Technical Note

Single-Portal Arthroscopic Posterior Capsulorrhaphy for Recurrent Shoulder Capsule Laxity and Instability

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Abstract: Arthroscopic stabilization for posterior shoulder instability is well documented in the literature, offering good to excellent clinical outcomes after injury with favorable return-to-sport and patient satisfaction rates. Posterior capsulorrhaphy addresses recurrent laxity by decreasing the size of the posterior capsule through arthroscopic placement of sutures, in addition to addressing posterior labral tears and any intra-articular pathology within the joint. This technical note describes an arthroscopic posterior capsulorrhaphy for recurrent posterior shoulder capsule laxity and instability in an active patient. This technique uses a single posterior working portal and 2 suture anchors to tighten the posterior capsule onto the intact labrum.

The shoulder joint is the most mobile and least stable joint of the body, allowing the potential for a tremendous range of motion through a complex interplay between the osseous structures, surrounding soft tissue, and capsule that comprise the joint. Thus, dysfunction or trauma to any of these dynamic stabilizing structures may predispose the shoulder to concomitant pain, laxity, and dislocation.[1] Among traumatic shoulder instability events, posterior shoulder instability is relatively uncommon.[2] A study by Owens et al.[2] revealed that posterior shoulder instability occurred in just over 10% of patients with shoulder instability and anterior instability events occurred in over 80% of patients. Injuries will usually involve axial loading of the shoulder while in flexion or acute trauma to the anterior shoulder.[3] Posterior shoulder instability also commonly stems from repeated overuse and overhead throwing, with swimmers, weight lifters, tennis players, and baseball players being among the most at risk.[4] Repetitive microtrauma in which the shoulder is forward flexed, adducted, and internally rotated may lead to eventual laxity of or injury to the soft-tissue stabilizers.[3,5]

Nonoperative treatment of posterior shoulder instability consists of activity modification and physical therapy and serves as the first line of treatment.[6] Patients who experience recurrent posterior shoulder instability may be good candidates for surgical treatment. Several surgical stabilization procedures exist for posterior shoulder instability. Some address the soft tissue alone (capsular shift, labral repair, and reverse Putti-Platt procedure), some are bone based (glenoid and/or humeral osteotomy and glenoid bone block procedure), and others are a combination of both (modified McLaughlin procedure).[7] Arthroscopic stabilization of posterior shoulder instability is an effective way to eliminate pain and instability in athletes, offering good to excellent clinical outcomes in addition to possessing the highest return-to-sport and satisfaction rates after surgery, at over 90% for both metrics.[8-10]

This technical note describes an arthroscopic posterior capsulorrhaphy in an active female patient with recurrent posterior shoulder laxity and instability without labral injury. A single posterior working portal is used to reduce the capsule with 2 suture anchors downward onto the intact labrum. Additionally, capsule closure onto the labrum is performed without direct visualization of the posterior capsulolabral complex.

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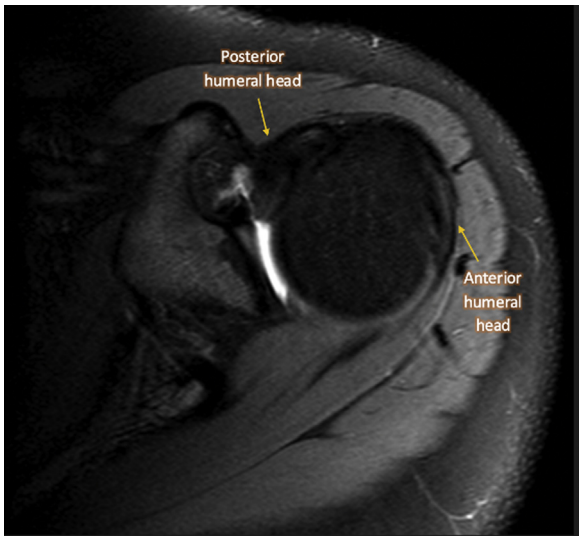

Fig 1. Preoperative axial magnetic resonance image of the operative left shoulder depicting posterior subluxation of the humeral head relative to the glenoid without a labral tear.

Surgical Technique

Preoperative Assessment

Preoperative assessment to evaluate for posterior shoulder instability involves a comprehensive history and physical examination associated with corresponding imaging studies (plain-film radiographs and advanced imaging). On physical examination, pain observed with the following tests may indicate posterior shoulder instability pathology: posterior drawer test, posterior apprehension test, jerk test, and Kim test.[1] Plain radiographs of the shoulder can help develop a differential diagnosis and aid in identification of a shoulder dislocation, glenoid or humeral head fracture, bone loss, and additional osseous trauma. Advanced imaging consists of magnetic resonance imaging to evaluate for soft-tissue injuries to the glenoid labrum and capsule (Fig 1).

Patient Positioning and Preparation

Once general anesthesia is administered, the patient is placed in the lateral decubitus position with a lateral wedge and all bony prominences are well padded. The operative extremity is placed in a suspended arm holder with 15 lb of traction. The arm is prepared and draped in the usual sterile fashion.

Arthroscopic Portal Placement and Diagnostic Arthroscopy

The shoulder landmarks are identified and marked. A No. 11 blade is used to establish the posterior portal in the operative extremity. A blunt trocar and scope sheath then enter the glenohumeral space, and the posterior portal is created. Glenohumeral arthroscopy of the operative shoulder joint is performed with a 30°, 4.0-mm arthroscope. The humeral head, biceps, and labrum are then evaluated and appear grossly intact without damage. The labrum is further inspected using a probe to assess fixation to the glenoid, and the labrum is noted to be fully intact without any evidence of injury. With the surgeon viewing arthroscopically from the posterior portal, the capsule is probed and the shoulder is manipulated, showing that the capsule is abnormally loose (Fig 2). An anterior portal is then established using spinal needle localization. An 8.25-mm cannula (Arthrex, Naples, FL) is placed in the posterior portal to proceed with the capsulorrhaphy.

Capsulorrhaphy

Through the posterior portal, a ConMed Linvatec Spectrum suture passer (ConMed, Chicago, IL) is used to pass No. 0 polydioxanone (PDS) suture through the shoulder capsule and around the intact labrum (Video 1). The passed end of the No. 0 PDS is retrieved through the anterior portal and tied to a No. 2 FiberWire suture (Arthrex). No. 0 PDS is then used to shuttle the No. 2 FiberWire suture around the labrum in an oblique fashion (Fig 3). The free ends of the No. 2 FiberWire suture are retrieved and subsequently passed through the looped end, thus creating a cinch suture around the posterior capsule and labrum. A 2.9-mm PushLock drill (Arthrex) and drill guide are used to establish a single pilot hole in the peripheral glenoid (Fig 4). The No. 2 FiberWire suture that is secured around the labrum is loaded into a 2.9-mm PushLock anchor (Arthrex) that is then impacted into the guide hole under tension. A second drill hole is established more superiorly on the glenoid, and this

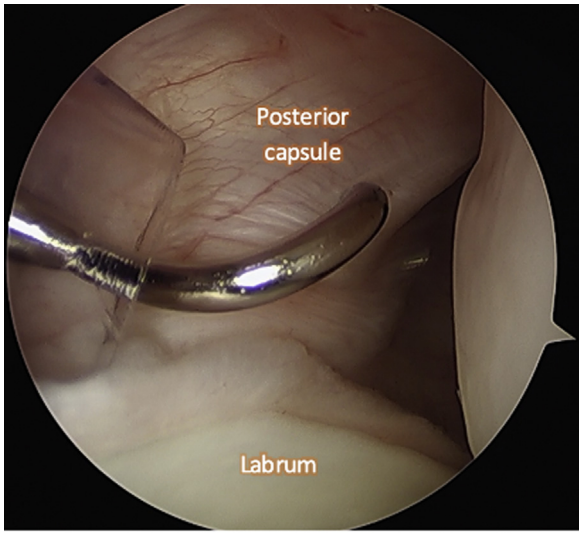

Fig 2. Arthroscopic image of the left shoulder through the anterior portal with a 30° arthroscope depicting an intact labrum without evidence of tearing prior to capsulorrhaphy. The posterior capsule is probed, and laxity is found. The patient is positioned in the right lateral decubitus position.

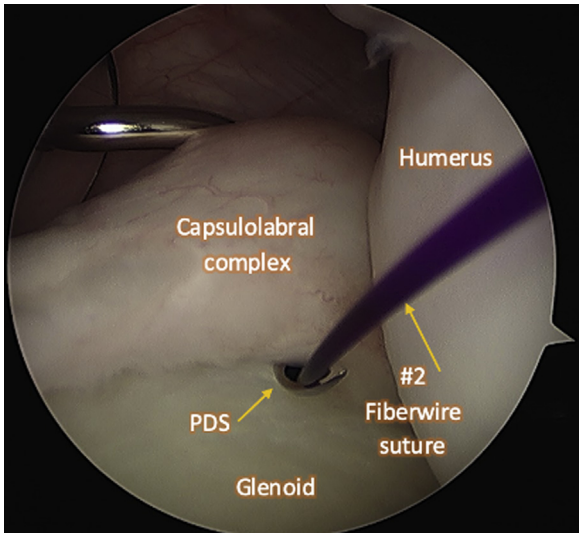

Fig 3. Arthroscopic image of the left shoulder through the anterior portal with a 30° arthroscope depicting a suture lasso used to grasp both the capsule and labrum prior to the use of a polydioxanone (PDS) to shuttle a No. 2 FiberWire suture around the capsulolabral complex. The patient is positioned in the right lateral decubitus position.

process is repeated, for a total of 2 PushLock anchors reducing the capsule down to the posterior labrum (Fig 5). The defect in the posterior capsule is then repaired with the No. 2 FiberWire suture using a suture passer (Spectrum) to pass the suture through the posterior capsule (Fig 6). Of note, the posterior capsule is closed through the posterior portal from outside the joint without direct visualization by the surgeon in standard fashion. The knot is tied, a knot pusher

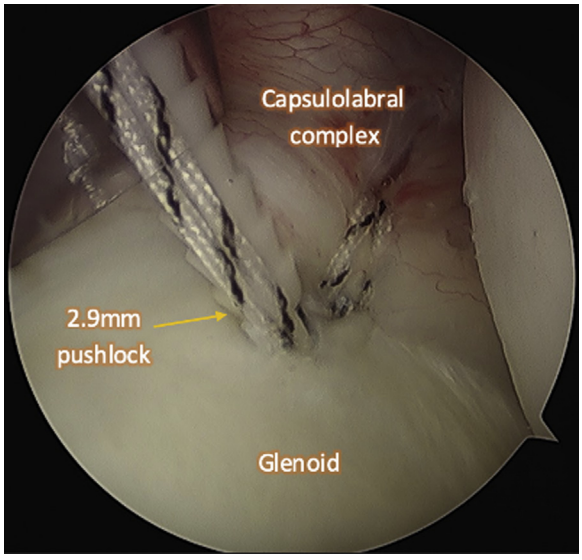

Fig 4. Arthroscopic image of the left shoulder through the anterior portal with a 30° arthroscope depicting a biocomposite 2.9-mm PushLock used to anchor the sutured capsule and labrum into the glenoid. The patient is positioned in the right lateral decubitus position.

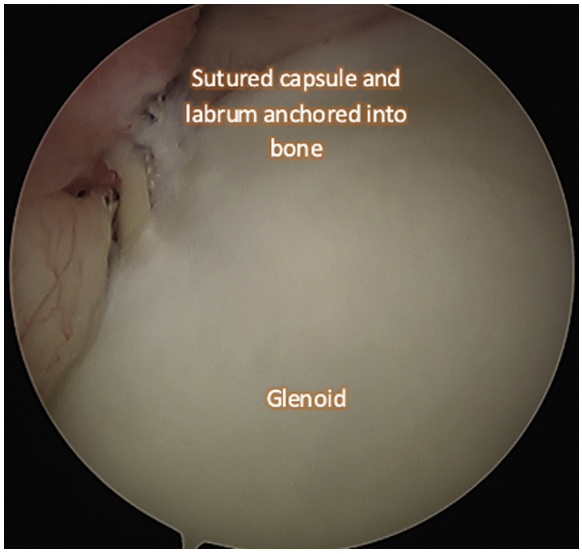

Fig 5. Arthroscopic image of the left shoulder through the anterior portal with a 30° arthroscope depicting capsular tightening performed once more. A second pilot hole in the glenoid is established, and once again, the sutured capsule and labrum are anchored into bone. The patient is positioned in the right lateral decubitus position.

secures the knot downward outside the posterior capsule, and a probe is used to finalize the tautness of the capsule.

Final Examination and Postoperative Care

Both anterior and posterior arthroscopic portals are closed with No. 3-0 nylon, covered with Xeroform (McKesson Brand, Texas), and dressed with 4 x 4-in

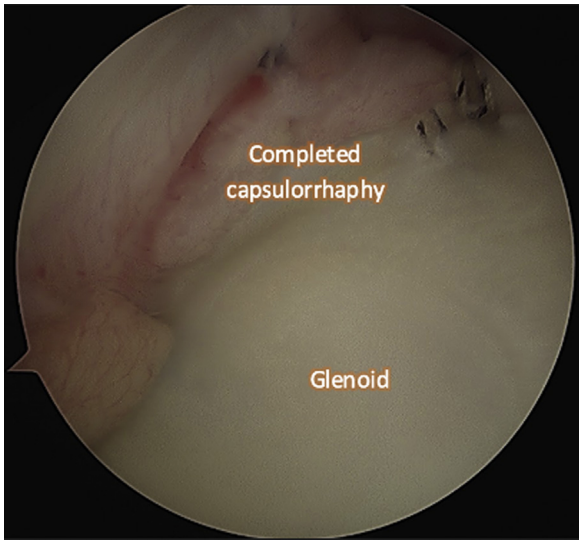

Fig 6. Arthroscopic image of the left shoulder through the anterior portal with a 30° arthroscope depicting the posterior capsular defect after blind repair from outside in through the posterior working portal. The posterior capsule is then probed and deemed to be taut. The patient is positioned in the right lateral decubitus position.

Table 1. Advantages and Disadvantages

Advantages
The technique uses a less invasive approach, resulting in less disruption of normal shoulder anatomy.
Intra-articular capsulolabral lesions, as well as the subacromial and intra-articular space, are observed via direct visualization.
The arthroscopic approach allows the surgeon to address multiple articular lesions and concomitant pathology in a precise, anatomy-specific manner.
The operative time is reduced and less instrumentation is used, decreasing the risk of postoperative complications and morbidity.
Relative to anchorless fixation, the use of suture anchors results in a decreased risk of laxity recurrence and future surgical revision.
Disadvantages
The technique is technically challenging.
Blind closure of the posterior capsule outside the glenohumeral joint limits direct visualization of the posterior capsulolabral complex.
Precise portal placement is required to avoid glenoid bone loss.

gauze, Abdominal Pad (McKesson Brand, China), and foam tape. Postoperative rehabilitation consists of 6 weeks postoperatively in a sling, followed by physical therapy for 2 to 3 months to regain strength and range of motion of the operative extremity. Full range of motion should be achieved between 2 and 3 months postoperatively. The patient may begin a gradual return to sport in the 5- to 8-month postoperative time frame under controlled guidance from the physical therapist, surgeon, and health care professional team.

Discussion

When conservative treatment of posterior shoulder instability fails, posterior shoulder stabilization procedures have been shown to be successful. In a 2020 systematic review of 23 studies on athletes who underwent posterior stabilization procedures, Matar et al.[11] found that a mean of 86.9% returned to sports and a mean of 74.9% returned to preinjury levels.

A recent shift toward arthroscopic stabilization procedures for posterior shoulder instability has been described throughout the literature, with superior outcomes relative to open procedures.[8,11-13] Favorable outcomes are well documented in the literature for anterior instability stabilization procedures; however, open stabilization procedures for posterior instability have proved unfavorable with failure rates between 30% and 70%, potentially owing to a larger surgical dissection and limited ability to visualize all posterior shoulder pathology.[14,15] A 2015 review on posterior instability by DeLong et al.[8] suggested that patients undergoing arthroscopic stabilization have superior outcomes with respect to postoperative functional and satisfaction scores, recurrence rates, and return to sport and previous level of activity. Furthermore, a review by DiMaria et al.[7] in 2019 reported a 90% success rate of arthroscopic stabilization procedures for posterior instability. If a posterior labral tear is present, surgical treatment typically consists of anchor or anchorless suture fixation of the posterior labrum with or without capsulorrhaphy.[8,14] When a true labral tear is not identified, capsulorrhaphy may be performed with sutures using the intact labrum or suture anchors to reduce the loose posterior capsule onto the labrum.[8,14] In 1998, Wolf and Eakin[16] reported recurrence in only 1 of 14 patients who underwent arthroscopic capsular plication for posterior shoulder instability in whom posterior capsule laxity was believed to be the primary pathology. Surgical stabilization may also consist of tightening the inferior glenohumeral ligament. In cases of severe glenoid retroversion, a glenoid osteotomy may be performed, and in cases of bone loss, a posterior bone block procedure may be performed.[17-19] The success of these procedures can vary, with systematic reviews by Malik et al.[18] in 2021 reporting an overall posterior shoulder instability recurrence rate of 22% for glenoid osteotomies and by Mojica et al.[19] in 2021 showing a recurrence rate of 9.8% for posterior bone block augmentation.

Our surgical technique and associated technical video (Video 1) demonstrate an efficient, reproducible posterior capsulorrhaphy procedure to address recurrent posterior shoulder laxity without a labral tear. Our technique possesses all the benefits of arthroscopy relative to an open procedure, including a less invasive approach, less disruption of normal shoulder anatomy, complete visualization of the intra-articular and subacromial spaces, the potential to address concomitant intra-articular and capsulolabral pathology, and an overall more precise repair.[7-9] Further highlighting the efficacy of arthroscopy for posterior shoulder instability, in a recent prospective study of 188 athletes who underwent arthroscopic posterior shoulder stabilization, Bradley et al.[12] observed a 94% patient satisfaction rate and 90% return-to-sport

Table 2. Pearls and Pitfalls

Pearls
The surgeon should use PDS suture to shuttle the suture anchor through the capsule during capsule closure.
Suture anchors should be placed appropriately within the glenoid to ensure proper coverage during capsule reduction.
The surgeon should establish the second anchor more superiorly to avoid unwarranted glenoid bone loss.
Pitfalls
Improper portal placement can make placement of suture anchors more difficult.
Potential glenoid bone loss can occur with improper anchor placement.
Poor suture management can lead to the suture ends from the same anchor being tied.
The surgeon should avoid disruption of the axillary nerve while working through the posterior capsule in the intra-articular space.

PDS, polydioxanone.

rate and showed that 64% of patients were able to return to their preoperative activity levels. Additionally, the use of suture anchors eliminates potential complications associated with anchorless fixation, such as glenoid osteolysis, glenoid retroversion, synovitis, and chondrolysis.[8,12,18] For instance, Bradley et al.,[12] in the aforementioned study of 188 athletes, reported that patients who underwent posterior capsulorrhaphy with suture anchors showed significantly greater improvements in American Shoulder and Elbow Surgeons scores ($P < .001$) and higher return-to-play rates ($P < .05$) relative to patients with anchorless fixation. Moreover, their study revealed a trend toward a higher failure rate with anchorless repair by 3-fold in all athletes and by 2-fold in the contact-athlete group.[12] Moreover, McIntyre et al.[20] reported a high failure rate of 25% when using arthroscopic anchorless suture anchors, which is comparable to failure rates of open posterior shoulder stabilization procedures.

Although our technique can be performed safely and effectively with low risk, it carries its own drawbacks. Given the intra-articular establishment of 2 suture anchors in the glenoid cavity for capsular closure, proper portal placement must be ensured to avoid unnecessary glenoid bone loss. In a 2020 study of patients undergoing arthroscopic posterior glenohumeral stabilization procedures, Wolfe et al.[21] found that patients with moderate posterior glenoid bone deficiency had a significantly higher rate of reoperation ($P = .024$), had increased glenoid retroversion ($P = .01$), had instability instead of pain on initial presentation ($P < .001$), and had positive jerk test results ($P = .01$). Furthermore, in a 2018 study of patients who underwent arthroscopic isolated stabilization of the posterior labrum at a single military treatment facility, Hines et al.[22] showed those with subcortical bone loss greater than 13.5% were statistically less likely to return to full duty. Owing to the precise nature of this procedure, it is imperative to avoid disrupting the normal anatomic structure of the shoulder joint and any neurovasculature near the joint. When the surgeon is working through the posterior portal in the intra-articular space, it is important to avoid disruption of the axillary nerve given its location relative to the inferior hemisphere of the glenohumeral joint.[13] Additionally, blind closure of the posterior capsular defect is performed from outside the shoulder joint without direct visualization of the capsulolabral complex, which is technically difficult to perform. A complete list of the advantages and disadvantages of this surgical technique is presented in Table 1, and pearls and pitfalls are listed in Table 2.

This technical note presents an arthroscopic posterior capsulorrhaphy of the shoulder to address recurrent posterior laxity and instability in an active patient. A single posterior working portal and 2 suture anchors are used to tighten the capsule, and closure of the posterior capsule is performed without direct visualization of the capsulolabral complex from outside the shoulder joint. All in all, this technique offers an efficient, reproducible procedure to address posterior shoulder instability pathology.

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