form of glenohumeral instability occurring in more than one direction: anterior, inferior and posterior. This kind of instability is frequently bilateral and is found in young patients who often have psychiatric difficulties. This is why a voluntary component always has to be looked for in these patients. There is still debate as to whether there is a clear definition of MDI at all.

Like Bigliani and Walch, we believe that MDI is only one extreme appearance of general hyperlaxity of different degrees. We prefer to speak of multidirectional hyperlaxity showing additional anterior, inferior or posterior instability, rather than multidirectional instability. Besides multidirectionally unstable shoulders in children, symptomatic instabilities can more often be found in athletes participating in overhead sports and usually result from a combination of recurrent microtrauma and hyperlaxity.

Both types can be the source of a secondary impingement syndrome. Furthermore, patients with hyperlaxity can naturally experience anterior dislocations resulting from macrotrauma which generates a miscellaneous type of instability with both traumatic and atraumatic components.

Pathomorphology

Anatomically the decisive structural abnormalities causing instability are to be found at the capsulolabral ligamentous complex. Post-traumatic instabilities result from the typical Bankart lesion representing a detachment of the labrum and anterior capsule from the glenoid rim with or without a chondral or osseous avulsion of the glenoid. Recurrent dislocations more often produce Perthes lesions (subperiosteal anterior capsulolabral disruptions reaching into the scapular neck), anterior labrum periosteal sleeve avulsion (ALSPA) lesions or capsuloligamentous disruptions into the direction of dislocation.

Rather than by capsuloligamentous disruptions or avulsions, multidirectional instabilities are characterized by the abnormal quality of the capsular tissue. General capsular redundancy anteriorly, inferiorly and posteriorly, as well as weak, poorly developed glenohumeral ligaments together with an enlarged rotator interval, cause increased humeral translation in all directions with the arm abducted and adducted. The situation of enlarged capsule together with a hypoplastic labrum is called a non-Bankart lesion.

Clinical appearance

Clinically, patients with MDI complain about recurrent subluxations and subjective instability rather than real
Dislocations. In cases of actual dislocation, more often minor traumatic events rather than adequate macro-trauma are the reason for injury. Reduction mostly occurs spontaneously. A voluntary component has always to be taken into account.

Mostly there is one dominant direction of instability. This is why in cases of anterior instability the patients feel pain or discomfort with the internally and externally rotated and abducted position, whereas in cases of posterior instability pain is felt in the flexed and internal rotated position. Problems (pain or discomfort) caused by inferior instability can be seen during the carrying of heavy weights; superior instability causes a secondary impingement (see above). Some patients experience dislocations while sleeping. It is important always to examine the patients for general joint laxity and systemic disease such as Ehlers–Danlos syndrome, as well as obtaining a family history.

Diagnosis

A careful and thorough examination of the shoulder includes the exact recording of the range of motion and muscular strength. Instability must be assessed separately using special stability tests. Anterior and posterior humeral head translation is examined using the drawer test with the arm adducted and 90° abducted and the scapula in a fixed position. For description the Hawkins classification should be used (see above). Inferior translation can be assessed using the sulcus sign: grade 1 is a distance of up to 1 cm between the undersurface of the acromion and humeral head, grade 2 is a distance of up to 2 cm, and grade 3 is a distance of more than 2 cm. An important test is the anterior and posterior apprehension test which – performed in three specific arm positions (60°, 90°, 120° abduction and external rotation) – can be used for testing of the individual anterior glenohumeral ligaments as well as for assessment of subjective patient instability (apprehension). In addition, the shift and load test and the relocation test can be performed, the latter being important in the diagnosis of posterosuperior glenoid labral lesions. Additionally SLAP lesions can be found. Tests for clinical diagnosis are the Crank test (palpable clicking in passive rotation of abducted arm), the O’Brien test and the ‘Slapprehension’ test (pain felt in flexion and internal rotation). Ideally, preoperatively translation in any direction should be tested under anaesthesia (Figure 18.1).

Radiographic examination

Three standard radiographs (true anteroposterior, axial, y-view or supraspinatus outlet view) should always be taken in order to exclude bony Bankart lesions or large Hill–Sachs defects, but often are normal in MDI.
The ‘gold standard’ investigation is magnetic resonance arthrography (arthro-MRI). Not only the capsulolabral structures but also the glenohumeral ligaments and the volume of the joint capsule (typically widened in MRI) can be assessed (Figure 18.2). Arthro-MRI is of special importance in diagnosing instability since it has better sensitivity than conventional MRI or computed tomographic arthrography. The latter imaging technique is indicated in situations of osseous injury or abnormalities such as large Hill–Sachs or Bankart defects or pathologically increased glenoid anteversion or retroversion, if operative correction is planned.

**Conservative treatment**

Multidirectional shoulder instability should primarily be treated conservatively. A physiotherapeutic rehabilitation programme should be initiated to strengthen the rotator cuff and improve coordinative abilities. Patients with instability and hyperlaxity have been shown to have a significant deficit of coordinative and proprioceptive capacities in the muscles of the shoulder girdle, giving this therapeutic regimen its scientific rationale. Furthermore, activities in which dislocations or pain might happen should be avoided. In all MDI patients operative management should not be considered before 6 months of thorough physiotherapy. Patients younger than 16 years should not be operated on at all since juvenile hyperlaxity sometimes improves spontaneously within years. Surgical treatment is contraindicated also in MDI patients who through voluntarily dislocating their shoulders have a secondary psychological benefit from their disease. In this case redislocation within 1 year of operation is very likely.

**Operative treatment**

The indications for surgical management of MDI have gradually been extended as new and better operative techniques in shoulder surgery – in particular...
arthroscopy – have been developed. Candidates for operation are patients in whom a specific arm position almost always leads to a dislocation. This type of patient tries to avoid the specific trigger situation. Their form of instability is by definition non-voluntary and is almost always of traumatic origin.

Patients with an unidirectional instability but multidirectional hyperlaxity are also suitable for surgery. These patients characteristically cannot voluntarily dislocate their shoulders. The direction of instability often is anterior, and sometimes on arthroscopy a SLAP lesion can be found in addition to hyperlaxity.1

Open surgical approach

Neer’s inferior capsular shift is the classic surgical treatment for multidirectional instability.8 It comprises a three-dimensional reduction of capsular volume (anterior, inferior, posterior).

Like anterior capsulorraphy, this technique requires an anterior approach to the shoulder joint. Incision of the capsule is performed along the anatomic neck from anterior to posterior up to the 9 o’clock position. After mobilization of the anterior and inferior capsule the anterior capsule is duplicated, resulting in an anterior shift of the axillary pouch which leads to increased tension of the posterior capsule. Neer called this technique ‘inferior capsular shift’ since by approaching from only one (anterior) side and by shifting the inferior part of the capsule, both the anterior as well as the posterior capsular tissue can be reduced. This is why the technique can equally well be performed from the posterior approach.2,3,8,61–67 It is up to the surgeon to choose the appropriate technique in each individual case. Cooper and Brems’ recommend working on the side where clinically the major direction of instability is found, on the grounds that scarring in the duplicated tissue increases stability. Occasionally the decision can only be made by clinical examination under anaesthesia. The operation is difficult, not least because manipulation at the inferior recess takes place in direct proximity to the axillary nerve.

The outcome after inferior capsular shift is promising. In a series of 43 patients Cooper and Brems reported 91% had a satisfactory result without redislocation after 2 years.4 In a study by Bigliani, 52 patients were followed up at an average of 5 (range 2–11) years after operation, 94% of whom were satisfied with the outcome.2,37

Typically the inferior capsular shift procedure should be performed if capsular redundancy is the main pathological problem. If – and this is most likely to be the case – additional lesions are present, alternative techniques have to be applied. In case of a Bankart lesion Altchek recommends the classic Bankart procedure in combination with a modified inferior capsular shift procedure.28 Altchek himself reported encouraging results, but Hawkins’ series of 31 patients had a more discouraging outcome: 39% of his patients were not satisfied and had redislocations after a follow-up period of 2–5 years.61

Arthroscopic technique

Arthroscopic shoulder stabilization has become a reliable treatment method in the management of unidirectional, post-traumatic instability and in the treatment of superior glenoid labral disorders.1 The development of fixation systems (suture anchors) and capsular shrinking techniques (electrothermal or laser-assisted) are enlarging the spectrum of indications.

Following failed conservative treatment of multidirectional instability, arthroscopic management largely depends on the capsulolabral anatomy. Osseous abnormalities such as increased glenoid anteverisons or retroversions or large Bankart lesions have to be excluded.

A typical Bankart lesion in combination with an increased capsular volume can be treated by arthroscopic capsular shrinkage of the posterior and inferior capsule, while anteriorly the capsulolabral ligamentous complex is reattached to the glenoid by means of suture anchors. More often, however, non-Bankart lesions are found in MDI. Arthroscopically these also require posterior, inferior and anterior shrinkage. Anteriorly, before suture anchor fixation, thorough debridement of the glenoid and subperiosteal mobilization of the capsulolabral tissue and ligaments are mandatory. By performing a shift of the tissue from inferior to superior, ‘new’ tissue for formation of the anteroinferior labrum is obtained, and additionally the inferior capsule is stretched. Ideally the most superior suture anchor is placed in the 1 o’clock position. It is important to give the anterior band of the inferior glenohumeral ligament enough strength and stability since it is one of the major stabilizing factors.1,28 In case of an additional SLAP lesion we recommend its refixation.25,26,29

Several techniques of arthroscopic capsulolabral reconstruction have been advocated. Staples and transglenoid sutures should be avoided because of their high complication rate.66 Refixation of the labrum and capsule can be performed using bioabsorbable tacks (Suretac)35,69 or suture anchors; absorbable (Panalok, Mitek) (Westwood, Massachusetts, USA) or non-absorbable (Fastak, Mitek) suture anchors are available (Figure 18.3). For laser-assisted capsular shrinkage the holmium-YAG laser is used;41,70–72 systems for electrothermally assisted capsular shrinkage (Figure 18.3b) are available from Arthrotec (Sunnyvale, California, USA), Oratec (Menlo Park, California, USA) and Mitek (VAPR).138,67,73–78

First results from arthroscopic operations of MDI using the techniques described above were published by McIntyre et al.71 In 19 patients only one recurrent subluxation was noted after an average follow-up of 34 months.
All the other patients were content with the result and most of them even returned to a high level of sporting activity. The outcomes of our patients treated arthroscopically for MDI confirm these positive results. However, the decisive prerequisite is the correct patient selection and indication.1,38

An alternative to the suture anchor technique in combination with capsular shrinking is the suture punch technique. Patients with multidirectional instability are managed by an arthroscopically assisted inferior capsular shift. Duncan and Savoie presented a report of this arthroscopic method.5 This technique involves extending the dissection and capsular freeing for the Bankart reconstruction inferiorly and posteriorly past the 6 o’clock position to approximately the 8 o’clock position. In patients with no detachment, an arthroscopic knife or end-cutting shaver is used to create a capsular detachment from the glenoid. The capsule is incised along a line projected from the rim of the glenoid. Sutures are then placed into the posterior inferior glenohumeral ligament, inferior glenohumeral ligament, anterior inferior glenohumeral ligament, and anterior middle and anterior superior glenohumeral ligaments. This requires approximately 10–12 sutures (20–24 strands). These sutures are then pulled through one or two drill holes through the glenoid neck, eliminating the redundancy of the posterior capsule, inferior pouch, and reconstructing the ligamentous tissues.

**Figure 18.3**
Capsulolabral reconstruction. (a) A suture anchor equipped with a polyester suture is used for anterosuperior refixation of the middle glenohumeral ligament. The suture is tied with the ‘sixth finger’. (b) Electrothermally assisted capsular shrinkage of the anterior band of the inferior glenohumeral ligament. (c) Postoperative radiograph showing three suture anchors in correct position.
Caspari has reported on a combined arthroscopic anterior and posterior capsular reconstruction for multidirectional instability. In this procedure, a 5 mm portion of the inferior glenohumeral ligament is left attached at approximately the 6 o'clock position. The anterior aspect of the shoulder is reconstructed as with a normal Bankart reconstruction in Caspari's method except that the 6 o'clock attachment of the capsule is maintained. The Caspari sutures are placed and then pulled out of the posterior aspect of the shoulder. The arthroscope is then placed anteriorly and a posterior reconstruction as described by Duncan and Savoie is accomplished. The arm is placed in a position of neutral rotation and adduction and the anterior and posterior sutures are tightened until central stability of the humeral head on the glenoid is achieved and the sutures are tied in this position.

Duncan and Savoie have reported 91% satisfactory results for the arthroscopic inferior capsular shift procedure. In their patient population no complications were noted. Caspari has reported on the anterior and posterior capsular shift for multidirectional instability. In a series of 40 patients followed up after 2–5 years, 36 (90%) satisfactory results were noted.

Another technique for the reduction of capsular volume is arthroscopic capsular plication (suture plication) without the usage of suture anchors (Figure 18.4). The technique can be applied anteriorly and posteriorly and can also be used for augmentation of a suture anchor reconstruction. The capsule is tightened with sutures that are pulled through the tissue ‘inside in’ by means of a curved suture hook. Either polydioxanone sutures (PDS) or braided synthetic absorbable sutures (Panacryl) can be used. The sutures are placed horizontally through the capsular tissue and tied inside the joint (Figure 18.4). Ideally, before tying all sutures should have been inserted; if not, handling of the suture hook may become difficult because of the narrowed joint space. Moreover, a ‘spider's web’ of sutures inside the joint may confuse the surgeon. To avoid this, Snyder recommends the use of ‘suture savers’ (angiocatheters without hubs) for identification and separation of the different suture strands.

**Postoperative protocol**

In both open and arthroscopic shoulder stabilization procedures we recommend 24 hours of immobilization (Gilchrist sling), followed immediately by initiation of passive physiotherapy with the sling worn only while sleeping for 2 weeks. During this period we advise against exercise involving more than −45° of external rotation and 45° of flexion and abduction. After two weeks the amount of external rotation can be extended to 0°, and from the sixth week the full range of external rotation is permitted but with only 90° of abduction.
and flexion. It is important to remember that after operative treatment of MDI a comprehensive physiotherapeutic programme of at least 3 months’ duration is required for an optimal outcome.

References

77. Imhoff AB, Burkart A, Roscher E. Adverse reactions to bioabsorbable suretac device in arthroscopic shoulder stabilisation. Arthroscopy 1999.