

## Posterior and Multidirectional Instability of the Shoulder

Andrew D. Heinzlmann, MD  
Felix H. Savoie III, MD

### Abstract

*The shoulder is an inherently unstable joint that is subject to different patterns of instability. Determining the direction of subluxation that is causing the patient's symptoms can be difficult. Although posterior and multidirectional instability share many characteristics, they have different etiologies and treatment requirements. Multidirectional instability was first described in 1980 by Neer and Foster, but the continuing lack of a consistent definition for the condition contributes to difficulty in both diagnosis and treatment. Posterior instability has been more precisely defined, but the diagnosis nonetheless can be difficult. For most patients with either condition, rehabilitation and bracing are the preferred treatment. If nonsurgical treatment is unsuccessful, arthroscopic treatment can provide a satisfactory result.*

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Two layers provide the shoulder with its stability. The inner layer is composed of the capsule, labrum, and ligaments. The outer layer is the rotator cuff musculature. However, the shoulder is an inherently unstable joint having laxity in all directions. By definition, instability is symptomatic laxity in one or more directions.<sup>1-3</sup> Instability in the shoulder most commonly is anterior and is the result of traumatic injury. The primary direction of instability sometimes is posterior. Symptomatic subluxation in a posterior direction can follow trauma that causes a posterior Bankart or reverse humeral avulsion of the glenohumeral ligaments (HAGL).<sup>4-6</sup> Posterior subluxation also can be related to unidirectional laxity that suddenly becomes symptomatic. Symptomatic subluxation

in more than one direction often is called multidirectional instability (MDI),<sup>7-10</sup> which can be defined as inferior instability in combination with anterior instability, posterior instability, or both. MDI most often occurs in a shoulder with laxity in multiple directions that suddenly becomes symptomatic in one or more directions because of muscle imbalance and loss of awareness of the shoulder's position in space.

### Posterior Instability

Posterior instability can have a multifactorial etiology. Acute trauma may damage the posterior capsulolabral complex and lead to posterior instability. Similar damage can result from repetitive stress in a posterior direction. Dysfunction of the anterosuperior capsulolabral complex

accompanies the instability and must be corrected as part of any surgical intervention.

The ability to voluntarily subluxate the shoulder posteriorly was formerly believed to be associated with attention-seeking behavior or mental illness. However, this ability was found to be common among people who are healthy.<sup>11,12</sup> Persistent voluntary posterior subluxation can lead to pathologic changes in the capsule, causing pain and involuntary posterior instability.

### Pathology

No single factor is responsible for posterior instability. Avulsion of the posterior capsulolabral complex and the associated posterior band of the inferior glenohumeral ligament can occur as a result of a traumatic injury. A similar avulsion of the lateral attachment is called a reverse HAGL.<sup>4</sup> Less commonly, the mid-substance area of the capsule splits. Laxity in the posterior capsule and ligaments can develop as a result of repetitive microtrauma or congenital laxity. In patients with either congenital laxity or repetitive microtrauma, symptomatic instability develops as the rotator cuff and periscapular muscles lose the ability to compensate for the laxity.

A lesion of the anterosuperior area of the shoulder usually causes

symptomatic laxity. The lesion may take the form of an avulsion of the anterosuperior labrum, a split in the superior glenohumeral ligament, or a stretching of the rotator interval and associated coracohumeral ligament. Harryman and associates<sup>13</sup> found that transection of the coracohumeral ligament produced an increase in inferior and posterior subluxation. Careful posterior and inferior arthroscopic inspection reveals damage in patients with recurrent posterior instability.

### **Clinical Evaluation**

The evaluation of a possibly unstable shoulder always should begin with a history of the symptoms. It is important to identify the first occurrence of subluxation as well as the first occurrence of shoulder pain. The exact location and timing of instability episodes, the nature of any behavior that exacerbates the condition, and any use of bracing or other treatment should be determined.

The physical examination should begin with an assessment of the patient's posture. Voluntary posterior subluxation requires the patient to protract the scapula so that the shoulder can slide posteriorly. It is almost impossible for a patient with a completely retracted scapula to have posterior instability. The posterior load-and-shift test (supine examination with subluxation of the humeral head posteriorly on the glenoid after adduction and internal rotation) should produce a positive result and reproduce the patient's sensation of instability. The push-pull test also can be used.<sup>7,8</sup> It is important to check for a sulcus sign with the patient erect and the arm in abduction, adduction and neutral rotation, and adduction and external rotation. The patient should be examined for an anterosuperior labral

tear or weakness in the supraspinatus during scapular protraction or retraction.

Although posterior instability usually is not visible on radiographs, axillary and lateral scapular radiographic views should be evaluated. Glenoid version is best evaluated with a CT scan. Arthrographic MRI or CT often provides more information than nonarthrographic MRI or CT and should be obtained if possible.

### **Nonsurgical Treatment**

Posterior instability usually responds to rehabilitation.<sup>14</sup> The most important objectives of rehabilitation for posterior instability are for the patient to control scapular position and regain awareness of the position of the entire shoulder girdle. Rehabilitation should begin with bracing and taping to hold the shoulder in retraction. A fixed scapular brace can be used for 1 to 2 hours per day in combination with McConnell scapular retraction taping twice per week and a commercial scapular retraction brace for as long as 4 hours per day. During all exercises, the therapist monitors the position of the scapula. As positional awareness improves, the exercise program is advanced to plyometrics, proprioceptive neuromuscular facilitation, and integrated rehabilitation, as described by Rubin and Kibler.<sup>15</sup>

### **Surgical Treatment**

The primary indications for surgery are pain, functional impairment, and failure of an adequate rehabilitation program. Several types of pathologic anatomy can be surgically treated in a shoulder with posterior instability.

### **Posterior Bankart Lesion**

Most posterior Bankart lesions are caused by trauma. The surgical

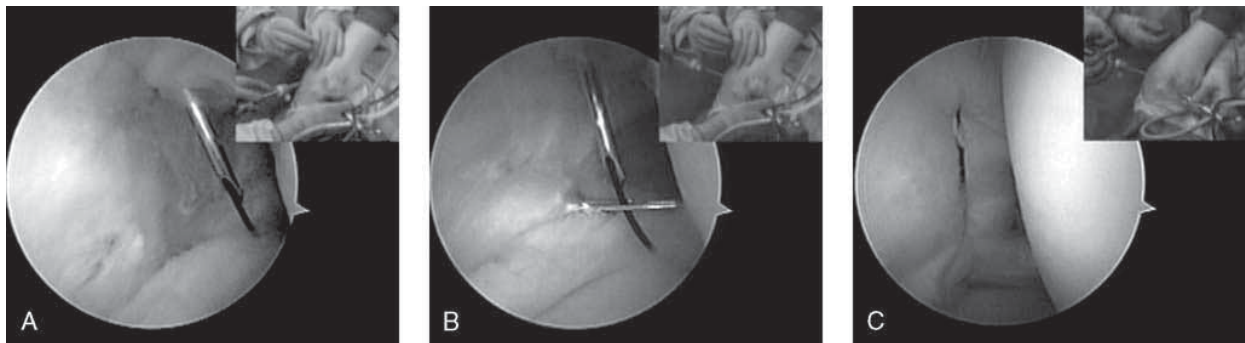
treatment is similar to that of an anterior Bankart lesion. It is important to establish a lateral and slightly inferior posterior portal because the standard posterior portal does not allow adequate mobilization of the capsule or proper orientation of the instrumentation for suture anchor placement. An anteroinferior cannula can be placed to assist with suture management, and an anterosuperior portal can be used for viewing. The posterior labrum and ligaments are freed from the underlying bone to or beyond the 6-o'clock position (Figure 1, A). A dual-loaded suture anchor is placed at the 5-o'clock position. The sutures are retrieved in vertical mattress fashion through the capsule and labrum to allow both direct repair and capsular plication. The first set of sutures is retrieved through the 6-o'clock area of the capsule, and the second set is retrieved through the capsule near the 5-o'clock position. A second dual-loaded suture anchor is placed at the 3-o'clock position, and the sutures are retrieved through the capsule at the 4-o'clock and 3-o'clock positions (Figure 1, B and C). A capsular plication stitch is added, and a needle retriever technique is used to close the posterior portals. The arthroscope is then placed posteriorly above the repair for the rotator cuff interval to be closed or the anterosuperior labrum repaired.

### **Posterior Laxity**

A patient with severe posterior laxity often has a very thin capsule, and the infraspinatus muscle can be seen through the capsule. Although inferior capsular plication may be effective, plication of both the capsule and infraspinatus tendon is more likely to stabilize shoulders with a very thin capsule. The technique in-



**Figure 1** Repair of a posterior Bankart lesion, viewed from an anterosuperior portal and working from a posterior portal. **A**, The posterior labrum freed to the 6-o'clock position. **B** and **C**, The second dual-loaded suture anchor placed in the 3-o'clock position, with sutures through the capsule at the 4-o'clock and 3-o'clock positions, respectively.



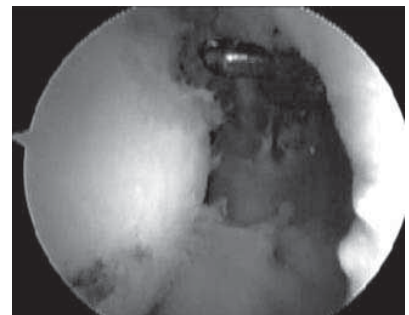
**Figure 2** Repair of posterior laxity, viewed from an anterosuperior portal and working from a posterior portal. **A**, A spinal needle placed through the lateral insertion of the infraspinatus tendon and the capsule. **B**, The suture retrieved through the medial capsule using a retrograde retriever. **C**, Plication of the capsule and infraspinatus tendon in the inferolateral-to-superomedial direction.

involves placing a spinal needle into the joint through the lateral insertion of the infraspinatus tendon and the capsule (Figure 2, A). The area of capsule and tendon medial to the needle is perforated or rasped to stimulate a healing response. A polydioxanone lead suture (size 1) is placed through the needle into the joint and retrieved with a retrograde retriever through the medial capsule and tendon superior to the needle insertion site (Figure 2, B). The polydioxanone suture can be used to pull a nonabsorbable suture along its path. The suture ends are retrieved into a cannula in the subacromial bursa and are tied to plicate the capsule and tendon together in an inferolateral-to-superomedial

direction (Figure 2, C). Additional sutures are placed through these structures until stability is achieved. The repair is completed by a wide plication of the rotator cuff interval using a similar needle retriever technique.

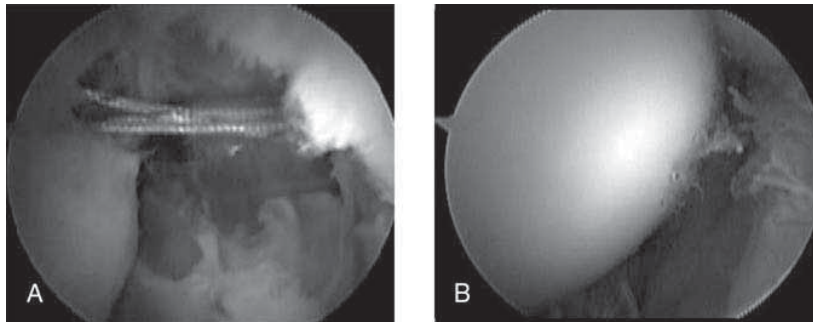
**Reverse HAGL**

A reverse HAGL lesion is viewed through an arthroscope placed in the superior portal (Figure 3). Usually the infraspinatus tendon is intact, and only the capsule is avulsed. The bare spot of the humerus and the normal capsule attachment site are lightly abraded. A rotator cuff anchor is placed into the humeral head at the most lateral aspect of the injury (Figure 4, A). The four limbs



**Figure 3** A reverse HAGL lesion viewed from an anterosuperior portal and working from a posterior portal.

of the sutures are retrieved through the lateral capsule using a retrograde retriever, and the capsule is repaired to the prepared bone bed (Figure 4, B).



**Figure 4** Repair of a reverse HAGL lesion, viewed from an anterosuperior portal and working from a posterior portal. **A**, Rotator cuff anchor placement. **B**, Final repair.

### Postsurgical Rehabilitation

A gunslinger-type brace or an abduction sling is used, depending on the quality of the capsule found during the surgical procedure. Bracing is used for the first 4 weeks after surgery, and only scapular retraction exercises are performed. Pain-free physical therapy is then initiated, emphasizing scapular positioning and control. Passive stretching, cross-chest adduction, and forced internal rotation are not used for at least 3 months after the surgery. As core and scapular strength improve, integrated rehabilitation exercises are added as tolerated. Extended push-ups and bench press activities are restricted until normal scapular control and core strength are achieved, usually after 3 to 6 months. Most patients can safely return to normal activities within 4 to 6 months after the reconstruction.

### Results

Savoie and associates<sup>16</sup> recently reported an overall success rate of 96% after 102 posterior reconstruction procedures using an anatomy-specific protocol. The risk of failure increased if the rotator cuff interval was not closed. Bradley and associates<sup>17</sup> reported a technique used for posterior reconstruction in 91 ath-

letes, with an 89% return-to-sport rate. These outcomes are favorable compared with those reported after open reconstruction.

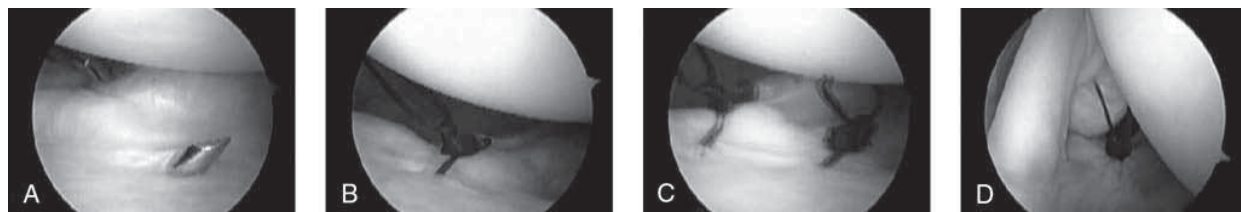
### Multidirectional Instability Pathology and Clinical Evaluation

A shoulder with symptomatic laxity in more than one direction can be described as multidirectionally unstable. Neer and Foster<sup>7</sup> first described MDI in 1980; however, the exact definition of MDI is unclear and classifying shoulders with MDI remains difficult. Lippitt and associates<sup>18</sup> described one type of shoulder instability as atraumatic, multidirectional, often bilateral, responding to rehabilitation, and rarely requiring inferior capsular shift (AMBRI).<sup>19</sup> Patients with AMBRI have laxity of multiple joints, including the fingers, elbows, and ankles. A second type of MDI is related to overuse; many patients in this group are swimmers, gymnasts, or other athletes who develop laxity because of repetitive stress. A third type of MDI results from multiple injuries to different areas of the shoulder. Considerable overlap in the three types of MDI leads to confusion in classification and treatment.

The most common physical finding in symptomatic MDI is a loss of spatial awareness of the shoulder.<sup>20</sup> Most patients have a painful, protracted shoulder, commonly originating in an inflamed rotator cuff. The patient's periscapular and core strength musculature is out of balance, and a relatively small injury or activity can cause an inflammatory response in the rotator cuff. Because the ligaments are providing little or no inherent stability, the inflammation leads to weakness and a lack of stability. The shoulder repeatedly becomes subluxated at rest and during activity. Loss of normal scapulothoracic tracking removes the base from which the rotator cuff normally stabilizes the shoulder.<sup>10,21</sup> The entire kinetic chain is disrupted, and the result is a cycle of inflammation leading to weakness, weakness leading to increased subluxation, and increased subluxation producing more inflammation. The inflammation leads to greater scapulothoracic malpositioning, causing both positional and functional weakness.

### Nonsurgical Treatment

Nonsurgical treatment is recommended for patients with MDI.<sup>22</sup> Neer and Foster believed that surgery was indicated only after 1 year of unsuccessful physical therapy,<sup>7</sup> and Lippitt and associates<sup>21</sup> also believed that MDI should be treated nonsurgically. The key to successful nonsurgical treatment is to begin by controlling pain and stabilizing the scapula. A combination of static and dynamic bracing with taping may be required to improve the position of the scapula and spatial awareness of the shoulder. Control of inflammation may require steroid injections, cryotherapy, and both oral and topical anti-inflammatory drugs. When an adequate scapular position has



**Figure 5** Reconstruction for MDI. **A**, Placement of a suture hook through the inferior capsule. **B**, Inferior capsular shift after tying of the initial plication stitch. **C**, Completed inferior capsular shift. **D**, Rotator interval closure. **A** through **C** are viewed from an anterosuperior portal, working from a posterior portal. **D** is viewed from a posterior portal, working from an anterior portal.

been achieved, rotator cuff strengthening and periscapular stabilization exercises can begin. Integrated rehabilitation exercises are added as scapular control improves. Plyometric and sport-specific conditioning exercises continue until normal function is restored. A successful return to normal activities must include a maintenance program for shoulder balance.

### **Surgical Treatment**

If adequate rehabilitation including scapular stabilization fails to restore stability, surgical intervention may be considered. Other indications for surgery are continuing pain and functional impairment. In true MDI, the most important surgical objectives are correction of inferior capsule laxity and widening of the rotator cuff interval.<sup>23</sup> The labrum often is atrophic, and anchor stabilization rather than simple suture plication may be required. Because the posterior capsule may be extremely thin, the surgeon may need to include the infraspinatus tendon in posterior sutures to provide adequate stability.

The procedure begins with examination under anesthesia and documentation of the degree and direction of subluxation in neutral position, internal rotation, and external rotation. The capsular laxity is confirmed via

diagnostic arthroscopy. Capsulolabral tearing and midsubstance or humeral injuries also should be identified. If none of the inspected areas appears to be torn, the surgeon proceeds with reconstruction. A shaver is placed through the anterior portal, and the capsule is abraded and perforated along the attachment to the labrum to create a healing surface. A suture hook or retriever is placed through the inferior capsule at the 6-o'clock position at the lateral end of the valley of the capsule (Figure 5, *A*). The hook is pulled superiorly to the 5-o'clock position or beyond and is passed between the labrum and the glenoid. If the glenoid labrum is detached, the suture should be replaced with an anchor. If the labrum-bone interface is stable, the two ends of the suture are tied, shifting the capsule in a superior and medial direction (Figure 5, *B*).

The inferior capsule shift is continued superiorly until the anterior laxity is eliminated (Figure 5, *C*). The arthroscope is then placed anteriorly, and the posterior capsule is plicated in a similar fashion. If the posterior capsule is too thin to hold a suture, plication sutures are placed to include the infraspinatus tendon.

The arthroscope is placed once again into the posterior portal, and the rotator cuff interval is plicated (Figure 5, *D*). Usually a wide plica-

tion is necessary and includes the coracohumeral ligament to decrease posterior and inferior instability. A needle retriever technique is used for this purpose, beginning laterally and including both layers of the rotator cuff interval. The anterior edge of the supraspinatus and the superior edge of the subscapularis muscles may be included if there is severe capsular atrophy. Additional sutures are added until the arm (held in 90° of external rotation) begins to internally rotate.

### **Postsurgical Rehabilitation**

The shoulder is immobilized in a gunslinger-type brace or an abduction sling for 6 weeks after surgery. Scapular repositioning exercises are done with the shoulder in the brace and when the brace is removed for bathing or dressing. Active-assisted range-of-motion exercises are performed at home beginning 4 to 6 weeks after the surgery. In addition, 6 weeks after surgery, gentle physical therapy emphasizing scapular retraction and awareness of the shoulder's position in space is initiated. Static and dynamic bracing and scapular taping often are useful during this phase of rehabilitation.

The therapist is not allowed to stretch the shoulder during the first 6 months after surgery, and stretching seldom is necessary in patients

with MDI. After 3 months, rehabilitation should include overhead exercises and progressive strengthening, with continued progression of core strengthening and periscapular exercises. Scapular position must be continually monitored to maintain a retracted, balanced position. After 4 to 6 months, functional rehabilitation and sport-specific conditioning can begin, with continued progression of integrated rehabilitation. The patient is allowed to resume normal activities as tolerated.

### Results

Since the original report of Duncan and Savoie,<sup>24</sup> numerous authors have documented the success of arthroscopic treatment of MDI. Treacy and associates,<sup>25</sup> Hewitt and associates,<sup>26</sup> and Lyons and associates<sup>27</sup> have reported success rates higher than 85% at long-term follow-up in large groups of patients. Duncan and Savoie<sup>24</sup> reported on seven consecutive patients with involuntary MDI treated with arthroscopic inferior capsular shift. At an average follow-up of 16 months, the average postoperative Bankart score was 90 (range, 75 to 100), with all patients graded as satisfactory using the criteria of Neer. Treacy and associates<sup>25</sup> reported on 25 patients treated with a transglenoid technique. At an average follow-up of 60 months, the average postoperative Bankart score was 95 (range, 50 to 100) with a satisfaction rate of 88% according to Neer's criteria. Lyons and associates<sup>27</sup> reported on 26 patients at 2-year follow-up after laser capsulorrhaphy and found that 96% were stable and 86% returned to their previous level of sports participation. Hewitt and associates<sup>26</sup> reported a success rate higher than 85% at long-term follow-up of a large series

of patients treated with pancapsular plication.

### Summary

Although posterior and multidirectional instability share many characteristics, they have different etiologies and require different treatments. Most patients should be nonsurgically treated with bracing and therapy. If nonsurgical treatment is unsuccessful, arthroscopic surgery provides a satisfactory result for most patients.

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