

Repair of Floating Posterior Inferior Glenohumeral Ligament Lesions: Surgical Technique

James A. Ames, MD, MSc, Olivier A. J. van der Meijden, MD, and Peter J. Millett, MD, MSc

Abstract: Posterior glenohumeral joint instability makes up approximately 2% to 10% of all shoulder instability reports in the literature and pathologic findings in patients, which often involve a spectrum of pathology rather than a single pathoanatomic finding. A combined posterior Bankart lesion and posterior humeral avulsion of the glenohumeral ligament has been defined as the floating posterior inferior glenohumeral ligament. This combination of pathology may result in severe posterior-inferior instability and the need to address both lesions during attempted surgical repair has therefore been stressed. In this study, we present our suggested techniques for repairing the various subtypes of floating posterior inferior glenohumeral ligament lesions. Repair of both the humeral and glenoid-sided injuries are addressed.

Key Words: posterior instability, surgical treatment, floating PIGHL
(*Tech Should Surg* 2011;12: 80–84)

BACKGROUND

The pathoanatomy of anterior shoulder dislocations was well documented by early pioneers such as Perthes¹ and Bankart² in the early 1900s. In contrast, the understanding of posterior instability is still evolving, with the first reported case of such instability not published until 1963.³ It was not until the past decades that the reports on arthroscopic treatment of posterior instability have increased.^{4–7}

Posterior glenohumeral joint instability is reported to be much less common than anterior instability, making up approximately 2% to 10% of all shoulder instability studies in the literature.⁵ Pathologic findings in patients presenting with posterior instability often involve a spectrum of pathology rather than a single pathoanatomic finding. The spectrum includes posterior Bankart lesions (Fig. 1), rotator interval lesions, and posterior capsular laxity in >50% of cases.⁸ Posterior humeral avulsions of the glenohumeral ligament (PHAGL) and other injuries to the posterior capsule are more rarely encountered.^{6,8,9}

A combined posterior Bankart lesion and PHAGL has been defined as the floating posterior inferior glenohumeral ligament (floating PIGHL, Fig. 2).¹⁰ Several researchers have

reported their experiences with floating PIGHL lesions.^{6,10,11} In addition, Chen et al⁹ reported on and described a posterior bony humeral avulsion of the glenohumeral ligament and considered this as a bony variation of the floating PIGHL. Most recently, an earlier unreported combination of a reverse bony Bankart lesion and a PHAGL injury has been described, along with a subtyping of floating PIGHL lesions based on pathoanatomy (Fig. 3).¹²

From a biomechanical perspective, both a posterior Bankart and PHAGL lesion mainly result in posterior instability.¹³ However, in case of a combination of these 2 lesions, postero-inferior instability is severely aggravated. The need to address both lesions during attempted surgical repair has therefore been stressed.¹³ In this study, we present our suggested techniques for repairing the various subtypes of floating PIGHL lesions. Repair of both the humeral and glenoid-sided injuries are addressed.

TECHNIQUES

Patient Positioning

The procedure can be performed in either the beachchair or lateral decubitus position. The beachchair position requires an assistant to apply direct lateral traction to the proximal arm for certain portions of the case, whereas the lateral decubitus position uses a traction device (Arthrex Star Sleeve; Arthrex, Naples, FL) with 20 degrees of abduction and 20 degrees of

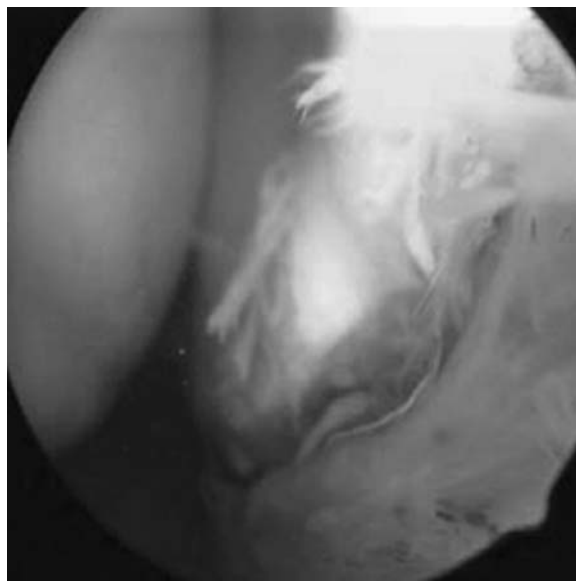


FIGURE 1. Arthroscopic image of the posterior view of a complete disruption of the posterior labrum (posterior Bankart lesion). The humerus can be observed on the left side and glenoid and disrupted posterior labrum on the left side.

Received for publication July 31, 2011; accepted August 29, 2011.

From the Steadman Philippon Research Institute, Vail, CO.

This study was not directly supported by a grant. However, Dr Millett is a consultant and receives payments from Arthrex and has stock options in Game Ready. In addition, Dr Van der Meijden's research scholarship was supported by Arthrex. This research was supported by The Steadman Philippon Research Institute which is a 501(c)3 nonprofit institution supported financially by private donations and corporate support from the following entities: Smith & Nephew Endoscopy, Arthrex, Arthrocare, Siemens, OrthoRehab, Ossur Americas, and Conmed Linvatec.

The authors declare no conflict of interest.

Reprints: Peter J. Millett, MD, MSc, Steadman Philippon Research Institute, 181 West Meadow Drive, Suite 1000, Vail, CO 81657 (e-mail: drmillett@steadmanclinic.com).

Copyright © 2011 by Lippincott Williams & Wilkins



FIGURE 2. Arthroscopic image of a floating posterior inferior glenohumeral ligament in which the posterior humeral avulsion of the glenohumeral ligament lesion is held on the right side by an arthroscopic grasper.

extension. Many surgeons prefer the lateral position for improved access to the axillary pouch, posterior capsule, and inferior aspect of the glenohumeral joint; however, we have found both positions acceptable.

Arthroscopic Portal Placement

Two anterior and 2 posterior portals are required for repair of floating PIGHL lesions. The posterolateral portal must be placed lateral enough to allow the appropriate angle



FIGURE 4. Posterior view of a left shoulder, prepped and draped for shoulder arthroscopy. The posteromedial (PM) and posterolateral (PL) portal placements have been marked. In addition, the lateral and posterior contours of the acromion have been marked.

for access to the posterior glenoid rim and repair of the posterior Bankart lesion, whereas the posteromedial portal should be placed medial enough to allow the correct angle of approach to the humerus for repair of the avulsed posterior band of the inferior glenohumeral ligament (Fig. 4). At times, it can be difficult to achieve far inferior anchor placement (approaching the 6 o'clock position) with these 2 posterior portals. In this case, a third stab incision could be made more inferiorly to facilitate placement of this anchor, with care taken to avoid the course of the axillary nerve.

Standard anterosuperior and mid-anterior portals are also used. The anterosuperior portal is used for viewing whereas the mid-anterior portal is used to shuttle sutures. When the diagnosis of a combined injury is known before arthroscopy, special care should be taken with the position of the anterior

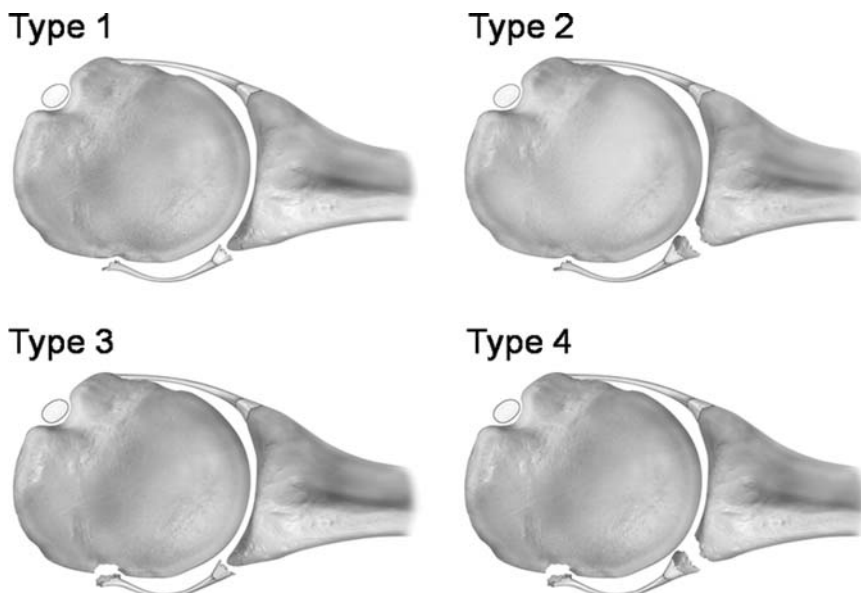


FIGURE 3. Floating posterior inferior glenohumeral ligament subtypes. Type 1: PHAGL with posterior Bankart lesion. Type 2: PHAGL with posterior bony Bankart lesion. Type 3: PBHAGL with posterior Bankart. Type 4: PBHAGL with posterior bony Bankart lesion. PBHAGL indicates posterior bony humeral avulsion of the glenohumeral ligament; PHAGL, posterior humeral avulsion of the glenohumeral ligament. Copyright: The Journal of Bone and Joint Surgery, Inc. Used with permission.

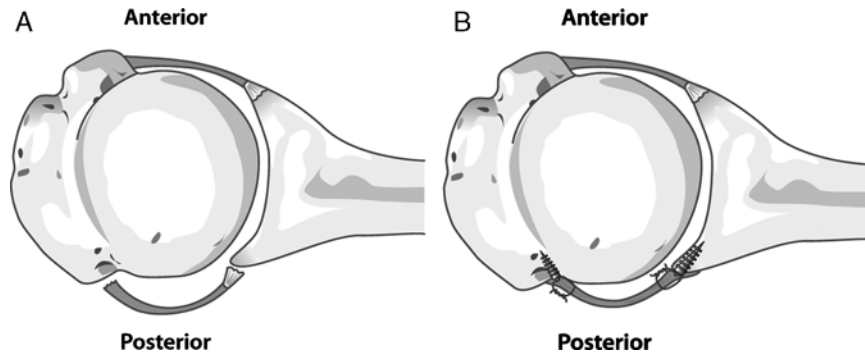


FIGURE 5. A and B, A subtype 1 floating posterior inferior glenohumeral ligament lesion (A) with resultant repair on both sides of the lesion (B). Either of the 2 lesions can be addressed first, depending on preference of the surgeon.

superior portal as this will be the primary viewing portal for the work performed posteriorly. This portal is established in standard outside-in manner through the rotator interval with a spinal needle used for localization. Care should be taken to assure that the portal is colinear with the glenohumeral joint to allow safe passage of a camera into the posterior joint space. At times, a 70-degree scope can help in complete visualization of the humeral attachment site of the IGHL.

General Points on Arthroscopic Repair

In the setting of a soft-tissue Bankart lesion, the postero-inferior glenohumeral ligament complex is mobilized from the glenoid neck as far inferiorly as the 6 o'clock position using electrocautery and/or a small elevator. The capsulolabral sleeve must be mobilized until it can be shifted superiorly and laterally onto its anatomic position on the glenoid rim.

Once the labrum has been mobilized, the glenoid is prepared with an arthroscopic shaver to assure a bed of bleeding bone for repair. After this preparation, the insertion site of the posterior band of the inferior glenohumeral ligament is identified. Shifting the working portal from the posterolateral portal to the posteromedial portal, the insertion site is prepared with the use of a shaver. The avulsion site is located at the articular margin of the rotator cuff, just lateral to the bare area of the humeral head.

Once this had been prepared, 2 to 3 suture anchors are placed. The avulsed end of the PHAGL lesions is stabilized with the use of a grasper through the posterior medial portal. A piercing suture passer is then placed through the posterolateral portal and the avulsed ligament is pierced, one end of the suture is grasped and pulled back through the ligament, creating a simple suture construct. The second suture is then grasped and pulled through the same canulla. At this point, the suture can either be tied, or if multiple anchors have been placed, the suture can be docked outside the canulla whereas the procedure is repeated and tied at a later time. We have found visualization of this region is reasonably good with the space between the infraspinatus/teres minor and the PIGHL lesion expanded with arthroscopic fluid. This allows extra-articular knot tying on this side of the lesion, limiting the number of intra-articular knots in the posterior aspect of the shoulder.

Attention is now turned back to the posterior Bankart lesion, which is restored in standard manner with 3 to 4 suture anchors and the appropriate capsular shift to restore stability to the shoulder. In the setting of gross capsular laxity, we use a "pinch/tuck" technique to incorporate our capsular shift into our Bankart repair.¹⁴

Order of Repair

It has been suggested that in all combined lesions, the humeral side should be fixed first to avoid over tightening of the joint capsule medially.¹⁵ We believe that there are situations in which it is appropriate to fix the lateral side first, followed by the medial side.

Arthroscopic Repair by Subtype

Subtype 1 involves soft tissue injury only, therefore, either the glenoid or humeral side can be addressed first (Figs. 5A, B). If the surgeon is more comfortable tensioning the PIGHL with repair of the posterior Bankart lesion (Fig. 6), then this should be performed after securing the PHAGL. Alternatively, the posterior Bankart can be addressed first, without a capsular shift, and then tension can be restored to the PIGHL complex through repair of the PIGHL lesion (Fig. 7).

A type 2 lesion includes a posterior bony Bankart lesion. If the bony lesion is acute, we prefer a "Bony Bankart Bridge" procedure which compresses the fracture down onto the glenoid with 2-point fixation, creating a large surface area for bony healing.¹⁶ The posterior capsule can then be tensioned in 1 of 2 ways.

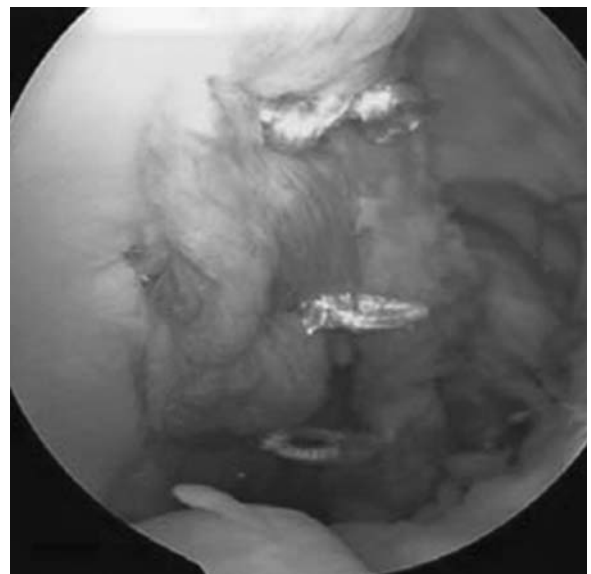


FIGURE 6. Arthroscopic image after posterior Bankart lesion repair using 3 suture anchors.

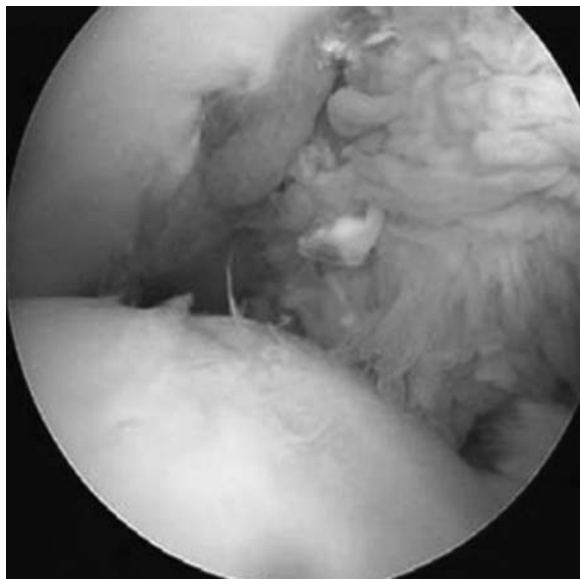


FIGURE 7. Arthroscopic image after complete repair of a floating posterior inferior glenohumeral ligament lesion on both the humeral and glenoid side.

The first option is to first repair the PHAGL lesion and place additional anchors above and below the bony bridge. For these additional anchors, the medial suture limb is passed through the PIGHL, shifting the PIGHL and labrum superiorly and medially tightening the axillary pouch. In the second option, additional suture anchors are placed above and below the bony bridge providing rotational control with fixation of the labrum only. After this, tension can be applied to the capsule through repair of the PHAGL.

We suggest to repair a type 3 lesion with similar techniques to repair of type 1 lesions. The bony avulsions that are associated with Bony Posterior Humeral Avulsions of the Glenohumeral Ligament lesions are generally small and not amenable to any type of specific bony fixation method, we therefore treat them in a similar manner to standard PHAGL lesions.

Type 4 lesions should be treated as one would treat a type 2 lesion with the posterior bony Bankart lesion addressed first, followed by tensioning on the posterior capsule on either the humeral or glenoid side.

POSTOPERATIVE REHABILITATION

After surgical repair, patients are placed in a shoulder immobilizer with an abduction pillow to maintain the arm in neutral rotation and 20 degrees abduction. The arm stays in an immobilizer for 6 weeks, coming out at least twice daily to work on pendulums and passive range of motion exercises. After 6 weeks, active range of motion is initiated and the arm can be used for activities of daily living. After 12 weeks, strengthening is started, and progresses under the supervision of a physical therapist. Contact and collision sports are allowed after 6 months.¹⁷

DISCUSSION

The humeral avulsion of the glenohumeral ligament (HAGL) lesion, as described by Bui-Mansfield et al¹⁰ comprises both a discreet anterior and posterior lesion. Posteriorly, they defined the PHAGL along with 2 variants of this lesion,

the posterior bony humeral avulsion of the glenohumeral ligament and the floating PIGHL. Recently, 4 subtypes of floating PIGHL lesions have been described.¹²

Although magnetic resonance imaging is an excellent tool for the evaluation of the labrum and capsular injury on the glenoid side, there are reports that the diagnosis of a HAGL is missed in up to 50% of cases based on imaging alone. Bokor et al¹⁸ reviewed 547 shoulders with instability—the cause of instability was considered to be avulsion of the lateral capsule, including the inferior glenohumeral ligament from the neck of the humerus in 41 patients (7.5%). Of patients who underwent revision procedures for instability, 18.2% (6 of 33) were diagnosed with a missed HAGL lesion. This underscores the importance of a complete evaluation of the anterior glenohumeral ligaments with treatment of all pathology found at the index procedure. The same is true of the posterior glenohumeral ligaments. Recurrence rates after posterior repair have traditionally been higher than for anterior instability. The cause of this is certainly multifactorial; however, we suggest that missed combined injuries may be a significant contributing factor.

We have outlined our treatment strategy for the 4 subtypes of floating PIGHL lesions and encourage the treating surgeon to make a complete evaluation of the posterior ligaments in all posterior instability cases so that all pathology can be addressed and the incidence of recurrent instability can be limited.

REFERENCES

- Perthes G. Operative treatment for habitual shoulder luxation. *Deutsch Ztschr Chir.* 1906;85:199–207.
- Bankart AS. Recurrent or habitual dislocation of the shoulder-joint. *Br Med J.* 1923;2:1132–1133.
- Reeves B. Recurrent posterior dislocation of the shoulder (two cases). *Proc R Soc Med.* 1963;56:897–898.
- Abrams JS. Arthroscopic repair of posterior instability and reverse humeral glenohumeral ligament avulsion lesions. *Orthop Clin North Am.* 2003;34:475–483.
- Bradley JP, Tejwani SG. Arthroscopic management of posterior instability. *Orthop Clin North Am.* 2010;41:339–356.
- Hill JD, Lovejoy JF Jr, Kelly RA. Combined posterior Bankart lesion and posterior humeral avulsion of the glenohumeral ligaments associated with recurrent posterior shoulder instability. *Arthroscopy.* 2007;23:327e321–327e323.
- Safran O, DeFranco MJ, Hatem S, et al. Posterior humeral avulsion of the glenohumeral ligament as a cause of posterior shoulder instability. A case report. *J Bone Joint Surg Am.* 2004;86-A:2732–2736.
- Savoie FH III, Holt MS, Field LD, et al. Arthroscopic management of posterior instability: evolution of technique and results. *Arthroscopy.* 2008;24:389–396.
- Chen L, Keefe D, Park J, et al. Posterior bony humeral avulsion of glenohumeral ligament with reverse bony Bankart lesion. *J Shoulder Elbow Surg.* 2009;18:e45–e49.
- Bui-Mansfield LT, Banks KP, Taylor DC. Humeral avulsion of the glenohumeral ligaments: the HAGL lesion. *Am J Sports Med.* 2007;35:1960–1966.
- Castagna A, Snyder SJ, Conti M, et al. Posterior humeral avulsion of the glenohumeral ligament: a clinical review of 9 cases. *Arthroscopy.* 2007;23:809–815.
- Ames J, Millett PJ. Combined posterior bony Bankart lesion and posterior humeral avulsion of the glenohumeral ligaments: a case report and pathoanatomic subtyping of “floating” posterior inferior glenohumeral ligament lesions. *J Bone Joint Surg Am.* 2011. In press.

13. Wellmann M, Blasig H, Bobrowitsch E, et al. The biomechanical effect of specific labral and capsular lesions on posterior shoulder instability. *Arch Orthop Trauma Surg.* 2011;131:421–427.
14. Westerheide KJ, Dopirak RM, Snyder SJ. Arthroscopic anterior stabilization and posterior capsular plication for anterior glenohumeral instability: a report of 71 cases. *Arthroscopy.* 2006;22:539–547.
15. Parameswaran AD, Provencher MT, Bach BR Jr, et al. Humeral avulsion of the glenohumeral ligament: injury pattern and arthroscopic repair techniques. *Orthopedics.* 2008;31:773–779.
16. Millett PJ, Braun S. The “bony Bankart bridge” procedure: a new arthroscopic technique for reduction and internal fixation of a bony Bankart lesion. *Arthroscopy.* 2009;25:102–105.
17. Millett PJ, Clavert P, Hatch GF III, et al. Recurrent posterior shoulder instability. *J Am Acad Orthop Surg.* 2006;14:464–476.
18. Bokor DJ, Conboy VB, Olson C. Anterior instability of the glenohumeral joint with humeral avulsion of the glenohumeral ligament. A review of 41 cases. *J Bone Joint Surg Br.* 1999;81:93–96.