Posterior Shoulder Instability in Athletes

Christopher B. Song, MA
Hassan Farooq, MD
Emily Kirillov, BS
Shreya M. Saraf, MS
John Miller, MD
Mary K. Mulcahey, MD

Investigation performed at Stritch School of Medicine, Chicago, Illinois

Abstract

» Posterior shoulder instability (PSI) constitutes approximately 10% of all shoulder instability cases and is prevalent among contact sport athletes because of recurrent blunt trauma to the shoulder.

» PSI presents as persistent pain and can be diagnosed using clinical tests such as the Kim test and the Jerk test.

» Surgical intervention is recommended for athletes who have exhausted nonoperative treatment. Shoulder arthroscopy with posterior labral repair is the primary surgical treatment for PSI, with the goal of mitigating risk for recurrent instability and persistent pain.

» The primary objective of this review was to discuss the relevant literature regarding the etiology, diagnosis, treatment, and rehabilitation for PSI.

Posterior shoulder instability (PSI) is prevalent among contact sport athletes, especially those performing repetitive overhead activity such as in football, baseball, and weightlifting[1]. Athletes experiencing PSI may report pain, weakness, and a sensation of the shoulder "giving out," which can affect not only their athletic performance but also their overall quality of life. White et al. first described PSI in 1741, and in 1952, Dr. McLaughlin documented the wide spectrum of PSI: from locked posterior shoulder dislocations to recurrent posterior subluxation[2,3]. Hawkins et al. later clarified that posterior shoulder dislocations occur less frequently than subluxations[4]. PSI in the young and active population accounts for up to 2% to 10% of all shoulder instability events treated surgically, influenced by the rising popularity of several contact sports and weightlifting[5,6]. Because of the paucity of literature and rarity of the condition, it is often misdiagnosed and therefore may be treated inappropriately[7]. The primary aim of this review was to discuss the relevant literature regarding the etiology, diagnosis, treatment, and rehabilitation for PSI.

Etiology

Although the etiology of PSI is often multifactorial, it is proposed to result from acute traumatic events, atraumatic causes, and repetitive microtrauma[5]. Of these theories, repetitive microtrauma is the most prevalent inciting cause of PSI in athletes[1]. Contact sport athletes, like football players, can experience repetitive microtrauma from blocking with an outstretched arm. Athletes involved in contact sports who sustain a clear posterior shoulder dislocation from 1 significant traumatic incident may develop a locked, posteriorly dislocated shoulder that needs to be manually or surgically reduced[8]. By contrast, athletes who experience instability because of repetitive overhead motion or microtrauma to the posterior capsule are more likely to encounter recurrent posterior shoulder subluxation, where the humeral head does not fully dislocate. Repeated stress on the glenohumeral joint can tear or stretch the posterior capsule, eventually resulting in

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persistent PSI[8]. Other mechanisms among athletes that increase the propensity for PSI have also been described, for example, when a gymnast performs a dip on a bar or when a boxer internally rotates their shoulder during a punch. In these scenarios, the recurrent trauma to the shoulder fatigues the dynamic stabilizers leading to PSI. In addition, athletes with pre-existing shoulder instability also face a higher risk of subluxation or dislocation as they rely more heavily on their static stabilizers while still demanding a wide range of motion from the shoulder. Furthermore, a stark dislocation of the shoulder will cause damage to the posterior capsule and can lead to repeated instability events.

Patients with bony abnormalities such as glenoid dysplasia, even those without a history of trauma, may suffer from PSI and accelerated degenerative joint disease. These bony abnormalities include a rounded J-shape and a delta-shape variety[9]. The delta- and round-shaped variations reduce the concavity of the inferior glenoid margin, increasing the risk of posterior glenohumeral instability[9,10]. There are other bony abnormalities and lesions that can lead to PSI. Excessive retroversion of the glenoid, because of a developmental deformity, can arise from an abnormal posterior angulation of the articular surface of the glenoid. This deformity can complicate shoulder reduction, increase the risk of PSI, and lead to a greater risk of labral tears.

History and Physical Examination

During the clinical assessment of patients, orthopaedic surgeons need to make a distinction between posterior shoulder laxity and PSI. While athletes frequently manifest joint laxity, characterized by an increased range of motion and joint translation, they often remain asymptomatic without subjective complaints such as pain or apprehension[11]. These patients exhibit joint laxity without concomitant instability. Conversely, the diagnosis of shoulder instability necessitates the presence of pain, discomfort, or apprehension, with shoulder translation beyond normal limits[12].

In 2006, Bradley et al. investigated the failure rate of 100 athletes with unidirectional recurrent posterior instability treated with arthroscopic posterior capsulolabral reconstruction and found failure rate to be mostly attributed to the misdiagnosis of PSI[13]. Patients were assessed pre- and postoperatively using the American Shoulder and Elbow Surgeons (ASES) scoring system[14]. The ASES scoring system is a standardized form that assesses shoulder function from 0 to 100, with 0 being the lowest level of shoulder function and 100 being the highest level of shoulder function[14]. Overall stability, strength, and range of motion were reported. The cohort was divided into contact (football and wrestling) and noncontact (baseball, softball, and swimming) athletes, which consisted of 77 males and 23 females ranging from all levels of competition (recreational to professional). Of the 100 shoulders evaluated, 9% was deemed failures based on the ASES scoring system. Of the patients studied, 11% failed clinical stability tests, and 8% reported dissatisfaction with the surgery, stating that they would not choose to undergo the procedure again. The most common cause for failures was diagnostic error. Overall, 62.5% of patients showed signs of inferior or multidirectional instability during revision surgery, and it appeared that these patients likely did not present with isolated PSI at the time of their initial surgery[13]. Understanding how to diagnose PSI may lead to overall better treatment and recovery of athletes.

Furthermore, understanding the differences between anterior shoulder instability and PSI may help in correctly diagnosing patients. A 2021 study by Teske et al. found differing complaints and disabilities between athletes diagnosed with anterior shoulder instability and PSI[15]. The authors demonstrated that anterior shoulder instability, which is often caused by a traumatic event, is primarily characterized by sensations of the shoulder "giving out" and by the presence of significant functional limitations. These patients usually show marked recovery with either nonoperative or operative management. On the other hand, PSI, which is less commonly observed, tends to present primarily as persistent pain linked to repetitive or chronic stress, rather than a single traumatic episode. As a result, patients with PSI frequently report lower satisfaction and more modest improvements after treatment[15]. Gender differences may also contribute to the difficult nature of diagnosing PSI. A 2009 study by Owens et al. examined 4,080 glenohumeral instability events between the years 1989 and 2004 in National Collegiate Athletic Association collegiate athletes[16]. Female athletes exhibited unique injury mechanisms compared with their male counterparts, with a higher propensity for sustaining shoulder dislocations through contact with objects or the ground, as opposed to male athletes whose injuries often resulted from contact with other players[16].

Physical examination of the shoulder includes visual inspection, palpation, and assessment of the active and passive range of motion. Patients often exhibit tenderness to palpation over the posterior joint line, which may be related to synovitis resulting from recurrent episodes of instability[12]. It is critical for surgeons to consider a posterior subacromial dimple as a unique sign of PSI as it was found to be 92% specific and 62% sensitive[17]. These dimples are small indentations found on the back of the shoulder, positioned roughly 1 cm inferiorly and medially from the acromion's posteromedial edge[17]. Additional provocative maneuvers can help determine the direction of instability. One such maneuver, the sulcus sign, involves applying a downward force on the shoulder while the arm is adducted at the side with neutral rotation. Inferior instability is a possibility with a translation more than 2 cm[18]. Furthermore, there are multiple tests that can be performed to give a more definitive diagnosis for PSI such as the Kim and Jerk tests (Table I). The Kim test is used to detect a posteroinferior labral lesion and consists of

TABLE I Physical Examination of Posterior Shoulder Instability

Test	Procedure/Method	Positive Findings
Jerk test	With the patient seated, abduct the shoulder to about 90° and internally rotate it. Apply an axial load along the humerus, and then slowly adduct the arm	A sudden "jerk" or clunk is felt, often accompanied by pain
Kim test	With the patient standing, flex the shoulder to 90° while keeping the elbow flexed at 90°. Apply a combined axial load and a downward-posterior force on the humerus as the arm is elevated	Pain and a clicking sensation during the maneuver
Sulcus sign	With the arm adducted at the side and held in neutral rotation, apply a downward force on the shoulder	A visible or palpable sulcus below the acromion; translation exceeding 2 cm suggests abnormal laxity

These tests should be clinically correlated with the patient's history and other findings to confirm diagnosis of posterior shoulder instability or related pathologies.

having the patient seated with their arm abducted to 90°. The examiner then stabilizes the elbow and the lateral side of the proximal arm while applying a firm axial load. After this, upward, downward, and backward forces are exerted on the shoulder while it is raised 45°[18]. A sudden onset of posterior shoulder pain, with or without a posterior clunk of the humeral head, indicates a positive test result. The Jerk test is used to detect posterior-inferior instability of the glenohumeral joint. While stabilizing the patient's scapula with 1 hand and positioning the affected arm in a 90-degree abduction and internal rotation, the examiner holds the elbow while applying an axial load to the humerus. The arm is then adducted across the body[20]. A positive test is indicated by a sudden clunk as the humeral head slips off the back of the glenoid, and a second jerk may occur as the humeral head returns to the glenoid[20]. In a study by Kim et al., when combined with the Jerk test, the Kim test was found to be 97% sensitive for detecting a posteroinferior labral lesion, resulting in instability[19].

Diagnostic Imaging

Athletes with PSI typically do not complain of symptoms of instability. Rather, their most common complaint is pain. Initial evaluation should include a comprehensive set of radiographs (true AP, scapular Y, and axillary lateral)[8]. Radiographs allow for the evaluation of osseous irregularities and traumatic injuries (e.g., reverse osseous Bankart, reverse Hill-Sachs, Bennett lesions, anterior or posterior translation/dislocation, excessive glenoid retroversion, fracture/erosion of posterior glenoid, anteroinferior glenoid rim abnormalities, and glenoid dysplasia). The West Point axillary lateral view, a modified radiographic projection, evaluates the anteroinferior glenoid rim for bony Bankart lesions, while the Stryker notch view assesses the posterolateral humeral head for Hill-Sachs lesions[21]. In addition, specialized views like the Bennett view evaluate for specific conditions such as the Bennett lesion (a bony spur on the posteroinferior glenoid rim) and posterior osteophytes[22]. Finally, the Bernageau view is highly reliable as a way to evaluate the glenoid profile of both the anterior and posterior aspects of the glenoid[23]. In addition, this radiographic view demonstrates a good correlation with glenoid bone loss on cross-sectional imaging[23].

Other imaging techniques are also useful in diagnosing PSI. Computed tomography (CT) plays a pivotal role in assessing bone irregularities and facilitating preoperative planning in instances of significant bone damage, necessitating internal fixation or bone grafting. Notably, CT imaging seems to be the best imaging modality in evaluating the size of reverse Hill-Sachs lesions because of the ability to detect the percentage of humeral articular cartilage involvement[24]. Moreover, CT scans aid in evaluating glenoid hypoplasia or version abnormalities in cases involving atraumatic instability. A magnetic resonance arthrogram (MRA), on the other hand, allows for a clearer evaluation of labral tears and is often used in practice. Labral tears can be seen on MRAs as contrast material entering abnormal spaces such as the labral junction (Fig. 1). There is often debate on whether MRA is more beneficial over conventional magnetic resonance imaging (MRI) for athletes with posterior shoulder pain or instability[25]. In a recent study conducted by Rixey et al., the authors found that MRA has a sensitivity of 84% and a specificity of 88% when identifying posterior labral tears[26]. In a 2006 study by Magee and Williams, the authors found that 3.0 T MRI has a sensitivity of 86% and a specificity of 100%; however, only 6 of the 7 posterior labral tears at arthroscopy were seen on MRI[27].

Treatment of PSI

Physical therapy is often the initial treatment of choice for patients with PSI to strengthen the muscles surrounding the shoulder and restore functional range of motion, which is described in detail in the "Rehabilitation" section. If a patient's symptoms do not improve with nonoperative treatment, surgical intervention should be considered[6].

Shoulder arthroscopy with posterior labral repair is the most common procedure performed for the treatment of PSI (Figs. 2-A, 2-B, and 2-C).

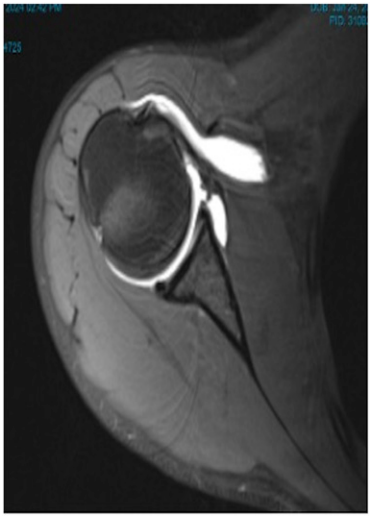

Fig. 1

Axial T2 image of the magnetic resonance arthrogram of a left shoulder demonstrating a posterior labral tear.

Operative treatment of PSI reduces the risk of recurrent instability and persistent pain compared with nonoperative treatment. It is important to note that operative treatment is usually offered to athletes who fail extensive physical therapy protocols and have tried nonoperative treatment for 6 months although a decision to proceed with operative treatment should be made on a case-by-case basis[6,28]. Arner et al. studied 56 American football players and found that arthroscopic capsulolabral repair for these players leads to a return rate of 93%, with 79% of players returning to their same level of play[29]. In this case, if an athlete were to endure an injury at the end of the season, earlier surgical intervention might be warranted to facilitate a quicker return to play protocol for the athlete. Rothrauff et al. performed a long-term study examining arthroscopic capsulolabral repair for PSI[6]. The authors evaluated a cohort of 183 patients (200 shoulders) who underwent arthroscopic capsulolabral repair for PSI between 1998 and 2009. These patients were all athletes at all levels and included contact and noncontact sports such as lacrosse, ice hockey, football, wrestling, martial arts, swimming, golf, or basketball. The authors found that arthroscopic capsulolabral repair for PSI resulted in persistent long-term improvements in shoulder pain, stability, and function at a mean follow-up of 15.4 years. Consequently, throwing athletes typically demonstrated lower sport-specific shoulder function both before and after surgery, as assessed by the Kerlan-Jobe Orthopaedic Clinic score, and experienced lower return-to-sport rates in comparison with nonthrowing athletes[6]. However, a 2019 study by Kercher et al. reviewed the outcomes of arthroscopic posterior labral repair of baseball players with a minimum 2-year follow-up and found high return to play rates[30]. A total of 32 male athletes without previous ipsilateral shoulder surgery were evaluated, demonstrating that 94% of baseball players returned to play and 61% returned to their previous level of play[30]. The authors also found a high satisfaction rate of 94%[30]. Overall, arthroscopic posterior labral tear repair showed benefits in athletes; however, it should be noted that this study was only performed on baseball players.

If the cause of PSI is traumatic, patients usually have better outcomes with operative treatment and postoperative physical therapy[31]. The therapy protocol should consist of strengthening the dynamic stabilizers of the shoulder, the subscapularis muscle, the pectoralis major muscle, periscapular muscles, and the long head of the biceps tendon, and proprioceptive exercises[10]. In 2022, Lee et al. evaluated long-term outcomes of nonoperative management of PSI and found that increased pain at final follow-up is more common in athletes treated nonoperatively than those who underwent operative management[32].

In cases with excessive glenoid bone loss or anatomic abnormalities,

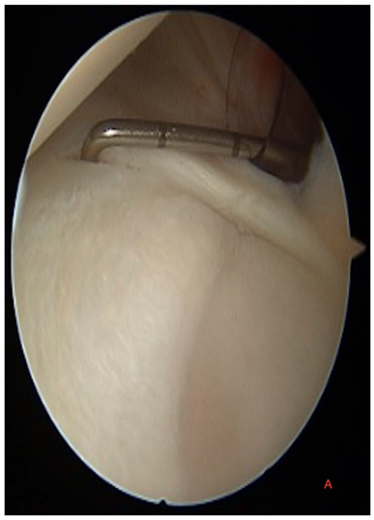

Fig. 2-A

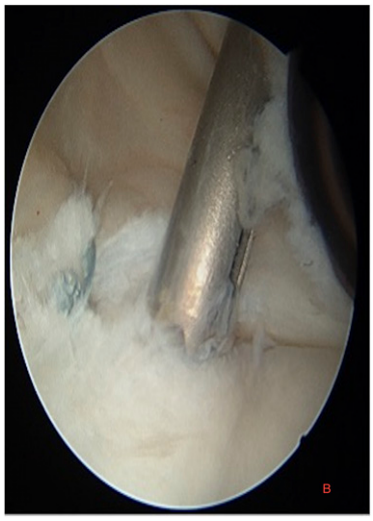

Fig. 2-B

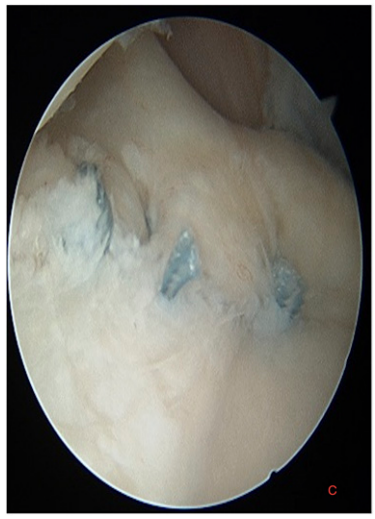

Fig. 2-C

Posterior labral repair in a left shoulder, viewing from the anterosuperior portal. **Fig. 2-A** Probing the posterior labral tear. **Fig. 2-B** Repairing the posterior labral tear with knotless all-suture anchors. **Fig. 2-C** Final repair of posterior labrum.

TABLE II Recovery Process After Posterior Shoulder Instability Surgery

Phase	Timeframe	Goals
Phase 1: Protection	0-4 weeks	Protect repaired area Minimize inflammation and pain Maintain mobility
Phase 2: Active ROM	4-8 weeks	Restore passive ROM Initiate isometric strength
Phase 3: Strengthening	8-12 weeks	Restore full ROM Begin strengthening Improve dynamic stability
Phase 4: Advanced strengthening and functional training	12-16 weeks	Improve strength and endurance Prepare for return to activities
Phase 5: Return to sport	16-24+ weeks	Full ROM and strength Safe return to activity

ROM = range of motion
Table information obtained from the studies by Rothrauff et al. and Goldenberg et al.[38,39]

alternatives to arthroscopic capsulolabral repair need to be considered. Mojica et al. evaluated patient-reported outcomes and complications of bone block augmentation, performed with either distal tibial allograft or iliac crest autograft in contact athletes of any level, noncontact athletes of any level, and nonathletes[33]. The authors found that the patient-reported outcomes were consistently high across Rowe, Constant-Murley, and Walch-Duplay tests, all exceeding 80 points for patients after posterior glenoid bone-block augmentation transfer for PSI[34,35].

An important goal of athletes who undergo surgery for PSI is to return to sport at their preinjury level of performance. Pavlik et al. examined the outcomes of 40 shoulders in 37 athletes who all underwent arthroscopic posterior labral repair over an average period of 54 months[36]. Patients were contact and noncontact athletes from swimming, water polo, boxing, running, soccer, and wrestling. In total, 98% of athletes were able to return to their respective sport; furthermore, around 50% of the athletes returned to their respective sport at their preinjury level. Over 90% of the patients demonstrated satisfactory strength and mobility with low postoperative reinjury rates[36].

Rehabilitation

Postoperative rehabilitation is very important in the overall recovery after posterior labral repair; however, a standard protocol for rehabilitation is yet to be established[37]. Most surgeons use a period of immobilization in a sling for 2 to 4 weeks to facilitate proper healing and protection of the repair. Pain-free passive range-of-motion exercises can be initiated as early as postoperative day 1[38]. During the first 4 weeks, forward flexion is limited to 90° and external rotation is restricted to 0°[37,39]. At 4 to 6 weeks, the sling is discontinued and physical therapy and the implementation of pain-free gentle internal rotation are started[38,39]. According to Goldenberg et al., the rehabilitation process after posterior labral repair goes through 5 chronological phases[38] (Table II). The first phase is protection, followed by testing for active range of motion and endurance of the neighboring muscles. The third and fourth phases focus on increasing resistance training. Finally, during the last phase, the patient can return to sport or their previous activity level. Through each stage of rehabilitation and recovery, there is an emphasis on maximizing the stability of the injured joint, which not only aids in recovery of the current injury but also protects against reinjury. Because recovery depends on the individual progression by the patient, the length of time for the entire rehabilitation process varies. However, patients usually regain normal function in their injured shoulder within 6 months[8,40]. Table II describes the timeline process for patients undergoing postoperative rehabilitation.

Conclusion

Research on PSI has increased substantially in the past couple of decades. Even still, significant gaps persist that emphasize the need for further investigation. Because of the increasing prevalence of PSI in sports, understanding an athlete's clinical presentation, accurate diagnosis, and proper management strategies is crucial. Nonoperative management remains the first-line treatment for PSI, but surgical intervention may be indicated in cases of persistent instability or pain. Ultimately, the goal is to restore shoulder function, return athletes to their previous level of play, decrease the risk of reinjury and pain, and ensure long-term athletic performance and well-being.

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Christopher B. Song, MA[1],
Hassan Farooq, MD[2],
Emily Kirillov, BS[3],
Shreya M. Saraf, MS[2],
John Miller, MD[2],
Mary K. Mulcahey, MD[2]

[1]Rush Medical College, Rush University, Chicago, Illinois

[2]Department of Orthopaedic Surgery and Rehabilitation, Loyola University Medical Center, Maywood, Illinois

[3]Stritch School of Medicine, Loyola University Chicago, Maywood, Illinois

Email address for corresponding author: mary.mulcahey.md@gmail.com

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