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Recurrent Posterior Shoulder Instability

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- Recurrent posterior shoulder instability is an uncommon, debilitating condition in young adults that is being diagnosed with increasing frequency.
- Although a number of predisposing factors have been identified, their relative importance remains poorly understood.
- Poor results have been reported following operative intervention to treat recurrent posterior instability with nonanatomic techniques.
- The more recent development of lesion-specific surgery has improved clinical results, particularly when that surgery has been performed arthroscopically. Operative treatment is therefore being increasingly recommended at an earlier stage to patients who do not respond to supervised rehabilitation programs.

Epidemiology
Accurate assessment of the prevalence of posterior glenohumeral instability is difficult because of the lack of concrete diagnostic criteria, but the condition is estimated to be present in up to 5% of all patients with shoulder instability.1,2 With increased awareness of the condition, it is being diagnosed more frequently, particularly after sports injuries.3,4

Affected patients are usually men between the ages of twenty and thirty years and often are active and competitive athletes playing overhead or contact sports. Although approximately 50% of patients report a discrete injury to the shoulder that initiated the symptoms, a documented previous episode of posterior dislocation requiring relocation is relatively uncommon: only seventeen (23%) of seventy-four patients undergoing operative stabilization for posterior instability reported such an episode in four series in which this information was recorded.5-7

Classification and Pathogenesis
Recurrent episodes of subluxation or dislocation may occur following reduction of a first-time traumatic posterior dislocation. However, recurrent instability most commonly presents with episodes of subluxation and there may be no history of injury. The etiology of recurrent instability is complex and multifactorial, and although several classification systems have been suggested, none are entirely satisfactory. Recurrent posterior instability is perhaps best considered a syndrome in which the pathological processes are incompletely understood and in which several predisposing factors may coexist in the same patient (Fig. 1).

Volition
Many patients are able to voluntarily demonstrate the shoulder instability. Three variations are described, although there is overlap and disagreement about their exact defining features.4,10-12

Psychogenic
Patients with psychological problems may be able to subluxate one or both shoulders voluntarily (under conscious control), often with the arm at the side, as a result of unbalanced muscle force couples.10,13 These patients often develop instability during adolescence for secondary gain (to impress their peers, receive attention, or obtain medication), and they have been described as “habitual” or “willful” dislocators. An involuntary element (without conscious control) to the instability, which becomes symptomatic, may develop in some patients.

Positional
Some patients have subluxation that occurs involuntarily when the shoulder is placed in the unstable position of flexion, adduction, and internal rotation.10,13,14 As the arm moves into abduction from this position, the shoulder visibly and audibly relocates. These so-called positional dislocators usually show no evidence of psychological disturbance and are often more troubled by instability than pain.
Muscular
The final, largest group of patients are commonly physically active, psychologically normal athletes who play overhead or contact sports. They present with posterior shoulder pain and involuntary subluxation, which interferes with their sports performance. In contrast to habitual dislocators, patients with muscular posterior dislocations most commonly have symptoms in only one shoulder, which develop in early adult life (between the ages of twenty and twenty-five years). A subgroup is able to voluntarily display the instability or has subluxation that is demonstrable on examination.

Injury to the Shoulder
Recurrent posterior instability may develop following a posterior dislocation. However, this is less common than recurrent anterior instability following an anterior dislocation. Another group of patients, who have no confirmed evidence of a prior dislocation, recall a substantial injury (usually a blow to the front of the shoulder, or an axial loading injury to the arm, while the shoulder is flexed) that initiated the problems ("macrotrauma"). In a third group, the symptoms develop insidiously, aggravated by repetitive minor injury when the shoulder is in the provocative position of flexion, adduction, and internal rotation. This "microtrauma" is particularly associated with locked, straight-arm pass-blocking techniques in American football; bench-pressing; and overhead sports such as baseball, tennis, and swimming.

Degree of Instability
Recurrent posterior dislocation is much less common than recurrent posterior subluxation. Most patients who experience frank episodes of recurrent dislocation have had an initial traumatic dislocation, and many are epileptics whose shoulders dislocate during seizures. Patients more commonly present with a sense of shoulder instability or looseness when the shoulder is in flexion, adduction, and internal rotation. A subgroup of patients with recurrent subluxation have no symptoms of instability but experience a poorly localized posterior shoulder ache when the arm is placed in this provocative position.

Structural Abnormalities of the Shoulder
Soft Tissue
Tears of the posteroinferior aspect of the capsulolabral complex (a reverse Bankart lesion) involving the posterior band of the inferior glenohumeral ligament may be present. These lesions are more commonly found when there has been a discrete injury to the shoulder, and they may be degenerative in origin, caused by recurrent episodes of instability. An incomplete and concealed avulsion of the posteroinferior aspect of the labrum (a Kim lesion) may also be associated with unidirectional or posteroinferior instability.

With recurrent subluxation, the capsule undergoes plastic deformation, producing a patulous posteroinferior capsular...
pouch1,52 and increased joint volume (Fig. 2)39. Other lesions associated with recurrent instability include a reverse humeral avulsion of the glenohumeral ligaments (RHAGL lesion)11,32, posterior labrocapsular periosteal sleeve avulsion (the POLPSA lesion)15, osseous avulsion of the posterior aspect of the glenoid rim (a reverse osseous Bankart lesion), posterior chondrolabral erosion of the glenoid rim27,29,34, and a tear of the posterior aspect of the capsule or rotator cuff35. Patients with bidirectional (posterior and inferior) instability often have concomitant insufficiency of the rotator interval, whereas those with multidirectional (posterior, inferior, and anterior) instability usually have a generalized increase in joint volume with posterior, inferior, and anterior capsular redundancy.

Bone
Instability may theoretically occur through increased glenoid retroversion, posterior glenoid erosion, engaging anterior humeral head defects, localized posteroinferior glenoid hypoplasia, or increased humeral head retrotorsion. No clear association has been demonstrated between posterior instability and the latter two conditions36-38.

Glenoid version varies widely in the normal population30,46, and it cannot be assessed with conventional radiography41,46. Studies of the degree of association between glenoid retroversion and posterior instability have produced conflicting results12,54,55,48. It is probable that excessive glenoid retroversion is rarely a primary cause of instability but should be considered as a contributory factor44,46.

Localized posterior glenoid erosion is often documented in patients with instability19,21,47. It may be due to localized glenoid hypoplasia or it may be secondary to repeated subluxation. A relationship between the extent of glenoid erosion seen on computerized tomography and recurrent instability was reported in one study31, although it has not yet been independently validated. Posterior glenoid erosion has also been demonstrated in patients with fixed posterior subluxation of the humeral head and glenohumeral osteoarthrosis48. However, these patients have no history of instability, and it is thought that these changes represent an early form of osteoarthrosis48. Anterior humeral head defects caused by traumatic dislocation may cause recurrent dislocation of the shoulder by engaging with the posterior part of the glenoid rim as the arm is internally rotated.

Directions of Instability
Although recurrent unidirectional posterior subluxation may occasionally occur in isolation, posterior instability more commonly develops as part of a more complex bidirectional (posterior and inferior)24,44 or multidirectional (posterior, inferior, and anterior)19,50,51 pattern. There is often a family history of joint instability and evidence of generalized ligament hyperlaxity or instability in both shoulders or in other joints45.

Scapulothoracic Dysfunction
Disturbance of the normal coordinated scapulothoracic and glenohumeral rhythm may be apparent in patients with instability8, although its importance is poorly understood. In many patients with so-called positional instability, transient winging of the scapula develops as the shoulder subluxates but there is no evidence of dysfunction of the long thoracic nerve. It is often unclear whether the asynchrony of scapulothoracic movement is contributory to the instability or whether it is an acquired compensatory mechanism to prevent posterior escape of the humeral head.

Scapulothoracic dysfunction has recently been associated with fatigue of the serratus anterior, which may occur in sports such as golf, in which the muscle is constantly active in the lead arm of the swing. This may predispose the shoulder to instability and impingement42,50.

Assessment and Diagnosis
An examiner assessing a patient with suspected posterior instability should attempt to answer two questions. First, does the patient have true instability or some other cause for the symptoms? Second, what is the pathological foundation for the instability? These questions are usually best answered on the basis of the clinical history and examination, since the findings on radiographic and arthroscopic assessments may be nonspecific.

Clinical Assessment
Recurrent subluxation typically presents with aching over the posterior aspect of the shoulder together with a sense of shoulder instability. Symptoms are usually present during periods of overuse, especially sports activities48,47. A history of trauma or volitional instability should be sought, and a psychological assessment is indicated if habitual dislocation is suspected.
If the patient has no sensation of instability\textsuperscript{18,56}, other causes for the symptoms, including suprascapular nerve entrapment\textsuperscript{15}, quadrilateral space syndrome\textsuperscript{19}, a posterior glenoid spur (a Bennett lesion)\textsuperscript{20,46}, early osteoarthrosis\textsuperscript{9}, or a tumor, should be considered.

The physical examination is directed toward reproducing the symptoms and direction of the shoulder instability. The signs of instability are often nonspecific, and features of rotator cuff dysfunction or impingement may coexist\textsuperscript{20,23}. Posterior shoulder laxity, with the humeral head subluxated by up to 50\%, is common in athletes and may not be pathological. Positive findings on provocative tests may support the diagnosis of instability by demonstrating excessive symptomatic posterior translation of the humeral head, rather than apprehension\textsuperscript{19,22,24}. These tests include the load and shift\textsuperscript{18}, posterior stress\textsuperscript{19}, posterior drawer\textsuperscript{23}, and pivot shift\textsuperscript{61} tests. The patient may be able to demonstrate the instability, which may be associated with scapular winging. It is important to determine the positions at which subluxation occurs as well as the muscular activity involved in order to distinguish among the various types of volitional instability.

The patient should be examined for signs of generalized ligamentous laxity and to establish whether the instability is unidirectional, bidirectional, or multidirectional by provocative testing\textsuperscript{18}. A positive sulcus sign strongly suggests an inferior component to the instability, which may be due to rotator cuff insufficiency or inferior capsular attenuation. The integrity of the rotator interval capsule can be confirmed by a lessening of the sign on external rotation of the shoulder\textsuperscript{18}. Patients with unidirectional instability typically demonstrate subluxation on provocative testing with the shoulder flexed to 80\° to 90\°, whereas those with bidirectional instability exhibit more instability with the shoulder flexed to 110\° to 120\°\textsuperscript{18}. Patients with multidirectional instability usually have more florid signs of generalized ligamentous laxity and have excessive translation of the humeral head in all directions on provocative testing. If the diagnosis is in doubt, an examination with the patient under anesthesia and arthroscopic evaluation of the shoulder may be helpful\textsuperscript{18}. Although the arthroscopic findings may be nonspecific, detection of posterior capsulolabral pathology is strongly suggestive of instability\textsuperscript{17}.

**Imaging Studies**

Standard radiographs often show normal findings in patients with suspected instability\textsuperscript{18}, but they may be useful for revealing anterior impression defects of the humeral head\textsuperscript{17,22,23} or posterior lesions of the glenoid rim\textsuperscript{23}. Magnetic resonance arthrography is currently the best method for imaging capsulolabral lesions\textsuperscript{6}, whereas computerized tomography is more useful for the assessment of the osseous anatomy and the orientation of the articular surfaces.

**Treatment**

Operative treatment of posterior instability has a poor reputation\textsuperscript{18,56}. Consequently, an initial trial of physical therapy is usually recommended, irrespective of the predisposing causes\textsuperscript{18,63,67}.

It is thought that the poor results of operative intervention may have been due to inappropriate patient selection or a failure to adequately treat all pathological features of the condition. Operative treatment that corrects the underlying pathology is therefore being increasingly offered at an earlier stage to patients whose symptoms are refractory to nonoperative measures\textsuperscript{18}. The operative treatment may involve more than one procedure to address the factors contributing to the instability\textsuperscript{18,69}.

**Factors Influencing the Choice of Operative Intervention**

**Volition**

Operative treatment is contraindicated for patients with voluntary, habitual instability due to psychological problems. Moreover, these patients usually do not respond to physiotherapy regimens; hence, psychotherapeutic treatment is needed\textsuperscript{18,61}. The majority of other volitional subluxators, who do not have psychological problems, usually report a decrease in the involuntary instability symptoms after completing a program of physiotherapy\textsuperscript{15,19,46}. This is particularly true of patients who have evidence of hyperlaxity\textsuperscript{18,61,67,68}. Pain management, activity modification, and strengthening of the scapulothoracic and rotator cuff muscles are all key elements of conservative treatment\textsuperscript{61}. Promising results have also been achieved with use of biofeedback in association with muscle retraining programs in patients with positional instability\textsuperscript{14,69}.

In the past, high failure rates have been reported following operative treatment of patients with volitional instability\textsuperscript{17,67}. However, recent studies have shown improved results\textsuperscript{8}, and operative treatment is usually recommended if nonoperative treatment has failed after six months\textsuperscript{3}.

**Injury to the Shoulder**

There is evidence that nonoperative treatment is less successful for instability that commenced after a discrete injury to the shoulder\textsuperscript{7,17}. Operative treatment is therefore often considered at an earlier stage for these individuals.

**Degree of Instability**

Patients with episodes of frank posterior dislocation often have anterior defects of the humeral head and posterior deficiencies of the glenoid rim, which may contribute to recurrent instability\textsuperscript{17,71}. If the patient has unstable epilepsy and is sustaining dislocations during seizures, attempts must be made to reduce the frequency of the seizures by adjusting the patient’s medication before operative treatment is considered.

When performing operative stabilization for recurrent dislocation, the surgeon should attempt to address all components of the instability; the operation may include bone-grafting of defects of the humeral head and glenoid rim as well as posterior soft-tissue reconstruction to address capsulolabral pathology. In the more common clinical scenario of recurrent subluxation, a posterior soft-tissue stabilization procedure is typically performed.
Structural Abnormalities of the Shoulder
Soft-Tissue Injury
A wide variety of nonanatomic operative approaches, such as the reverse Putti-Platt operation (plication of the infraspinitus and teres minor) and the Boyd-Sisk procedure (transfer of the triceps to the posterior aspect of the glenoid rim) have been advocated to treat the soft-tissue component of posterior instability.¹⁷ The recent trend has been toward lesion-specific treatment, whether performed as open surgery or with arthroscopic techniques. Stabilization typically involves repair of posteroinferior labral defects and retensioning of the redundant posteroinferior aspect of the capsule.

Open Techniques
Operative treatment is usually performed through a posterior approach. Access is achieved by incising or splitting the infraspinatus tendon or by developing a plane between the infraspinatus and teres minor tendons while protecting the axillary nerve and the posterior circumflex humeral vessels. If improved visualization is required, the infraspinatus tendon can be incised vertically and retracted medially, while the suprascapular nerve is protected.

A T-shaped capsulotomy is performed, and through this the posterior labral avulsion can be reattached to the decorticated glenoid rim with use of bone tunnels, bioabsorbable tacks, or suture anchors. Superior advancement and plication of the posterior aspect of the capsule is then performed with non-absorbable sutures to retension the posteroinferior capsular complex (Fig. 3).²⁰,²³ If the capsular tissue is attenuated, it can be reinforced with the infraspinatus tendon. Capsulorrhaphy with metal staples is contraindicated because of the complications associated with its use, including pain, staple migration, symptomatic ectopic bone formation, and arthrosis.³,⁵,⁶

A four to six-week period of postoperative immobilization with an orthosis holding the shoulder in neutral or external rotation is usually recommended to reduce stresses on the repair.¹⁹,²¹,²₅,⁷₄ Physiotherapy with isometric rotator-cuff-strengthening, proprioceptive, and active range-of-motion exercises is commenced thereafter.

Arthroscopic Techniques
Arthroscopic stabilization has theoretical advantages over open repair, including a better cosmetic result, less postoperative pain, and a shorter hospital stay. However, posterior stabilization is technically demanding, and because posterior instability is uncommon it is difficult for surgeons to gain sufficient experience in its operative treatment. However, arthroscopic stabilization is being performed with increasing frequency, and patients with unidirectional instability with capsulolabral lesions are considered ideal candidates for this treatment.²,²⁷

Arthroscopic procedures for unidirectional instability include posterior labral repair (Fig. 4), with use of techniques similar to those used in open repair, and plication, superior shift, or thermal shrinkage of the posteroinferior aspect of the capsule.¹,²,⁷,²³,²⁷,⁷₂ Patients with a Kim lesion (an incomplete and concealed avulsion of the posteroinferior aspect of the labrum) should be treated with conversion of the concealed incomplete labral detachment to a complete tear, which is then repaired with the posterior band of the inferior glenohumeral ligament.⁹

Subacromial decompression, rotator cuff repair, and repair of superior labral tears (SLAP lesions) can also be performed arthroscopically if coexistent impingement, cuff tears, or SLAP lesions are encountered.⁴⁸,⁵⁵,⁷³,⁷₆ A postoperative regimen similar to that used after open stabilization is usually adopted.

Fig. 3
Schematic diagram of an open posterior capsular plication. The redundant posteroinferior aspect of the capsule is retensioned by superiorly advancing the inferior leaf (B) of the humeral-based T-shaped capsulotomy over the superior leaf (A). (Printed with permission of Jennifer Fairman, Fairman Studios, Waltham, Massachusetts.)
Distortion of the Osseous Anatomy

Posterior glenoplasty, in the form of an opening wedge osteotomy with interposition of bone graft, has been used to treat patients with excessive glenoid retroversion. A posterior bone-block operation has also been used as a primary procedure in patients with deficiency of the posterior wall of the glenoid, or when the posterior aspect of the capsule is attenuated. Both of those procedures are now much less commonly used primarily.

Soft-tissue techniques, such as the McLaughlin procedure, tend to be ineffective for the treatment of anterior defects of the humeral head that are large enough to engage with the posterior aspect of the glenoid. The use of either an osteochondral allograft to fill the defect or a rotational osteotomy of the proximal part of the humerus theoretically is the most effective treatment, although there are no clinical data about their use in these circumstances.

Directions of Instability

Patients who have bidirectional or multidirectional instability usually respond to a rehabilitation program similar to that prescribed for patients with volitional instability. The prospects for successful operative treatment of patients who do not respond to physiotherapy have improved recently. Whether operative treatment is performed open or arthroscopically, the surgeon should attempt to treat all directions of instability. In addition to a posteroinferior capsular shift, an anterior and inferior shift and closure of the rotator interval may be required. Adjuvant arthroscopic thermal or laser-assisted capsular shrinkage has also been used to reduce joint volume. While successful results have been reported following these techniques, there may be severe complications.

Scapulothoracic Dysfunction

In addition to the typical rehabilitation program of rotator-cuff-strengthening, proprioceptive, and range-of-motion exercises, periscapular strengthening exercises are usually emphasized for patients who have disturbance of normal scapulohumeral rhythm. Only rarely is scapular winging severe enough to warrant separate surgical intervention.

Outcome of Treatment of Recurrent Posterior Instability

Although several well-designed Level-IV case-series studies have been performed, we are not aware of any peer-reviewed comparative Level-I or II studies. Studies have varied with regard to their inclusion criteria, case mix, operative techniques, and duration of follow-up (see Appendix). Many methods, with use of a variety of scoring systems, have been employed to assess functional outcome, and this makes objective comparisons difficult.

The chief outcome measure that has been consistently recorded is the rate of recurrent instability, but its use as a benchmark of success is simplistic. While some patients with postoperative recurrence rate their operation as a failure, others have a decrease in subjective instability and functional incapacity despite the continuation of the subluxations.

The results of open operative treatment of unidirectional soft-tissue instability have been variable and unpredictable. The overall prevalence of recurrent instability following open soft-tissue stabilization has been 24% (forty-nine of 202 shoulders), with reported rates ranging from 0% (zero of fourteen shoulders) to 83% (five of six shoulders) (see Appendix). However, of the four studies with the highest recurrence rates, three involved the use of the nonanatomic reverse Putti-Platt procedure and one involved the use of staple capsulorrhaphy in half of the patients. If those studies are excluded, the overall rate of recurrent instability is only fourteen (11%) of 130 shoulders.

The outcomes following open glenoid osteotomy and bone-block procedures, whether used in isolation or combined with capsulorrhaphy, have been generally poor, with recurrence rates of nearly 25% for both techniques (see Appendix). The methodological quality of some of the older studies of these techniques was poor, with some authors assessing glenoid version preoperatively and others using methodology that is now considered inaccurate.

As reported in the literature, the overall prevalence of recurrent instability following arthroscopic stabilization for the treatment of unidirectional posterior instability is 5%.
(eight of 154 shoulders), with rates ranging from 0% (zero of thirteen shoulders) to 10% (two of twenty-one shoulders) (see Appendix). Arthroscopic surgery was also used successfully in two small series to treat competitive athletes with posterior instability or labral lesion.

The results of arthroscopic stabilization in patients with bidirectional (posteriorinferior) instability, as reported in five studies (see Appendix), are more heterogeneous but generally poorer than those of arthroscopic stabilization of unidirectional posterior instability.

Both open and arthroscopic techniques have been used to treat patients with multidirectional instability in which the major component was thought to be posterior. Good results have been reported after the use of an anterior approach to perform an anterior, inferior, and posterior capsular plication and rotator interval closure to decrease joint volume. The failure rate of open posteriorinferior capsular shift through a posterior approach has been higher in patients with multidirectional instability than it has been in patients with more simple instability patterns. However, patients with multidirectional instability often have undergone previous, failed repairs for the instability, which may adversely affect the results. Arthroscopic thermal capsulorrhaphy has also yielded poor results in a small subgroup of patients who have multidirectional instability in which posterior instability is the predominant component.

Factors Associated with Recurrent Instability After Operative Repair
Factors contributing to the failure of posterior repairs include inappropriate patient selection and surgical error. However, irrespective of its quality, a repair can fail if the shoulder is reinjured or if an athlete returns to a sport that inflicts repetitive microtrauma on the shoulder.

Inappropriate selection of patients for surgery is usually due to inadequate preoperative assessment. Failure is almost inevitable if operative treatment is performed on a habitual dislocator, and it is more likely if a simple posterior repair without capsular retensioning is carried out in a patient with bidirectional or multidirectional instability. Higher rates of failure have also been reported in patients with Workers’ Compensation claims and in those with a previous failed repair. While some authors have reported poorer results in patients with voluntary instability, this has not been found in other studies.

The most common surgical error is a failure to address all components contributing to instability. Failure to treat a rotator interval lesion, a concomitant inferior or anterior component of the instability, excessive glenoid retroversion, a Kim lesion, or posterior erosion of the glenoid rim increases the likelihood of postoperative recurrence. Deficient capsulolabral tissues may also preclude a satisfactory soft-tissue repair, thus predisposing to recurrence.

Failed Operative Repair
The results of the few reports of the outcomes following revision posterior stabilization suggest high failure rates when compared with those of primary posterior stabilization. Evidence-based guidelines for the operative treatment of failed posterior repairs are lacking, but attempts should be made to address all components of the instability with use of a lesion-specific approach.

Other Complications of Treatment
Complications of open repairs include infection, neurovascular injury, pain, weakness, and shoulder stiffness (particularly loss of internal rotation). The alteration of joint kinematics following a tight open repair may predispose a patient to degenerative joint disease. Fuchs et al. reported asymptomatic degenerative changes in six (23%) of twenty-six shoulders treated with posterior stabilization, and osteoarthritic changes have been reported in other studies. Staple capsulorrhaphy has been associated with pain, joint erosion and arthrosis, anterior instability, and staple migration and has fallen out of favor as a result.

Because of the high risk of severe complications with both posterior bone-block and glenoid osteotomy, neither of these treatments is now commonly used as a primary therapeutic intervention.

Arthroscopic posterior stabilization is more demanding technically than is anterior stabilization because of the difficulty of gaining access and the poor quality of the posterior capsulolabral tissue, which may lead to an inadequate repair. The use of adjunctive thermal capsulorrhaphy has also been associated with an increased risk of axillary nerve injury, biceps tendon rupture, adhesive capsulitis, and recurrent instability with capsular insufficiency. Some patients also report pain or subjective stiffness, which may be associated with loss of internal rotation.

Overview
In summary, most patients with recurrent posterior instability notice lessening or eradication of the symptoms following a shoulder physiotherapy rehabilitation program, and this remains the initial treatment of choice. The results of operative treatment of posterior instability are not as good as those of operative treatment of anterior instability. However, the use of lesion-specific surgery to correct all components of the posterior instability appears to have improved results over the last ten years. Operative stabilization can now offer a good chance of success and should be recommended to patients who have persistent, symptomatic, nonhabitual instability following a six-month course of physiotherapy.

The best outcomes appear to follow an open or arthroscopic soft-tissue procedure to repair posterior labral pathology and to reorient the posteroinferior capsulolabral complex. More complex patterns of instability may require adjunctive repositioning of the inferior and anterior aspects of the capsule and a closure of the rotator interval. Osseous procedures should be reserved for the very rare patient with definite evidence of marked glenoid erosion or glenoid retroversion that is thought to contribute to the instability.
Appendix

Tables showing reported recurrence rates following various types of surgical procedures are available with the electronic versions of this article, on our web site at jbjs.org (go to the article citation and click on “Supplementary Material”) and on our quarterly CD-ROM (call our subscription department, at 781-449-9780, to order the CD-ROM).

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