



# Arthroscopic Management of Posterior Instability due to “Floating” Posterior Inferior Glenohumeral Ligament Lesions

Lawrence O’Malley II, M.D., Eric D. Field, B.A., and Larry D. Field, M.D.

**Abstract:** The “floating” posterior inferior glenohumeral ligament (floating PIGHL) is an uncommon cause of posterior shoulder instability. This pathologic lesion, defined as detachment of both the origin of the PIGHL (posterior Bankart lesion) and insertion of the of the PIGHL from its humeral head insertion site, often results in significant and persistent shoulder instability symptoms. An effective surgical technique for arthroscopic repair of a floating PIGHL lesion is described and demonstrated.

Well-documented and described anterior shoulder dislocations were first reported in the early 20th century.<sup>1,2</sup> In addition, it was not until the 1960s that extensive descriptions of cases of posterior instability were documented by Reeves.<sup>3</sup> The literature has classically reported that the overall rate of posterior instability ranges between 2% and 10% of all instability cases.<sup>4</sup> Over the past decade, an increased number of articles reporting on the indications for surgical intervention and techniques designed to surgically address a variety of posterior instability pathologic conditions and lesions have been published.<sup>4-7</sup>

Shoulder instability is often present in patients as a consequence of damage to both the glenoid labrum and shoulder capsule. Labral detachment combined with capsular stretching or disruption results in symptoms consistent with those caused by shoulder instability. Capsular injury, in the majority of cases, is due to stretching

of the capsule. There are shoulder instability cases, however, that result from detachment of the humeral attachment of the glenohumeral joint capsule and ligaments. When the capsule is detached from its humeral head and neck insertion anteriorly, this lesion is identified as a humeral avulsion of the glenohumeral ligament (HAGL).<sup>8,9</sup> Similarly, when an HAGL lesion occurs along with a Bankart lesion, both the origin and insertion of the anterior inferior glenohumeral ligament (AIGHL) is detached. Field et al. first described this combined lesion in a series of 5 patients with recurrent anterior instability and termed this combined Bankart lesion and HAGL lesion as the “floating AIGHL.”<sup>8</sup>

Lesions involving the posterior capsule and ligaments most often result from some degree of capsular stretching and usually occur in combination with some degree of posterior labral disruption.<sup>10</sup> More rarely, and similar to the combined lesions seen with a floating AIGHL, avulsion of the posterior capsule from its attachment to the posterior humeral head occurs instead. This capsular disruption of the posterior inferior glenohumeral ligament (PIGHL) is often referred to as a reverse humeral avulsion of the glenohumeral ligament (RHAGL). When a RHAGL is identified and occurs in combination with a posterior Bankart lesion, this combined detachment of the labrum and RHAGL is termed a “floating” PIGHL. In 2007, Bui-Mansfield et al. first introduced the term “floating PIGHL” in a review of HAGLs.<sup>11</sup>

## Examination and Diagnosis

A high level of suspicion is required when evaluating patients in whom shoulder instability is suspected. A thorough history and physical examination are

*From the Sports Orthopedics and Spine (L.O.), Jackson, Tennessee; and Mississippi Sports Medicine and Orthopaedic Center (E.D.F., L.D.F.), Jackson, Mississippi, U.S.A.*

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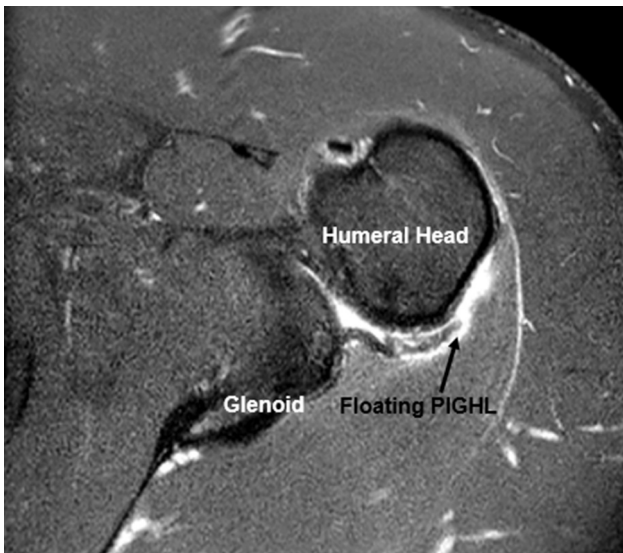
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*Address correspondence to Larry D. Field, M.D., Mississippi Sports Medicine and Orthopaedic Center, 1325 East Fortification Street, Jackson, MS 39202, U.S.A. E-mail: [lfield@msmoc.com](mailto:lfield@msmoc.com)*

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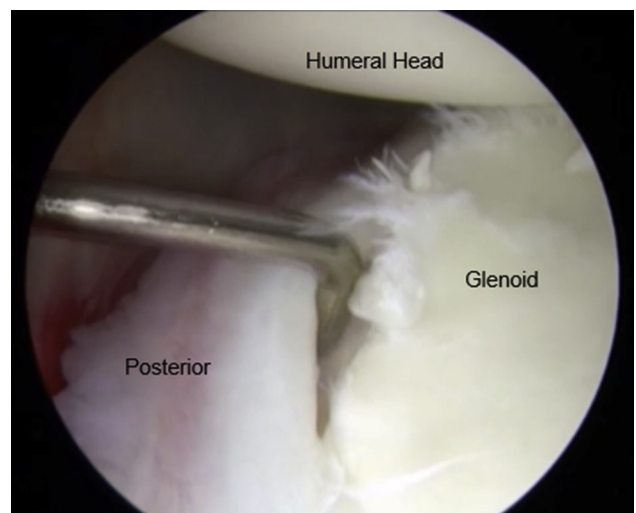
**Fig 1.** Axial magnetic resonance imaging series shows humeral detachment of posterior inferior glenohumeral ligament in left shoulder with loss of capsular tension.

necessary to define the direction and degree of an individual patient's instability pattern. Clinical assessment should also incorporate not only standard anteroposterior, scapular-Y, and axillary radiographic images but also more specific radiographic views that may be more informative in identifying changes in the characteristics of shoulder instability when present. Physical examination for patients with posterior instability will often demonstrate increased posterior shoulder translations on the affected side as well as posterior shoulder pain when appropriate physical examination tests are employed. Specifically, physical examination may demonstrate a positive posterior load and shift test, jerk test, Kim test, and/or positive posterior stress test.<sup>12-14</sup> Such findings are indicative of posterior instability. Unfortunately, however, no known physical examination test has yet been described that can specifically and reliably identify an RHAGL when one is present. Fortunately, magnetic resonance imaging obtained in patients for whom posterior instability is suspected will often not only demonstrate the posterior labral tear but also can show the detachment of the posterior capsule and ligament from its humeral attachment site when a floating PIGHL is present (Fig 1).

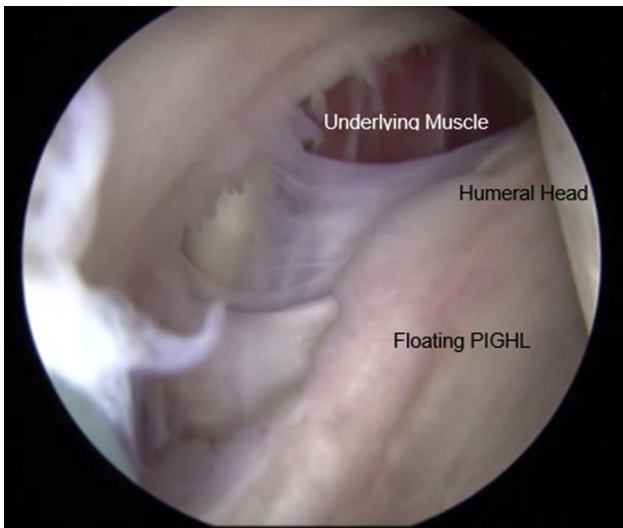
### Operative Technique

Following the induction of general anesthesia, the patient undergoes a careful and thorough examination under anesthesia assessing glenohumeral joint range of motion and humeral head translations. Following the examination under anesthesia, the patient is placed in the lateral decubitus position and typically positioned in approximately 45° of abduction and slight forward

flexion with approximately 10 pounds of balanced suspension added to support the extremity. Diagnostic arthroscopy commences using a standard posterior portal and a 30° arthroscope. A thorough diagnostic arthroscopic assessment is completed, paying particular attention for possible lesions of the posterior labrum and posterior capsule. A standard anterior midlateral portal is created after first localizing the appropriate location using a spinal needle. A second anterior portal, the anterosuperior portal (ASP), is also made anteriorly. This portal is localized with a spinal needle as well and should be established along the anterior edge of the supraspinatus tendon within the rotator interval. The camera is then moved to this ASP, and the posterior capsule is carefully assessed (Video 1). The ASP typically provides excellent visualization of the posterior labrum and capsule (Fig 2). Typically, the floating PIGHL is clearly visualized and is represented by both the posterior labral disruption as well as detachment of the lateral capsule from its humeral insertion. Often infraspinatus muscle fibers can be observed due to the absence of the normally overlying posterior capsule (Fig 3). Once the floating PIGHL lesion is identified, an accessory posterior portal is then localized using a spinal needle and a cannula is placed. This accessory posterior portal, termed the "posterior instability portal," is located inferior and lateral to the standard posterior portal because it improves access to the inferior capsule and also improves the angle for anchor placement along the posterior glenoid rim. Often the standard posterior portal can be redirected through the capsular lesion (Fig 4). The posterior labral detachment is then mobilized using this posterior instability portal. A soft-tissue elevator and arthroscopic shaver are both useful for separating the



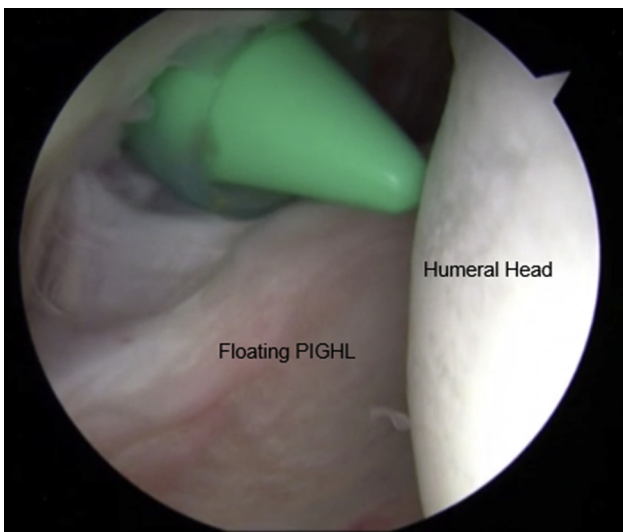
**Fig 2.** View of a left shoulder from the anterior superior portal in the lateral decubitus position. Careful examination using a probe from the posterior portal reveals the posterior labral tear off the glenoid.



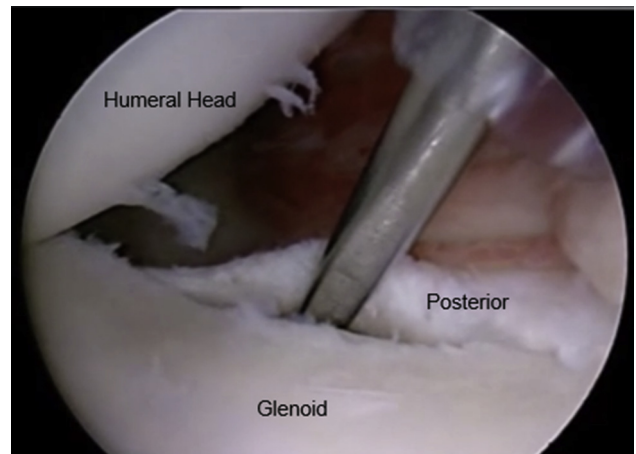
**Fig 3.** View of a left shoulder from the anterior superior portal in the lateral decubitus position. Careful examination of the posterior capsule allows for identification of the capsular tear and the floating posterior inferior glenohumeral ligament. If muscle is identified, then careful capsular assessment should occur.

labrum from the glenoid (Fig 5). In addition, the arthroscopic shaver is used to lightly abrade the posterior glenoid neck.

Following successful mobilization of the posterior labral tear, attention is then turned to the insertion site of the RHAGL on the humeral head while viewing through the ASP. Once this area is localized arthroscopically, debridement and light abrasion are carried

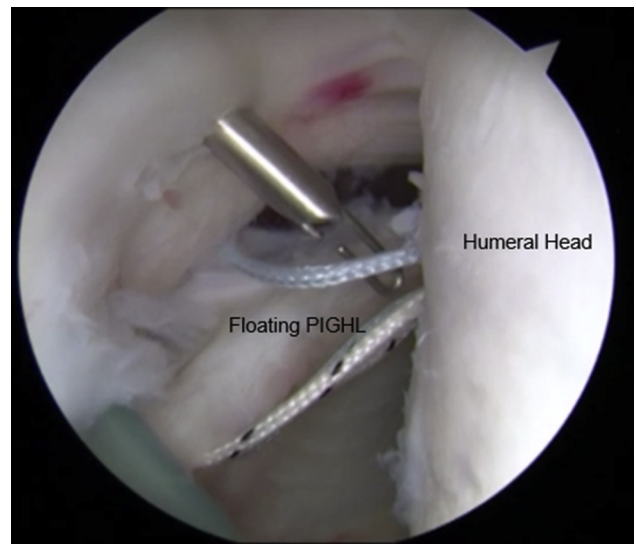


**Fig 4.** View of a left shoulder from the anterior superior portal in the lateral decubitus position. The posterior medial portal is redirected through the posterior inferior glenohumeral ligament lesion. This allows for ease of capsular mobilization, debridement of insertion, and anchor placement.

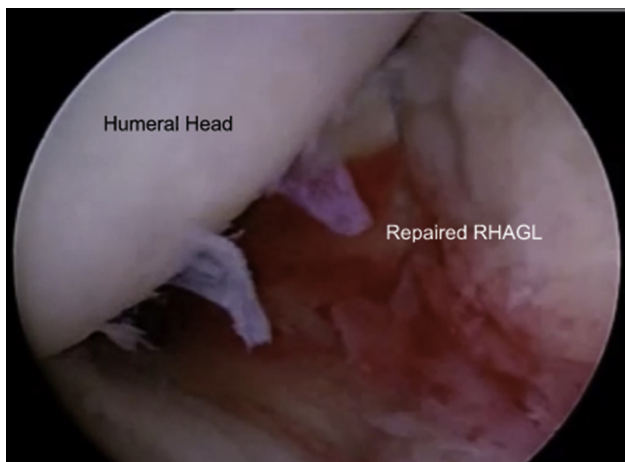


**Fig 5.** View of a right shoulder from the anterior midlateral portal in the lateral decubitus position. The soft-tissue elevator is used through the anterior superior portal to elevate and mobilize the posterior labral tear.

out to prepare this bony bed for reattachment of this lateral capsular and ligamentous detachment. The specific insertion site of the RHAGL is typically located just lateral to the bare area of the humeral head and just medial to the rotator cuff insertion. Prior to placing anchors into this abraded area of the humeral head, the surgeon must confirm that the capsule can be adequately reduced to its humeral head insertion site. If the lateral capsule cannot be reapproximated, mobilization of the posterior capsule can be carried out by bluntly separating the capsule from the underlying

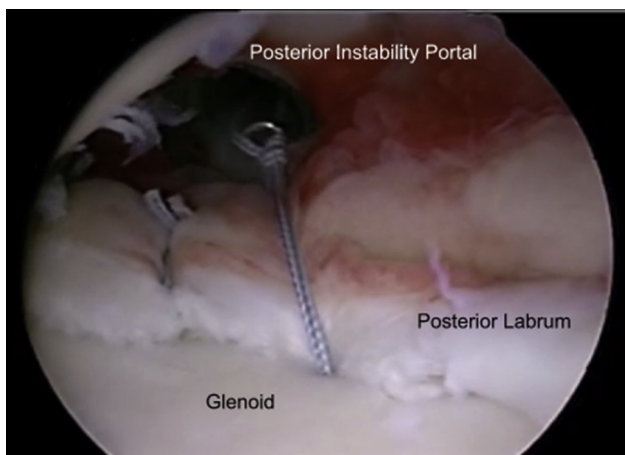


**Fig 6.** View of a left shoulder from the anterior superior portal in the lateral decubitus position. Anchor inserted into humeral head at the anatomic insertion of the posterior inferior glenohumeral ligament. A Mitek IDEAL 60° suture grasper is passed through the posterior inferior lateral portal posterior instability portal, and sutures are retrieved in a retrograde fashion. Sutures are then tied extracapsularly.

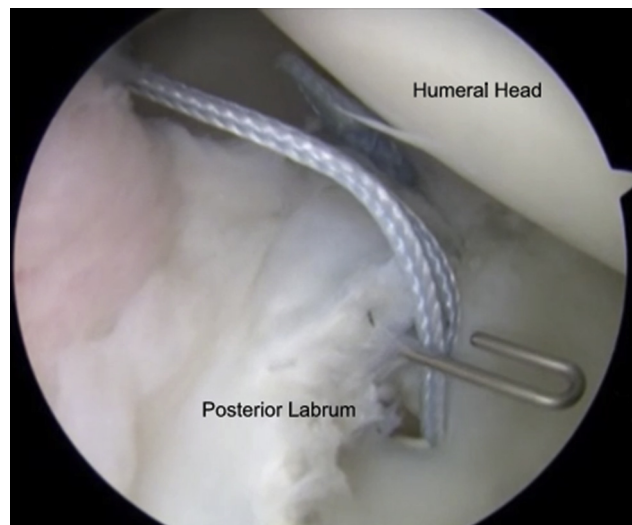


**Fig 7.** View of a right shoulder from the anterior superior portal in the lateral decubitus position. Following repair of the reverse humeral avulsion of the glenohumeral ligament to the humerus, the extent of capsular repair and posterior translation is evaluated.

infraspinatus muscle until reduction of this tissue to its humeral insertion site is possible. One or 2 double-loaded suture anchors are then employed to reattach the lateral capsular tissue to its humeral insertion site. Securing this RHAGL to the humeral head is accomplished by withdrawing the posterior cannula slightly so this it remains immediately posterior to the posterior capsule in an extra-articular location. A retrograde suture retriever (Mitek IDEAL 60° suture grasper) is then used to sequentially retrieve and tie the suture anchor sutures extra-articularly in a mattress fashion until the RHAGL is completely reattached (Fig 6). This lateral capsular reapproximation is then tested for stability by probing the repair and by directly arthroscopically



**Fig 8.** View of a right shoulder from the anterior superior portal in the lateral decubitus position. The posterior instability portal is reestablished by carefully advancing the cannula through the repaired posterior capsule to allow for access to and repair of the posterior labral tear.



**Fig 9.** View of a left shoulder from the anterior superior portal in the lateral decubitus position. Anchors are sequentially inserted in the glenoid from inferior to superior. A Mitek IDEAL 60° suture grasper is passed in a pinch-and-tuck technique. Each anchor is passed and tied prior to placement of the next anchor.

visualizing the repair site while placing the shoulder through a gentle, passive range of motion (Fig 7). Next the posterior instability portal is reestablished by carefully advancing the cannula through the repaired posterior capsule so as to allow for access to and repair of the posterior labral tear (Fig 8).

The posterior labral detachment is then reattached using standard arthroscopic technique. The first suture anchor is inserted into the inferior glenoid at the articular margin adjacent to the previously mobilized posterior labral lesion. A retrograde suture retriever (Mitek IDEAL 60° suture grasper) is then used to retrieve one of the suture limbs after this suture retriever has penetrated the posterior capsule and labrum in a location that is inferior to the suture anchor so that effective retensioning of the labroligamentous tissues is accomplished when this suture is tied (Fig 9). These steps are repeated as necessary until the entire posterior labral lesion is reattached to the posterior glenoid rim. Postoperatively, patients are immobilized in an abduction shoulder immobilizer with organized physical therapy usually initiated at 1 to 4 weeks depending on the extent of the floating PIGHL lesion that was encountered intraoperatively along with the degree of posterior instability present preoperatively. The passive phase of rehabilitation often begins 3 to 4 weeks postoperatively. We begin passive supine external rotation, gradually increasing to full motion. Passive supine forward elevation is gradually increased to full in the scapular plane. The active phase of rehab begins at week 7. Patients warm up with pendulums and progress active range of motion with terminal stretch as tolerated. External rotation and forward elevation (in the scapular plane) are progressed to full supine and then

**Table 1.** Advantages and Disadvantages of Surgical Technique

Advantages
This technique provides a reproducible step to repair a floating posterior inferior glenohumeral ligament.
Easiest if performed in the lateral decubitus position.
Does not require suture shuttling instruments.
Restores the RHAGL and posterior labrum to anatomic position and restores capsular tension.
Disadvantages
Mitek IDEAL 60° suture grasper requires practice to master use of the instrument.
Technique may be more difficult if performed in the beach chair position.
Requires portals placed in appropriate position to allow for correct trajectory for tissue mobilization and anchor placement.
Requires blind tying of sutures in cannula for RHAGL repair.
RHAGL, reverse humeral avulsion of the glenohumeral ligament.

progressed in the seated position. Internal rotation is gradually increased in full by week 12. The resisted phase of rehab begins at week 11. Begin therapy sessions with pendulums to warm up and continue with the active phase exercises. Progress resisted external and internal rotation, standing forward punch, seated rows, and shoulder shrugs. Weight training can begin at week 12. Avoid posterior capsular stretch (do not lock arm out in forward bench press). Minimize overhead activities, and keep hands within eyesight. No pull-down behind head, wide grip bench, or military press. Guidelines for return to sports are as follows: golf chip and putt at 12 weeks and full swing at 6 months, tennis can begin at 5 + months, no contact sports for a minimum of 6 months.

This sequence of repairing the lateral capsular detachment prior to repairing the posterior labral lesion is carried out by the authors specifically to ensure that the lateral capsule can be adequately reapproximated to the humeral head. The alternative sequence of reattaching the posterior labroligamentous detachment and capsule to the glenoid prior to reattaching the RHAGL could inadvertently result in capturing excessive capsule, thus restricting lateral capsular mobility that could preclude reattachment of the RHAGL to its humeral insertion site (Video 1). Thus, repairing the RHAGL before reattaching the posterior labral tear ensures that the RHAGL will always be able to be reattached. In addition, reattaching the RHAGL first also allows the surgeon the opportunity to perform a supplemental “pinch-and-tuck” capsulorrhaphy as necessary without concern that such a capsulorrhaphy could unduly restrain lateral capsular translation.

Alternatively, this sequence of repair steps can be reversed so that the posterior labrum is repaired prior to the lateral capsular detachment from the humeral head. If the labrum is repaired first, one needs to be careful not to incorporate excessive capsule when the labral/capsulorrhaphy is performed. If too much posterior capsular volume is reduced prior to PIGHL lesion repair, then anatomic reattachment of the PIGHL may not be possible.

## Discussion

RHAGL lesions are often difficult to accurately and reliably diagnose preoperatively. While a thorough history and comprehensive physical examination can consistently identify the presence and degree of posterior instability, no specific elicited history or reliable physical examination finding exists that can specifically identify RHAGL lesions or floating PIGHL lesions when present. Also as many as 50% of HAGL lesions are not identified on magnetic resonance imaging.<sup>11</sup> Bokor et al. reviewed 547 cases with shoulder instability and found that 7.5% ( $n = 41$ ) of those patients had instability due, in part, to the presence of an avulsion of the glenohumeral ligament.<sup>15</sup> Also, in a separate study, revision instability cases were more likely to demonstrate an HAGL lesion.<sup>16</sup>

All arthroscopic surgical stabilization procedures should begin with a thorough diagnostic assessment of all labral and ligamentous structures with specific attention paid to the humeral attachments of the glenohumeral ligaments in an effort to identify any and all cases with humeral avulsions of the AIGHL or PIGHL. Failure to address these lesions can result in persistent instability postoperatively.

The authors have successfully repaired a number of these floating PIGHL lesions over the last 10 years.<sup>4</sup> The

**Table 2.** Pearls and Pitfalls of Surgical Technique

Operative Pearls
Critical evaluation of the magnetic resonance imaging will help with preoperative diagnosis of floating posterior inferior glenohumeral ligament.
Localization with spinal needle and placement of 4 portals. Posterior medial portal, posterior inferior lateral portal (posterior instability portal), anterior superior portal, and anterior midlateral portal.
Mobilize the posterior capsule and labrum and confirm ability to reduce it to the anatomic position.
Place the humeral anchors at the anatomic insertion then repair humeral attachment of RHAGL (lateral to the bare area of the humeral head and medial to the rotator cuff insertion).
When using the Mitek IDEAL 60° suture grasper to repair the RHAGL, the surgeon must only remove the cannula in the posterior instability portal just outside the capsule. This will allow for the cannula to be positioned so the grasper can penetrate the RHAGL and grab the suture. The sutures will be in the cannula for tying extracapsularly.
Once humeral detachment has been repaired, then the posterior labral tear can be repaired using a pinch-and-tuck capsulorrhaphy. The benefit of repairing the humeral attachment first is that if the labral tear is repaired with a capsulorrhaphy, then there is a risk of being unable to repair the humeral attachment to its anatomic insertion.
This technique can be reversed and the labrum fixed prior to the humeral attachment of the RHAGL.
Operative Pitfalls
If the cannula in the posterior instability portal is pulled back too far extracapsularly then there is risk of tying muscle into the repair of the RHAGL.

RHAGL, reverse humeral avulsion of the glenohumeral ligament.

described technique has allowed the authors to consistently access and reapproximate these combined detachments of the posterior labrum and RHAGL lesions (Table 1). Accurate portal placement combined with use of an accessory posterior instability portal provides excellent visualization and an appropriate trajectory that maximizes access to both the posterior labral tear and RHAGL lesion (Table 2).

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