

# The Treatment of Primary Anterior Shoulder Dislocations

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## Abstract

*The treatment of primary anterior shoulder dislocations is complex and challenging. The goal of treatment is to achieve a stable, pain-free shoulder with a full range of motion. The currently available evidence on the outcomes of nonsurgical treatment and immediate surgical stabilization conflicts; decision making must also take into account patient-specific variables, including age, occupation, functional demands, sports participation, physical characteristics, and compliance.*

*Although recurrence rates after anterior shoulder dislocation are difficult to pinpoint, abundant data indicate that the shoulder is more vulnerable to instability after a first traumatic dislocation. Relatively young patient age at the time of injury is the most consistent and significant prognostic factor for recurrent instability. Male gender is independently predictive of recurrent instability. Most recent studies have not identified sports participation or a type of sports activity as correlated with the risk of recurrent instability.*

*Nonsurgical treatment typically involves closed reduction, a period of immobilization, and physical therapy for strengthening the rotator cuff and scapular stabilizers. The evidence for this treatment strategy is largely anecdotal, and the literature on its efficacy is inconclusive. Several recent studies suggested that immobilization of the shoulder in external rotation after a primary traumatic anterior shoulder dislocation may decrease the risk of recurrent instability more than conventional sling immobilization.*

*The limited evidence available from randomized, controlled trials supports early surgical stabilization of a first traumatic anterior dislocation in high-risk young adults who engage in demanding physical activities. Although different outcome tools were used, the reported recurrence rates and functional outcomes consistently and significantly favored surgical treatment over nonsurgical treatment in this population of young, active patients. Early or prophylactic stabilization is not advisable unless the patient has a high risk of recurrence.*

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The shoulder is one of the most versatile joints in the body, allowing a wide functional range of motion in multiple planes. This freedom of motion renders the shoulder particularly vulnerable to instability, and it is the most commonly dislocated large joint. Simonet and associates<sup>1</sup> reported that primary or recurrent traumatic shoulder dislocation occurs at least 11.2 times per 100,000 person-years; the incidence is 0.7% for men and 0.3% for women younger than 70 years. In a study of more than 2,000 people age 18 to 70 years, Hovelius<sup>2</sup> found the incidence of shoulder dislocation to be 1.7%.

Anterior traumatic dislocation is the most common injury of the shoulder, accounting for 96% of all glenohumeral dislocations.<sup>2,3</sup> Treatment of a primary anterior shoulder dislocation is complex and challenging. The evidence comparing the outcomes of nonsurgical treatment and immediate surgical stabilization is conflicting, and decision making is further complicated by patient-specific variables, including age, occupation, functional demands, sports participation, physical characteristics,

and compliance. Whether the treatment is nonsurgical or surgical, the goal is a stable, pain-free shoulder in which the full preinjury range of motion has been restored.

This chapter reviews the pathology and natural history of primary traumatic anterior shoulder instability and addresses several clinically relevant questions in the treatment of these injuries, based on a comprehensive review of the evidence-based literature.

## Pathology of Initial Dislocation

Traumatic glenohumeral dislocation typically results in damage to the bony or soft-tissue stabilizers of the joint, although the degree and nature of the injury are highly variable. Most patients who sustain a traumatic anterior dislocation of the shoulder have an avulsion of the anterior labrum and capsule (the classic Bankart lesion) at the time of surgery.<sup>4</sup> The anterior labrum and inferior glenohumeral ligament complex are the primary passive anterior stabilizers of the shoulder, and the high rate of recurrent instability after dislocation is attributable to a failure of the labrum to heal in an anatomic position.

Biomechanical studies have found that an isolated Bankart lesion is insufficient to allow for frank glenohumeral dislocation.<sup>5-8</sup> Apreleva and associates<sup>5</sup> used a dynamic shoulder-testing apparatus in a cadaver model to evaluate the effects of varying degrees of capsulolabral injury on the kinematics of the glenohumeral joint during abduction and external rotation. Dislocation did not occur after the creation of a large Bankart lesion or sectioning of the anterior joint capsule. However, circumferential division of the capsule resulted in a significant increase

in posterior translation during abduction in the scapular plane, and two of nine shoulders became dislocated posteriorly. External rotation of the abducted extremity produced no increase in anterior or posterior translation. Pouliart and associates<sup>6,7</sup> evaluated stability after sectioning different combinations of four zones of the capsuloligamentous complex in 50 cadaver shoulders. Anteroinferior dislocation occurred in 18 specimens after three zones were sectioned and in 14 after all four zones were sectioned. The authors concluded that compromise of the superior and posterior stabilizing structures is necessary, in addition to the classic Bankart lesion, before complete anterior glenohumeral dislocation occurs. These findings were supported by Speer and associates,<sup>8</sup> who measured coupled anterior-posterior and superior-posterior translations in cadaver shoulders while variably directed forces were sequentially applied before and after detachment of the anteroinferior labral complex from the glenoid rim. The simulated Bankart lesion resulted in small increases in anterior translation at all positions of elevation, in posterior translation at 90° of elevation, and in inferior translation at all positions of elevation. These increases were less than 3.4 mm in any plane.

A variety of other injuries to the osseous and soft-tissue stabilizers of the shoulder joint can occur after anterior dislocation. The Hill-Sachs lesion (a compression fracture of the humeral head), a fracture of the greater tuberosity, capsular stretching or tearing, a superior labral lesion, and tearing or dysfunction of the rotator cuff muscles commonly occur.<sup>9,10</sup> Wintzell and associates<sup>11</sup> evaluated 30 patients age 18 to

30 years; MRI studies obtained immediately after injury showed that 20 (66%) had an avulsion of the glenohumeral ligaments, 22 (73%) had a pathologic condition of the labrum, and 16 (53%) had a combined capsulolabral avulsion.

Taylor and Arciero<sup>12</sup> reported on 63 young patients who underwent immediate arthroscopic stabilization after a primary anterior shoulder dislocation. All of the patients had a hemarthrosis; 61 (97%) had complete detachment of the anterior capsuloligamentous complex from the glenoid rim. One patient had an avulsion of the inferior glenohumeral ligament from the humeral neck, and one had an interstitial capsular tear. Fifty-seven patients had a Hill-Sachs lesion, and six patients had an associated superior labrum anterior and posterior tear.

Wheeler and associates<sup>13</sup> used arthroscopy to evaluate acute intra-articular injuries in 45 young military cadets. Six patients had a capsular rupture, 11 had a capsular rupture in combination with a partial avulsion of the labrum, and 28 had a capsular rupture with complete avulsion of the labrum.

After arthroscopic examination of 45 primary shoulder dislocations in patients with no history of shoulder pathology, Baker and associates<sup>14,15</sup> identified three groups based on injury pattern and severity. In group I (6 shoulders), minimal hemarthrosis was found, with a capsular tear but no labral lesion. In group II (11 shoulders), the hemarthrosis was moderate, with a capsular tear and partial labral detachment. In group III (28 shoulders), the hemarthrosis was large, with a capsular tear and complete labral detachment.<sup>14,15</sup>

A study by te Slaa and associates<sup>16</sup> reported similar findings for pa-

tients who underwent arthroscopy and lavage within 10 days of an anterior dislocation; 62% of the patients had a Baker type III labral tear, 25% had a Baker type II labral tear, and 13% had a Baker type I labral tear. One patient had an associated superior labrum anterior and posterior cuff tear, and most had a traumatic Hill-Sachs lesion. However, the arthroscopically identified intra-articular pathology was not predictive of recurrent shoulder instability.

### Natural History of Initial Dislocation

Although a few of the available retrospective studies include moderate- or long-term follow-up, the natural history of a first-time anterior shoulder dislocation remains poorly defined.<sup>17-27</sup> The consequences of recurrent shoulder instability include pain, decreased activity level, potential arthritic change, and overall decrease in quality of life. The difficulty in defining the incidence and prevalence of these sequelae is largely attributable to the absence of prospective, randomized studies as well as the heterogeneity of the patient population and treatment regimens in the published studies.

In a multicenter Swedish study, 247 primary anterior dislocations in 245 patients age 12 to 40 years were treated nonsurgically with a variable period of sling immobilization.<sup>24</sup> At an average 10-year follow-up after the initial injury, 129 shoulders (52%) had experienced no additional dislocation, but 58 shoulders (23%) had a recurrent dislocation requiring surgical intervention. Of the 107 shoulders that had at least two recurrences during the first 5 years, 24 (22%) had stabilized without surgical intervention at final

follow-up. The type and duration of immobilization was found to have no significant effect on the rate of recurrence. Radiographic evaluation for posttraumatic arthropathy at final follow-up revealed no correlation between recurrence and mild or moderate arthritic change. However, of the 18 shoulders found to have moderate or severe arthropathy, 12 had recurrent dislocation.

Robinson and associates<sup>17</sup> helped define the natural history of primary glenohumeral dislocation in a prospective study of 252 patients age 15 to 35 years. The patients were treated with closed reduction and immobilization for 4 weeks, followed by rehabilitation exercises. Recurrent instability developed in 150 patients (56%) within the first 2 years and in 178 (67%) within the first 5 years. Because 87% of all patients who developed recurrent instability did so within 2 years, an instability-free period of 2 years after the primary dislocation was predictive of a low risk of recurrent dislocation. Of the patients with recurrent instability, 110 (82%) were treated with surgical stabilization after the first episode. The remaining 24 patients (18%) initially declined surgery, but only 8 (7%) of them avoided additional dislocation and subsequent surgery. Functional outcome scores revealed a small but measurable degree of impairment 2 years after the initial dislocation.<sup>17-19</sup> Although no significant differences were found in the mean Medical Outcomes Study Short Form-36 Health Survey scores of patients who had a stable shoulder at 2 years and those who underwent surgical stabilization for recurrent instability, persistent deficits in range of motion and function of the injured shoulders were present in both groups, as assessed using the

Disabilities of the Arm, Shoulder and Hand questionnaire and the Western Ontario Shoulder Instability Index (WOSI).

In a prospective natural history study of 131 patients who were evaluated for an average of 4 years after primary anterior shoulder dislocation, Sachs and associates<sup>20</sup> found that at least one episode of recurrent instability occurred in 43 patients (33%), and 18 of these patients (49%) requested surgery for the recurrent instability during the study period. Most of these patients were younger than 40 years and were participants in contact or collision sports. The functional outcomes of patients who had successful nonsurgical treatment were not significantly different from those of patients who had successful surgical repair, as measured using the American Shoulder and Elbow Surgeons Shoulder Pain and Disability Index, the WOSI, and the Constant-Murley Shoulder Outcome Score. However, patients who chose nonsurgical treatment for recurrent instability had poorer outcomes than patients with a stable shoulder ( $P < 0.03$ ).<sup>20</sup> Even among patients in the highest risk subgroup (young men requiring overhead use of the arm in contact or collision sports), only half ultimately requested surgery. In support of the findings of Hovelius and associates, Sachs and associates concluded that the need for immediate surgery could not be accurately predicted.<sup>20-22</sup>

### Risk Factors for Recurrence

Although specific rates of recurrence after anterior shoulder dislocation are difficult to determine, data show that the shoulder is more vulnerable to recurrent instability after a traumatic dislocation; rates as high as 94% have been reported.<sup>23-25</sup>

Several studies have attempted to define the prognostic factors for recurrence, to permit identification of high-risk patients in whom early or prophylactic surgical stabilization may be warranted.

### **Age and Gender**

Multiple studies have confirmed that young age is the most consistent and significant prognostic factor for greater risk of recurrent instability.<sup>23-34</sup> Hovelius and associates<sup>21</sup> found that 66% of patients who were between ages 12 and 22 years at the time of the primary dislocation had experienced a recurrent instability episode at 10-year follow-up, compared with 24% of patients who were between ages 30 and 40 years. One third of patients who had an initial dislocation before age 30 years ultimately required surgical stabilization. Patients in the younger group (age 12 to 25 years) had surgical treatment earlier than those in the older group (age 26 to 40 years;  $P < 0.02$ ). The prevalence of bilateral dislocation also differed significantly by age; the risk was substantially higher in patients younger than 29 years than in patients older than 29 years.<sup>21,22</sup> Studies have supported these findings; reporting a recurrence rate as high as 94% in young, athletic patients.<sup>23,25</sup> Rowe and associates reported a 94% risk of recurrence in patients younger than 20 years, compared with a 14% risk in patients older than 40 years.<sup>23,25</sup> A multivariate logistical analysis of a large retrospective series, reported by Sachs and associates,<sup>20</sup> found that the only strong predictor of subsequent instability was age younger than 25 years.

Male gender also was found to be independently predictive of recurrent instability. A multivariate analysis by Robinson and associates<sup>17</sup> at-

tempted to assess potential risk factors for recurrence, including age, gender, generalized ligamentous laxity, sports participation, greater tuberosity fracture, and presence of a nerve injury. Only male gender and relatively young age were factors found to independently predict recurrent instability ( $P < 0.05$ ). Chalidis and associates<sup>29</sup> followed 308 patients for a mean of 5.9 years after an acute primary glenohumeral dislocation. The patients were initially treated with closed reduction followed by immobilization in a sling for an average of 3 weeks. The risk of recurrent anterior dislocation was found to be 50%; men had a higher risk than women (57% and 42%, respectively;  $P < 0.001$ ). The highest risk of recurrent instability (89%) was in patients age 14 to 20 years. No correlation was found between recurrent instability and the duration of immobilization.

### **Sports Activity**

Conflicting evidence has been reported on the correlation of sports participation and increased risk of recurrent instability after a first-time traumatic dislocation. Older retrospective studies raised the concern that athletic patients, particularly those participating in shoulder-straining sports, were at increased risk of recurrent dislocation.<sup>30-32</sup> In Bankart's original report,<sup>4</sup> glenohumeral dislocation was referred to as a condition "peculiar to athletics and epileptics." Simonet and Cofield<sup>31</sup> reported a recurrence rate of 82% in athletes, compared with 30% in nonathletes. Wheeler and associates<sup>13</sup> reported a recurrence rate of 85% in highly trained active military personnel who were treated nonsurgically for a primary anterior shoulder dislocation.

Most recent studies have not identified sports participation as a significant risk factor for recurrent instability. In a retrospective evaluation of 107 primary anterior shoulder dislocations at a mean 71-month follow-up, te Slaa and associates<sup>33</sup> found a 26% overall probability of recurrence within 4 years. Age was the most significant prognostic factor; 64% of dislocations occurred in patients younger than 20 years, compared with 6% in patients older than 40 years. No difference in rates of recurrence was found between patients who were active in sports and those who were not. In a smaller retrospective series, the same authors reported a 60% instability rate in patients who participated in shoulder-stressing sports, compared with 58% in other patients.<sup>16,33</sup> In a retrospective review of 241 patients with a primary anterior shoulder dislocation who were followed an average of 43.5 months, Kralingër and associates<sup>34</sup> did not find a correlation between sports activity and recurrence. Sachs and associates<sup>20</sup> found no correlation between the number of sports-participation hours or participation in contact or collision sports and the likelihood of a recurrent dislocation. They did find that patients whose occupation required them to use the arm at or above chest level were more likely to have a subsequent instability event ( $P = 0.05$ ).

### **Hill-Sachs Lesion**

Whether a Hill-Sachs lesion compromises glenohumeral stability and increases the risk of subsequent dislocation is determined by the size and severity of the osseous defect. However, radiographic identification of a Hill-Sachs lesion at the time of injury has been associated with an increased likelihood of

recurrence.<sup>21,22,34</sup> Hovelius and associates<sup>21</sup> identified a Hill-Sachs lesion in 54% of shoulders and correlated this finding with a poorer prognosis for recurrence, compared with patients in whom the lesion was not evident ( $P < 0.04$ ). Kralinger and associates<sup>34</sup> correlated the severity of the Hill-Sachs lesion with the risk of recurrence, reporting a recurrence rate of 23.3% in patients with a grade I Hill-Sachs defect, 16.2% in patients with a grade II defect, and 67% in patients with a grade III defect ( $P = 0.014$ ). Not surprisingly, significant bony defects involving the humeral head and the inferior glenoid have been associated with a high failure rate after arthroscopic stabilization surgery.<sup>35-38</sup>

### **Greater Tuberosity Fracture**

The presence of a greater tuberosity fracture with a traumatic anterior dislocation appears to lessen the risk of recurrent instability. Although the precise etiology is unknown, the transmission of force into the fracture at the time of injury may protect the remaining soft-tissue stabilizers of the glenohumeral joint (the capsule and labrum). At 10-year follow-up, Hovelius and associates<sup>21</sup> reported a significantly reduced risk of recurrence in patients with an anterior dislocation and an associated greater tuberosity fracture ( $P < 0.0002$ ). In a study by te Slaa and associates,<sup>16</sup> 19% of 107 patients with a first-time anterior dislocation were found to have an associated greater tuberosity fracture. None of these patients had a recurrence, compared with 32% of patients who did not have this fracture. Neither McLaughlin and MacLellan nor Robinson and associates reported any recurrences among patients with an associated tuberosity

fracture.<sup>17-19,39</sup> Kralinger and associates<sup>34</sup> made a similar observation, but they did not attribute the lower risk of recurrence to the presence of a greater tuberosity fracture. Instead, the reduced risk was correlated with a secondary reduction in attainable external rotation at 0° of abduction in the injured shoulder.

## **Treatment**

### **Decision Making**

The goal of both nonsurgical and surgical treatment is a pain-free, stable shoulder with a fully restored range of motion. The immediate treatment is to reduce the shoulder dislocation. However, the factors determining the subsequent selection of nonsurgical treatment or early surgical stabilization are complex. The treatment strategy must be individualized and reflect the patient's age, occupational demands, general health, ligamentous laxity, compliance, and expectations.

### **Nonsurgical Treatment**

#### ***Does the Duration of Immobilization or Rehabilitation After Injury Affect Outcome?***

Nonsurgical treatment typically involves a variable period of immobilization after closed reduction, followed by physical therapy to strengthen the rotator cuff and scapular stabilizers. However, the evidence for this treatment strategy is largely anecdotal, and the literature on its efficacy is controversial.

Aronen and Regan<sup>40</sup> reported that immobilization followed by intense rehabilitation prevents recurrent instability. Twenty military personnel who sustained a primary anterior shoulder dislocation were followed for an average of 36 months. All patients participated in an identical regimen that included a rehabilitation program emphasizing the

muscles of internal rotation and adduction, with rigid activity restrictions until the rehabilitation program goals were achieved. The rehabilitation program progressed from isometric to isotonic and isokinetic exercises. The authors reported a 75% success rate, concluding that adherence to an aggressive rehabilitation program can allow a full return to preinjury activities, without recurrence of instability.

Later studies failed to corroborate this conclusion. Burkhead and Rockwood<sup>41</sup> reported on 140 shoulders that were treated with a specific set of muscle-strengthening exercises for traumatic or atraumatic recurrent subluxation. Only 16% of the 74 shoulders with traumatic subluxation had a good or excellent result, compared with 80% of the 66 shoulders that had atraumatic subluxation. Hovelius and associates<sup>21</sup> found no correlation between the type or duration of immobilization and the recurrence rate in 247 shoulders with a primary anterior dislocation that were followed for 10 years. Neither Chalidis and associates<sup>29</sup> nor Kralinger and associates<sup>34</sup> identified a correlation between duration of immobilization and the risk of recurrence in 308 patients or 241 patients, respectively. Kralinger and associates<sup>34</sup> were unable to find a substantial benefit from supervised physical therapy, suggesting that a well-structured home-based program that is independently completed by the patient may be equally effective.

#### ***Does Immobilization in External Rotation Improve Outcome?***

Several recent studies suggested that immobilization of the shoulder in external rotation after a primary traumatic anterior shoulder dislocation may reduce the risk of recur-

rent instability more than conventional sling immobilization.<sup>42-46</sup> MRI studies have shown that the position and coaptation of a Bankart lesion against the glenoid rim is improved with external rotation.<sup>45</sup> The contact force between the Bankart lesion and the glenoid with the arm in 60° of internal rotation, neutral rotation, and 45° of external rotation was measured in biomechanical cadaver studies.<sup>43,46</sup> Miller and associates<sup>46</sup> reported no contact force with the arm in internal rotation, increased contact force as the arm passed through neutral rotation, and maximal contact force at 45° of external rotation.

Three randomized clinical trials<sup>42,44,45</sup> provided additional evidence that immobilization in external rotation can be beneficial. Itoi and associates studied 40 patients who after initial dislocation were randomly assigned for 3 weeks to conventional immobilization in internal rotation or immobilization in 10° to 30° of external rotation.<sup>44</sup> At a mean 15.5 month follow-up, 30% of the patients treated with internal rotation had a recurrence, compared with none of the patients treated with external rotation.<sup>42</sup> A much larger study by the same authors reported 2-year follow-up data on 198 patients with a primary anterior dislocation who were randomly assigned to 3 weeks of immobilization in internal rotation or external rotation.<sup>42</sup> The compliance rate was 53% in the patients treated with internal rotation and 72% in those treated with external rotation. Statistical analysis revealed that the recurrence risk was significantly lower for patients treated with external rotation (a 38.2% relative risk reduction). Among patients younger than 30 years, the relative risk reduction was even greater (46.1%).<sup>46</sup>

### ***Surgical Treatment***

The goal of open or arthroscopic surgical stabilization is to restore the native anatomy, typically by repairing the Bankart lesion or capsular injury. A substantial deficiency of the osseous or soft-tissue restraints, such as gross capsular deficiency or significant glenoid or humeral head bone loss, may require a nonanatomic repair to compensate for the deficiency and restore stability. The ultimate goal of any surgical intervention is to achieve a pain-free, stable shoulder with maximal preservation of the glenohumeral joint's range of motion.

### ***Is There a Role for Arthroscopic Lavage After Injury?***

Arthroscopic lavage after surgery is controversial. It has largely been abandoned because of improvements in arthroscopic technique that permit lavage with early surgical repair of a traumatic Bankart lesion.<sup>11,47-50</sup> The rationale for lavage is based on a prospective, randomized study of 30 patients in Sweden, which reported a lower rate of shoulder redislocation and a better range of motion in patients who were treated with arthroscopic lavage than in patients who were treated nonsurgically.<sup>50</sup> At 2-year follow-up, the recurrence rate was 20% in the patients treated with lavage, compared with 60% in those treated nonsurgically. However, te Slaa and associates<sup>16</sup> did not find arthroscopic lavage to have any benefit in 31 patients who underwent isolated arthroscopy without repair within 10 days of the dislocation.

### ***Should High-Risk Patients Receive Early Surgical Stabilization?***

Historically, primary anterior shoulder dislocation has been treated nonsurgically, and surgical stabiliza-

tion has been considered after a recurrence. This treatment was reported as the strategy used by most orthopaedic surgeons in the United Kingdom.<sup>51</sup> However, several studies have promoted the role of early surgical stabilization after primary dislocation.<sup>26-34,52-62</sup> Unlike traditional nonsurgical treatment, arthroscopic repair can directly treat the shoulder pathology and any associated ligament or capsule compromise. At 18- to 67-month follow-up, arthroscopic repair for traumatic anterior shoulder dislocation was found to be remarkably effective in reducing the risk of recurrence in high-risk populations; the rates of recurrence ranged from 4% to 17%.<sup>52-62</sup>

Substantial evidence indicates that among young, active male patients with a dominant-side first-time dislocation, the recurrence rate is extremely high. For groups of these patients who were younger than 20 years, McLaughlin and MacLellan<sup>39</sup> reported a 90% recurrence rate, and Rowe and associates<sup>23-25</sup> reported a 94% rate. Immediate surgical stabilization may be particularly attractive for these patients. Larrain and associates<sup>52,53</sup> compared young athletes treated either with arthroscopic repair or nonsurgically for acute anterior traumatic glenohumeral dislocation. In the surgically treated patients, the redislocation rate was only 4%, compared with 95% in the nonsurgically treated patients. Wheeler and associates<sup>13</sup> reported a 22% redislocation rate in West Point cadets after Bankart repair with an arthroscopically inserted staple. Arciero and associates reported a 14% failure rate in 36 military cadets who received surgical stabilization, compared with an 80% failure rate in the cadets who were nonsurgically treated.<sup>27,28</sup>



Several studies documented not only a reduced risk of recurrence after early stabilization, but also an improved quality of life and functional outcome. Edmonds and associates<sup>56</sup> and Kirkley and associates<sup>55,57-59</sup> reported on 40 patients younger than 30 years with a primary traumatic anterior shoulder dislocation who were randomly assigned to receive one of two treatments: immediate anterior stabilization followed by rehabilitation or immobilization for 3 weeks followed by rehabilitation. At an average 32-month follow-up, the patients treated with immediate arthroscopic stabilization had a statistically significant and clinically better quality of life than the patients treated with immobilization, as assessed using the WOSI.<sup>54-58</sup> At a mean 79-month follow-up of 33 patients, the surgically treated patients had minimal change, and the patients treated with immobilization had a slight improvement; the difference in scores was reduced from 16.5% to 11%.<sup>57</sup> Nonetheless, a small but clinically meaningful difference in the disease-specific quality of life persisted between the two patient groups. In prospective, randomized controlled trials by Bottoni and associates,<sup>60,61</sup> nonsurgical treatment was compared with acute Bankart repair after primary anterior shoulder dislocation in active-duty military personnel. All patients completed the same rehabilitation program and returned to full active duty. At an average 36-month follow-up, 75% of the nonsurgically treated patients had developed recurrent instability, compared with only 11% of the surgically treated patients. Both the L'Insalata Shoulder Rating Questionnaire and the Single Assessment Numeric Evaluation (SANE) scores at final follow-up were significantly better

in the surgically treated patients than in the nonsurgically treated patients ( $P < 0.002$ ). Jakobsen and associates<sup>62</sup> recently presented a level I prospective study of 76 patients who were randomly assigned either to nonsurgical treatment using a sling for 1 week followed by rehabilitation or to an open Bankart repair. At a minimum 2-year follow-up, 56% of the nonsurgically treated patients had experienced a recurrence, compared with only 3% of the surgically treated patients ( $P < 0.005$ ). At a 10-year follow-up, 72% of the surgically treated patients had a good or excellent result on the Oxford Self-Assessment Shoulder Score; 75% of the nonsurgically treated patients had an unsatisfactory result because of recurrence, instability, or chronic pain. Among patients who did not have recurrent instability, the nonsurgically treated patients had more subjective instability symptoms, as assessed using the load-shift and apprehension tests.<sup>62</sup>

A Cochrane Database Review provided an evidence-based evaluation of the role of early surgical stabilization after a primary traumatic anterior dislocation.<sup>63</sup> Five randomized, controlled studies were analyzed, including three published studies<sup>48,57,60</sup> and two conference abstracts.<sup>64,65</sup> Surgical and nonsurgical treatments were compared in 239 participants, most of whom were young, active males. The type of surgery (arthroscopic repair, open primary repair, or arthroscopic lavage) and the duration of sling immobilization and rehabilitation differed among the studies. The pooled results revealed that episodes of recurrent instability were significantly less frequent in surgically treated patients (relative risk, 0.20; 95% confidence interval, 0.11 to 0.33). Patient-rated function, as assessed

using the SANE, L'Insalata questionnaire, or the WOSI, was also more favorable in the surgically treated patients. Pooled results from the two arthroscopic repair trials revealed significantly less dissatisfaction with outcomes in the surgically treated group (relative risk, 0.21; 95% confidence interval, 0.07 to 0.64).<sup>60,64</sup> The systematic review concluded that, in a subpopulation of young, male patients, surgery significantly reduced the risk of recurrent instability. This finding retained its significance when the two unpublished trials were omitted. Although the studies used different assessment tools, the functional outcome scores were consistently and significantly higher in the surgically treated patients.<sup>63</sup>

The risk of progressive, irreversible intra-articular injury with recurrent instability episodes also provides support for early surgical stabilization after a first-time dislocation. Few studies have longitudinally followed patients with recurrent dislocation. However, greater glenoid and humeral bone loss, capsular attenuation, rotator cuff injury, and damage to the superior labral-biceps complex have been documented in patients with recurrent dislocation.<sup>61,66,67</sup> Although the normal glenoid is pear shaped, patients with recurrent dislocation develop an inverted pear-shaped glenoid because of significant bone and cartilage loss from the anteroinferior glenoid rim resulting from the repeated impact of the humeral head. The presence of an inverted pear-shaped glenoid can compromise the efficacy of an arthroscopic stabilization procedure.<sup>35-38</sup> Habermeyer and associates<sup>66</sup> documented the cumulative soft-tissue and bone damage that can occur with repeated episodes of shoulder instability.

Patients with the most instability episodes also had the most soft-tissue and bone pathology.<sup>61</sup> In an MRI study, Urayama and associates<sup>67</sup> found irreversible glenohumeral ligament attenuation and lengthening with recurrent instability episodes.

Larrain and associates<sup>52</sup> reported on the effectiveness of arthroscopy in treating acute or recurrent traumatic anterior shoulder instability in 204 rugby players. Arthroscopic examination was followed by open surgery in patients with a humeral deficiency larger than one fourth of the articular humeral head, a glenoid deficiency larger than 25% of the glenoid extension, capsular laxity with poor tissue quality, or a humeral avulsion of the glenohumeral ligament. Arthroscopic stabilization was possible in 98% of the patients with acute instability but only 77% of the patients with recurrent instability. Burkhart and De Beer<sup>35</sup> also reported a high failure rate after arthroscopic stabilization in the presence of significant bony deficiency. Yianakopoulos and associates<sup>68</sup> arthroscopically examined intra-articular shoulder lesions in 127 patients with acute or chronic traumatic anterior instability. A Hill-Sachs lesion was found in 112 (88%), a Bankart lesion in 106 (83%), a superior labrum anterior and posterior lesion in 26 (21%), and a humeral avulsion of the glenohumeral ligament in 2 (1.6%). The capsule was considered lax in 2 patients with acute instability (8.7%) and 31 patients with chronic instability (29.8%;  $P = 0.037$ ). Loose bodies were found and removed in 17 patients with chronic instability and 4 with acute instability. A partial-thickness articular rotator cuff tear was significantly more common in the patients with recurrent dislocation, as was an inverted-pear configuration of the

glenoid ( $P < 0.05$ ). No patient with an acutely dislocated shoulder had a deficient glenoid ( $P = 0.044$ ).

Immediate stabilization in the high-risk subgroup of young, active patients may lead to improved use of resources. Prevention of recurrent dislocation can minimize the costs to the patient and society of lost time from school, work, and sports. If the physician can make a more rapid, accurate decision regarding the need for surgery, testing and follow-up examinations can be minimized.<sup>69,70</sup> A cost-benefit analysis of early surgical intervention for a patient with a first-time dislocation remains to be defined.

#### *Is a First-Time Dislocation Analogous to an Anterior Cruciate Ligament Injury?*

During the past several years, sports medicine physicians have reached a consensus as to surgical reconstruction of a complete anterior cruciate ligament (ACL) tear in high-risk young, active patients.<sup>71-73</sup> The goal of this intervention is to restore the knee's ligamentous stability to protect the menisci and prevent impact loading of articular cartilage and subchondral bone during pivoting. Although longitudinal studies have not yet fully defined the natural history of ACL tears, it is believed that protecting the affected knee structures and restoring the normal anatomy may prevent the development of osteoarthritis in the knee.<sup>71-73</sup> Similarly, it remains unclear if recurrent shoulder dislocation precipitates secondary intra-articular injury and articular cartilage degeneration in the glenohumeral joint. However, early surgical stabilization may help prevent the glenoid and humeral bone loss, capsular attenuation, and rotator cuff tears that are commonly found in chronic dislocation.

Individualizing the patient's treatment is critical, whether the physician is treating an ACL tear or a first-time shoulder dislocation. A relatively inactive patient who is sedentary or does not participate in high-risk activities may not require surgical intervention. However, ACL reconstruction or arthroscopic Bankart repair is appropriate for young, active patients to minimize the risk of recurrence, expedite return to function, and minimize the risk of secondary intra-articular injury.

#### *Treatment of the Contact Athlete*

The risk of recurrent instability after a primary traumatic dislocation historically was believed to be greater in contact athletes than in noncontact athletes, although published studies are inconclusive on the prognostic significance of participation in a collision sport. Concern about an increased risk of recurrence has led to open Bankart repair as the preferred treatment of contact athletes.<sup>70,74-76</sup> Pagnani and Dome<sup>77</sup> recently reported that only 3% of American football players developed recurrent instability after open surgical repair. Cho and associates<sup>78</sup> reported a significantly increased risk of failure after arthroscopic stabilization in collision athletes compared with noncollision athletes. At a mean 62-month follow-up after arthroscopic stabilization in 14 collision-sport athletes and 15 noncollision-sport athletes, the Rowe and Constant functional outcome scores were equivalent, although the collision athletes had a substantially higher risk of recurrence than the noncollision athletes (28.6% and 6.7%, respectively).<sup>78</sup>

Several studies reported good outcomes and low rates of recur-



rence after arthroscopic stabilization in contact athletes. In a retrospective study of 13 collision and 5 contact athletes who underwent arthroscopic anterior shoulder stabilization for traumatic instability, Mazzocca and associates<sup>79</sup> found that only 2 patients, both collision athletes, had experienced a recurrent dislocation at a mean 37-month follow-up. No contact athletes had a recurrent dislocation. All of the patients in the study had returned to organized high school or college sports. Larrain and associates<sup>52</sup> reported 92% to 95% good or excellent results after arthroscopic stabilization in 204 rugby players with acute or recurrent traumatic anterior shoulder instability. Bacilla and associates<sup>80</sup> found recurrent instability in only 7% of 40 high-risk patients after arthroscopic Bankart repair with suture anchor fixation; 29 of 32 patients returned to sports activity at the same or a higher level. Ide and associates<sup>81</sup> found no difference in the recurrence rates of contact athletes and noncontact athletes after arthroscopic stabilization.

Boileau and associates<sup>38</sup> evaluated the outcomes of arthroscopic Bankart repair using suture anchors in 91 consecutive patients with recurrent anterior shoulder instability, 40 of whom participated in high-risk sports activities. At a mean 3-year follow-up, 14 patients (15.3%) had recurrent instability. Multivariate analysis revealed that the risk of postsurgical recurrence was significantly related to the presence of a bone defect, on either the glenoid side (a glenoid compression-fracture involving more than 25% of the glenoid surface;  $P = 0.01$ ) or the humeral side (a large Hill-Sachs lesion;  $P = 0.05$ ). Recurrence of instability was also significantly higher in patients with

inferior shoulder hyperlaxity ( $P = 0.03$ ) or anterior shoulder hyperlaxity ( $P = 0.01$ ). The number of suture anchors had prognostic significance; patients who had three or fewer anchors were at higher risk of recurrent instability than those with four or more anchors ( $P = 0.03$ ). The patient's age at the time of initial dislocation, gender, or type of sports activity did not influence the recurrence rate.<sup>38</sup>

### Summary

The treatment of a first-time anterior shoulder dislocation is complex and challenging. It must be individualized by considering patient age, occupation, functional demands, sports participation, physical characteristics, compliance, and expectations. The limited evidence available from randomized, controlled trials supports the use of early surgical stabilization for high-risk young adults who engage in demanding physical activities after a primary traumatic anterior dislocation. The value of early or prophylactic stabilization has not been established for patients who do not have a high risk of recurrence.

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