

Open Repair of an Anterior Humeral Avulsion of the Glenohumeral Ligament



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Abstract: A humeral avulsion of the glenohumeral ligament, or HAGL lesion, is an uncommon yet disabling shoulder injury, which leads to complaints of pain and overall inability to properly use the shoulder from patients. The diagnosis of a HAGL lesion is particularly challenging. To arrive at an accurate diagnosis, the use of a magnetic resonance arthrogram is suggested along with high clinical suspicion. A HAGL lesion may be anterior or posterior. This difference dictates the type of surgical treatment to be undertaken. Although a posterior HAGL lesion is repaired arthroscopically, an anterior HAGL lesion is treated through an open approach. The purpose of this Technical Note is to describe our preferred technique to surgically treat an anterior HAGL lesion through an open approach.

A humeral avulsion of glenohumeral ligament (HAGL) lesion, while rare, has been reported to be present in 2% to 9% of all cases of recurrent shoulder instability.¹⁻⁴ A HAGL lesion usually occurs as a result of a traumatic event, such as an anterior dislocation of the shoulder, and usually is not seen in isolation.¹ Although the inferior glenohumeral ligament more often will avulse off its insertion on the glenoid, thereby resulting in a Bankart lesion, an avulsion of the ligament off its humeral attachment, or HAGL lesion, also occurs. An anterior avulsion off the humerus is more commonly seen than a posterior avulsion. HAGL lesions are frequently overlooked because these lesions are often seen in combination with other shoulder pathology.⁵ A high level of suspicion is needed to successfully detect the lesion, especially in patients with a prior shoulder surgery resulting in failure.⁶

A variety of imaging modalities may be used to arrive at an accurate diagnosis of a HAGL lesion. Radiograph studies can be used to evaluate if a bony avulsion of the ligaments on the humeral neck is present.^{5,7} Furthermore, plain films contribute to the evaluation of glenoid and/or humeral head bone loss, while also able to detect a bony Bankart lesion or an associated fracture of the shoulder girdle.⁸ Moreover, a magnetic resonance imaging (MRI) scan can be used for diagnosis of HAGL lesions. However, an MRI



Fig 1. A magnetic resonance arthrogram image of the right shoulder showing extension of the intra-articular contrast down the glenoid neck (yellow arrow). This finding is consistent with a humeral avulsion of the glenohumeral ligament, or humeral avulsion of glenohumeral ligament lesion.

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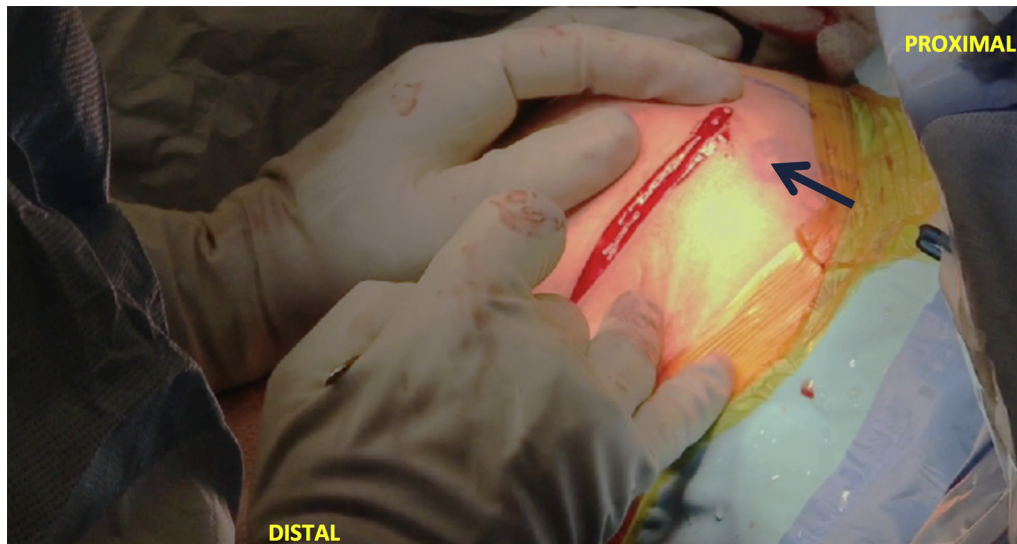


Fig 2. A standard deltopectoral approach is performed in the right shoulder. The incision begins at the level of the coracoid process (blue arrow) and extends distally through the axillary fold for 6 cm. After this, the clavicopectoral fascia is incised in line with the skin incision, and then the cephalic vein is identified and retracted laterally.

should be used with caution because previous studies have reported both false positives and missed HAGL lesions when reviewing MRIs.^{9,10} We recommend the use of a magnetic resonance arthrogram (MRA) for the detection of a HAGL lesion.

HAGL lesions can be treated both conservatively and through surgical repair, dependent on the location and size of the lesion. Park et al.¹¹ showed that larger lesions (6 o'clock to 9 o'clock position on humerus) resulted in increased external rotation, anterior-inferior translation, and abnormal humeral head apex position. All of these abnormalities were normalized by repair of the lesion. Longo et al.⁶ reported in their systematic review that surgical repair of HAGL lesions was associated with significantly less recurrence, defined as luxation or subluxation, when compared with conservative treatment. The purpose of this Technical Note is to describe our preferred technique to surgically treat an anterior HAGL lesion through an open approach.

Surgical Technique

Patient Positioning and Anesthesia

A video overview of the technique with narration is provided in the surgical technique video ([Video 1](#)). The patient is placed in the supine position on the operating table and general anesthesia is used for induction. Single shot or catheter infusion regional anesthesia may be used as well. The patient is then brought into the beach-chair position with care taken to pad all bony prominences. Moreover, the head and neck positioning should be carefully assessed before starting the procedure. We do not use an arm positioner; rather, the

operative extremity is draped free with a well-padded Mayo placed under the elbow.

Objective Diagnosis

Preoperative evaluation should start with a thorough history and physical examination. Diagnostic imaging should consist of shoulder radiographs to assess for osseous abnormality, including glenoid and humeral head bone loss. MRI of the shoulder allows confirmation of the size and extent of the HAGL lesion, as well as any concomitant loose bodies, labral, chondral, or other soft tissue injuries. We recommend the use of an MRA, which should show the extension of intra-articular contrast down the glenoid neck in the setting of a HAGL lesion ([Fig 1](#)).

Operative Technique

General endotracheal anesthesia may be combined with regional nerve blocks to maximize postoperative

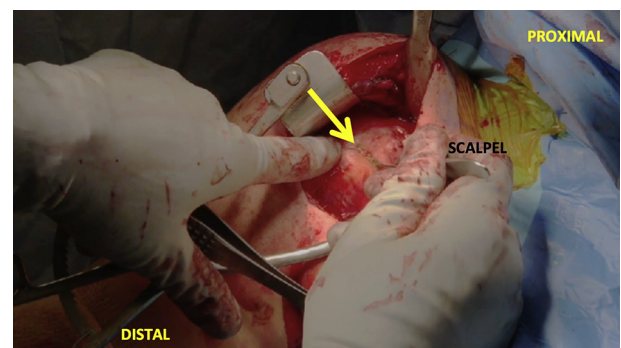


Fig 3. To access the humeral avulsion of the glenohumeral ligament in this right shoulder, the subscapularis tendon insertion is identified and sharply split (yellow arrow) using a scalpel.

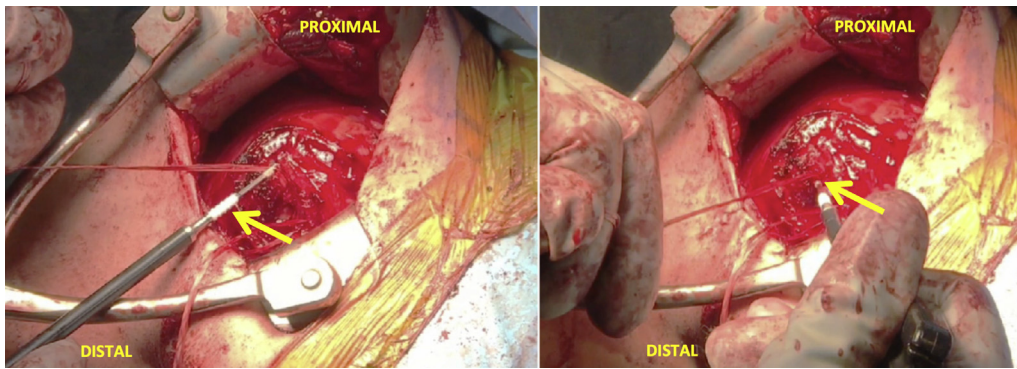


Fig 4. The humeral avulsion of the glenohumeral ligament is identified in a right shoulder, and then the insertion of the ligament on the humeral head is prepared until a bony bleeding surface is formed. The avulsed tissue is secured with FiberTape (Arthrex, Naples, FL), and a 4.75-mm SwiveLock anchor (Arthrex) is used to secure the tissue proximally.

pain control. Perioperative antibiotic prophylaxis is administered intravenously before incision. A diagnostic arthroscopy is usually conducted first to directly visualize the chondral surfaces, glenoid labrum, biceps tendon, and rotator cuff. Any concomitant arthroscopic procedures are carried out at this time.

The open HAGL repair is begun with a deltopectoral approach using an approximately 6 cm skin incision (Fig 2). Subcutaneous flaps are created medially and laterally, and the cephalic vein is mobilized laterally. The clavipectoral fascia is incised proximally to the coracoid, and a Kolbel retractor is placed under the conjoint tendon and deltoid for deep retraction. Throughout the procedure, the axillary and musculocutaneous nerves are protected with careful retraction. Next, the inferior 1 cm of the subscapularis tendon is incised approximately 1 cm medial to its insertion on the lesser tuberosity (Fig 3) with care taken to avoid injury to the axillary nerve, as well as the anterior circumflex humeral artery and veins. A Cobb elevator is used to carefully reflect the inferior subscapularis tendon. This allows direct visualization of the HAGL injury. In this case, the HAGL lesion extends from approximately 3 o'clock anteriorly to 6 o'clock inferiorly along the proximal humerus.

The avulsed inferior glenohumeral ligament is then sharply excised, and all granulation tissue is removed. Suture anchor fixation is used to repair the avulsed tissue. In this case, we used 1 anchor with suture tape (4.75-mm SwiveLock, FiberTape, Arthrex, Naples, FL) superiorly and 2 anchors with suture tape (3.5-mm SwiveLock, FiberTape, Arthrex) inferiorly (Fig 4). The inferior portion of the subscapularis tendon is then repaired anatomically using a single-row technique with suture anchors and suture tape, and a knotless configuration (Fig 5). During the repair, the arm is positioned in approximately 50° of external rotation. Once the repair is complete, a standard, layered closure is performed and the procedure is complete. The advantages and

disadvantages as well as pearls and pitfalls associated with the technique are listed in Tables 1 and 2, respectively.

Postoperative Rehabilitation

The patient is placed in a sling with the shoulder in neutral or internal rotation. Passive range of motion is limited to 60° external rotation, 30° abduction, and 90° forward flexion for 4 weeks. From 4 to 6 weeks postoperatively, range of motion exercises are used that specifically increase external rotation. Progressive resistance training is permitted 6 weeks after surgery. After 4 months, the patient is allowed to return to all activities.

Discussion

Anterior HAGL lesions result in anterior shoulder instability and require extra clinical suspicion to ensure

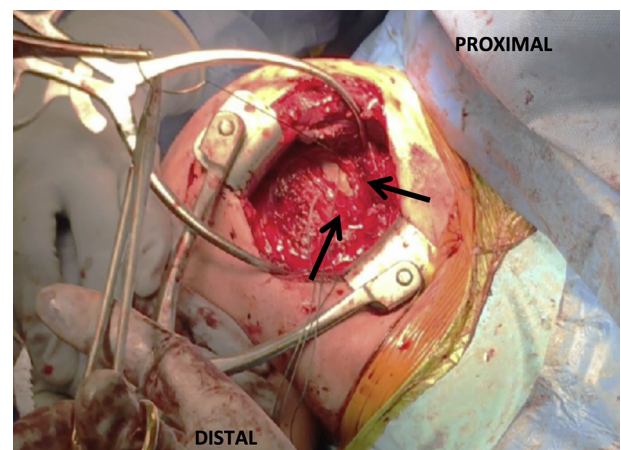


Fig 5. Once the avulsed inferior glenohumeral ligament is reattached to its anatomical position in a right shoulder, the inferior portion of the subscapularis tendon (black arrows) is closed in a standard fashion. Of note, care must be taken to avoid damage to the axillary nerve as well as the anterior circumflex humeral artery and veins.

Table 1. Advantages and Disadvantages

Advantages	Disadvantages
Surgical repair has been shown to lead to significantly increased stability when compared with conservative management	Open procedures do have a risk of increased swelling and inflammation leading to arthrofibrosis and stiffness
Open technique allows direct visualization of the humeral avulsion of glenohumeral ligament lesion for an accurate and anatomic repair	Proximity of neurovascular structures, such as the axillary and musculocutaneous nerves and the anterior circumflex humeral artery and vein, leads to a risk of iatrogenic injury
Open approach allows easy visualization of neurovascular structures to avoid iatrogenic injury	

that they are not missed. These lesions, although less common than other shoulder pathology, can lead to significant pain and instability. Proper diagnosis starts with a thorough physical examination and use of plain radiographs, MRI, and MRA. However, although all these techniques are helpful, the “gold standard” for diagnosis of a HAGL lesion is arthroscopic evaluation.

Once diagnosis has been confirmed, treatment, whether conservative or operative, can be considered. Some studies suggest that conservative management is sufficient for the most HAGL lesions.^{12,13} Furthermore, biomechanical studies, as completed by Park et al.¹¹ and Pouliart and Gagey,¹⁴ suggest that there is a role for conservative management in smaller HAGL lesions. However, numerous studies have shown that conservative treatment do not resolve the issue and ultimately lead to persistent instability. Wolf et al.² attempted nonoperative treatment in 6 patients with HAGL lesions, and all 6 (100%) experienced recurrent instability events. Those same patients underwent repair, and then subsequently had no residual instability.²

Table 2. Pearls and Pitfalls

Pearls	Pitfalls
Localization and lateralization of the cephalic vein help reduce the risk of iatrogenic injury	The open approach, while improving visualization, does increase the risk of arthrofibrosis
Identification, mobilization, and careful retraction of the musculocutaneous and axillary nerves help reduce the risk of damage	
Initial diagnostic arthroscopy allows for visualization of important structures to assess for secondary damage, and also allows an opportunity to perform additional arthroscopic procedures	

Outcomes from both open and arthroscopic repair have shown excellent outcomes in regard to the restoration of stability and resolution of shoulder pain. Longo et al.⁶ reported no difference seen between open and arthroscopic repair with all patients showing no reoccurrence of instability and no complications. George et al.⁵ similarly reported excellent outcomes with both surgical techniques. Arciero and Mazzocca¹⁵ argue for a mini-open approach that allows for preservation of the subscapularis tendon and leads to very little weakness along with a rapid return of strength after surgery.

We believe that the open technique allows for improved visualization of the lesion and the most complete restoration of native anatomy for an anterior HAGL lesion. Our technique is very reproducible and, ultimately, allows for restoration of stability. Equally as important as the procedure is the subsequent rehabilitation program, which focuses on the early restriction of motion. One shortcoming noted for the repair of HAGL lesions is loss of external rotation.⁶ However, we believe if the described technique is undertaken along with the described rehabilitation protocol, then this complication can be avoided and an excellent post-operative outcome is possible. Nevertheless, long-term studies with patient-reported outcomes after open repair of anterior HAGL lesions are required to fully assess and validate the described technique.

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