



# Arthroscopic Repair of Humeral Avulsion of the Glenohumeral Ligament Lesion

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**Abstract:** Humeral avulsion of the glenohumeral ligament (HAGL) is a lesion associated with anterior shoulder instability. Although uncommon, HAGL lesions are a significant contributor to shoulder pain and dysfunction and, if missed, can even be a cause of failed Bankart repair. HAGL lesions should generally be repaired surgically; however, given their low prevalence, there is no consensus on the optimal surgical approach. The purpose of this Technical Note is to describe our preferred surgical technique for the fixation of an HAGL lesion using an all-arthroscopic approach and a knotless suture anchor construct.

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**H**umeral avulsion of the glenohumeral ligament (HAGL) lesions are rare but significant contributors to pain, instability, and functional loss of the shoulder. Although the exact prevalence is unknown, previous studies have identified HAGL lesions in 2.8% to 9.3% of shoulders with anterior instability.<sup>1-3</sup> Most commonly, an HAGL lesion affects the inferior glenohumeral ligament (IGHL) complex, with studies reporting that the anterior band of the IGHL is affected in up to 93% of HAGL cases.<sup>4,5</sup> In general, both the anterior and posterior bands are a major restraint to anterior and posterior translation at 90° of abduction with simultaneous external rotation.<sup>6</sup> The West Point classification system by Bui-Mansfield et al.<sup>7</sup>

can be used to categorize various patterns of injury to the IGHL.

Proper diagnosis and management of these lesions are critical to restore shoulder stability and function, as highlighted by biomechanical studies.<sup>8</sup> However, because of their low prevalence, no comparative studies exist regarding the treatment of HAGL lesions. Although previous reports showed good results after surgical repair, conservative treatment was associated with a high rate of recurrent instability in up to 100% of the cases.<sup>9</sup> Therefore, after diagnosis of an HAGL lesion, surgical repair is generally recommended to prevent persistent pain and recurrent instability of the shoulder joint.<sup>9</sup>

Arthroscopic treatment of HAGL lesions is a technically challenging and demanding technique requiring comfort with infrequently used portals to achieve adequate lesion fixation. The purpose of this Technical Note and [Video 1](#) is to describe an all-arthroscopic technique for the repair of an HAGL lesion in a step-by-step and comprehensible fashion.

## Surgical Technique

### Preoperative Planning

The clinical history and physical examination of patients with HAGL lesions will frequently be similar to that of traumatic anteroinferior instability of the shoulder. However, patients may also present with nonspecific complaints of pain and weakness after failed shoulder instability surgery. In both cases, a high index of suspicion is necessary to diagnose HAGL lesions. Important components to assess on physical

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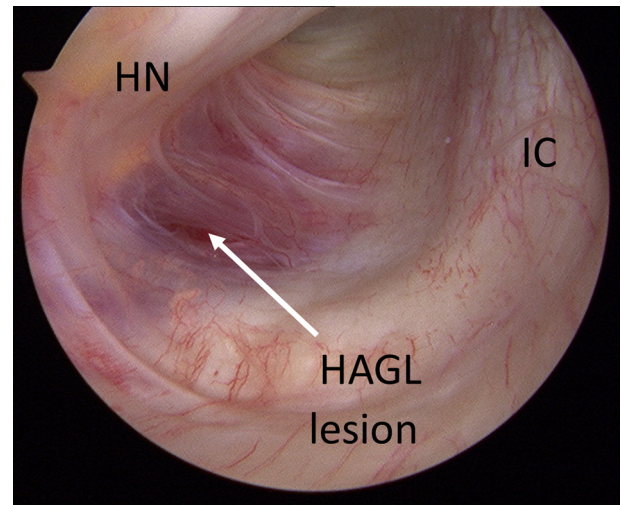
**Fig 1.** T2 MRI coronal view of the left shoulder showing an HAGL lesion. Note how the HAGL lesion has permitted fluid extravasation of contrast from the joint capsule inferiorly into the soft tissue of the arm. (Ac, acromion; F, fluid; G, glenoid; HAGL, humeral avulsion of glenoid ligament; HH, humeral head; HN, humeral neck; MRI, magnetic resonance imaging; SSP, supraspinatus.)

examination include range of motion, the apprehension and relocation tests, and load-and-shift tests. All physical examination findings should be compared with the uninjured, contralateral shoulder.

Standard radiographs including anteroposterior, scapular-Y, and axillary views are obtained routinely. These images assess bony lesions, such as Hill-Sachs lesions or glenoid fractures. In rare cases, a bony avulsion of the humeral neck may be present in cases of HAGL lesions. Magnetic resonance imaging with intra-articular contrast is the best modality for identifying an HAGL lesion and should be obtained when an HAGL lesion is suspected. On a coronal view, an HAGL lesion will result in contrast extravasation from the joint capsule inferiorly into the soft tissues of the arm (Fig 1).

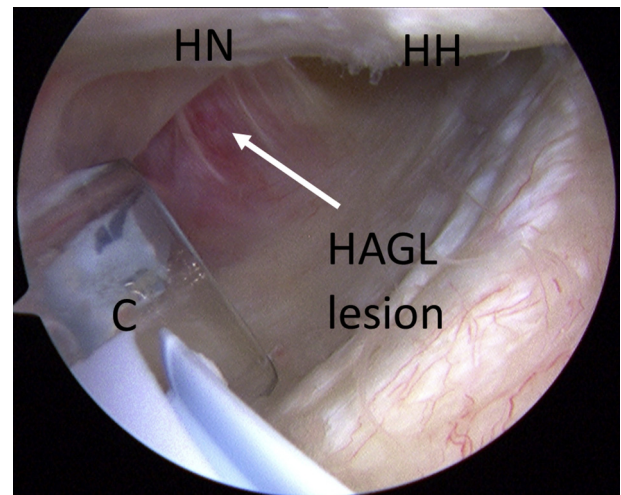
### Anesthesia and Patient Positioning

After induction of general anesthesia, the patient is placed in the beach-chair position. An examination under anesthesia is performed comparing the affected shoulder with the contralateral side and increases in

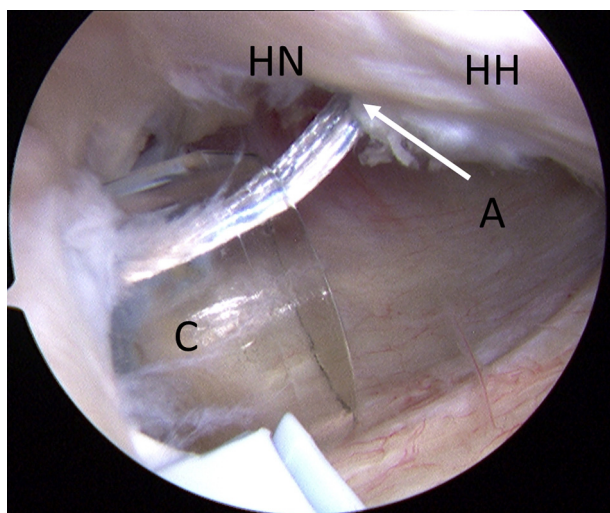


**Fig 2.** Arthroscopic view of a left shoulder through the standard posterior viewing portal confirming the diagnosis of an anterior HAGL lesion within the surrounding inferior glenohumeral ligament complex. (HAGL, humeral avulsion of glenoid ligament; HN, humeral neck; IC, inferior capsule.)

translation of the affected shoulder are noted. The shoulder is prepped and draped using sterile techniques with the operative extremity placed in a pneumatic arm holder (Tenet T-Max Beach Chair and Spider arm positioner; Smith & Nephew; Memphis, TN). Finally, bony landmarks are palpated and marked with an indelible marker.



**Fig 3.** Arthroscopic view of a left shoulder through the standard posterior viewing portal showing an anterior HAGL lesion and the placement of the accessory posteroinferior portal. A self-retaining 8.25-mm cannula (Gemini Cannula; Arthrex, Naples, FL) is used because the wings prevent back-out of the cannula and facilitate retraction of the joint capsule while allowing for the manipulation of the shoulder for arthroscopic instrument access. (C, cannula; HAGL, humeral avulsion of glenoid ligament; HH, humeral head; HN, humeral neck.)



**Fig 4.** Arthroscopic photograph taken from the standard posterior viewing portal in a left shoulder, illustrating a knotless suture anchor in the anterior inferior humeral rim with the sutures exiting the joint through the accessory posteroinferior portal. (A, anchor; C, cannula; HH, humeral head; HN, humeral neck.)

#### Diagnostic Arthroscopy and Debridement

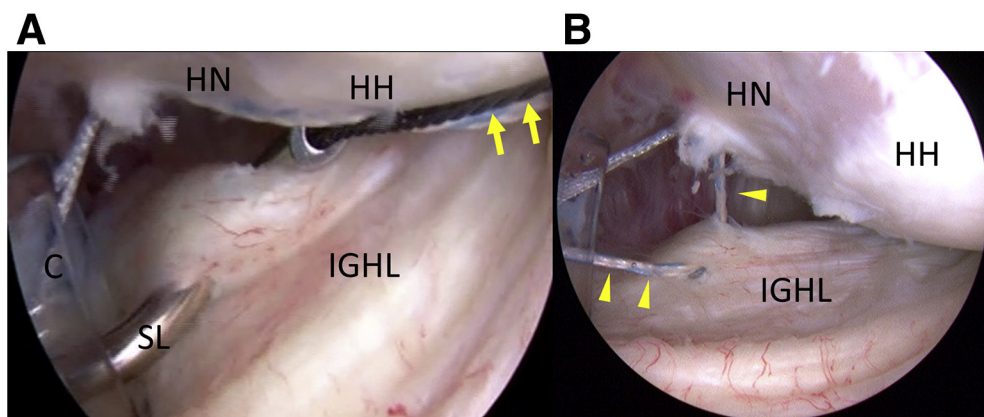
The complete surgical technique is shown in [Video 1](#). After establishing a posterior standard viewing portal, diagnostic arthroscopy is performed. Next, an anterior standard working portal through the rotator interval is created, and a probe is inserted. The rotator cuff, capsulolabral complex, articular cartilage, and long head of the biceps tendon are thoroughly evaluated, and the HAGL lesion is identified at this point ([Fig 2](#)). Furthermore, an additional Bankart lesion of the labrum is frequently present in these cases. If the biceps

tendon shows tearing or tenosynovitis, biceps tenotomy is performed at the attachment to the superior labrum for later tenodesis at the end of the case. Extensive debridement, synovectomy, and lysis of adhesions of the glenohumeral joint are subsequently performed with a 4.0-mm shaver (APS II; Arthrex, Naples, FL) and a 3.75-mm suction radiofrequency cautery device (Super TurboVac 90; ArthroCare, Austin, TX).

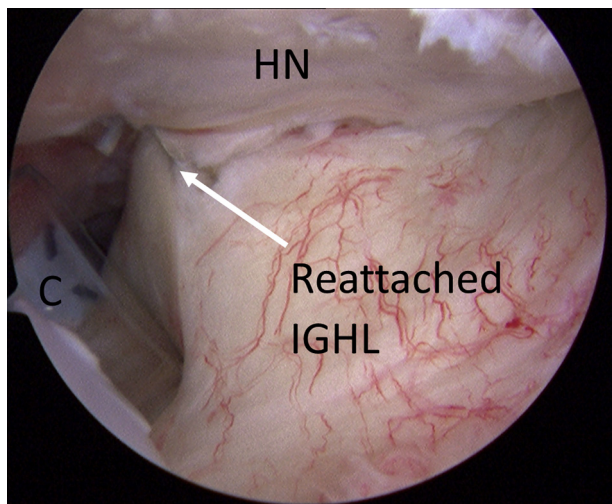
#### HAGL Repair

With the arthroscope placed in the posterior portal, an accessory posteroinferior portal is created under direct visualization using a spinal needle and switching stick. A self-retaining 8.25-mm cannula (Gemini Cannula; Arthrex) is then placed over the switching stick into the posterior inferior quadrant ([Fig 3](#)). The wings of the self-retaining cannula prevent back-out of the cannula and also facilitate retraction of the joint capsule while allowing for manipulation of the shoulder for arthroscopic instrument access. After identification of the anterior HAGL lesion, the anterior and inferior cortical rim of the humerus, also referred to as the humeral neck, is debrided with an arthroscopic shaver to prepare for the placement of suture anchors. The first anchor is placed anteriorly, whereas the second anchor is placed more posteriorly. This approach permits maximum working space during the repair.

Using a 2.4-mm drill and drill sleeve (Arthroscopic Spear; Arthrex) through the posteroinferior cannula, the surgeon drills the tunnel while ensuring that the chondral surface is not violated. When hard bone is encountered, the drill is cycled in and out 2 to 3 times to ensure that shavings and debris are removed from the hole. It is important during this process to stabilize the drill sleeve with the contralateral nondrilling hand to



**Fig 5.** Arthroscopic view of a left shoulder through the standard posterior viewing portal. (A) Via the accessory posteroinferior portal, a shuttling device (SL) is passed through the inferior glenohumeral ligament (IGHL), and the nitinol wire loop (arrows) is retrieved through the standard anterior portal. Not pictured, the repair suture is subsequently loaded through the nitinol wire loop. (B) This is then pulled through the SL, passing the repair suture (arrowheads) through the IGHL. The repair suture is looped through the shuttling suture, and the free end of the shuttling suture is pulled, thereby shuttling the repair suture back into the anchor. (Arrows, nitinol wire; arrowheads, repair suture; C, cannula; HH, humeral head; HN, humeral neck; SL, suture lasso.)



**Fig 6.** Arthroscopic view of a left shoulder through the standard posterior viewing portal. The repair suture has been passed through the splice locking mechanism within the suture anchor and back out the posteroinferior cannula, tightened to desired tension, and cut. The final repair construct is appreciated here. (C, cannula; HN, humeral neck; IGHL, inferior glenohumeral ligament.)

avoid skiving, which can cause articular surface iatrogenic injury or an oblong hole not suited for anchor placement. After the pilot hole is drilled, a 3.0-mm knotless suture anchor (BioComposite SutureTak; Arthrex) is inserted in the anterior, inferior humeral rim. The anchor is then inserted to its appropriate depth (Fig 4). The sutures are released from the anchor-inserter handle, and the inserter is gently removed with combined rotation and in-line traction. The suture anchor is then checked with a shuck on the sutures. We prefer to use knotless anchors to minimize the risk of abrasion on the articular surface or soft-tissue irritation.

The repair suture is retrieved through the anterior arthroscopic portal. An arthroscopic knot-pusher may be necessary to aid in this step, passing the repair suture to the anterior part of the joint. A shuttling device (SutureLasso; Arthrex) is then passed through the IGHL, and the nitinol wire loop is retrieved through the same anterior portal. This step again can be challenging and can be accomplished by passing the wire into the

joint as far as it will go, permitting the retrieval of the wire with an arthroscopic grasper.

The repair suture is loaded through the nitinol wire loop, which is then pulled through the suture lasso, passing the repair suture through the IGHL (Fig 5A). The suture lasso and wire loop are removed together through the accessory posteroinferior portal. The repair suture is then loaded through the loop of the shuttling suture. The free end of the shuttling suture is pulled, thereby shuttling the repair suture back into the anchor (Fig 5B). The shuttle suture is advanced with a series of light tugs until the repair suture is placed through the suture splice locking mechanism and back out the posteroinferior cannula. The free end of the repair suture can then be tightened until desired tension is achieved, and the suture is then cut (Fig 6).

A second knotless suture anchor is subsequently placed in a similar fashion. The second anchor should be placed more posteriorly and laterally compared with the first anchor. With the completed repair, tension is restored to the IGHL complex, creating a robust repair construct of the HAGL lesion. If necessary, additional Bankart or SLAP repairs are performed at this time. After completion of all repairs, integrity of the construct and stability of the shoulder are carefully assessed with an examination under anesthesia. The shoulder should not subluxate on examination, and passive range of motion should be maintained. Pearls and pitfalls of the complete surgical procedure are outlined in Table 1.

**Postoperative Rehabilitation**

Postoperative rehabilitation includes early passive range of motion for 3 weeks limited to 120° of forward elevation, 90° of abduction, and 30° of external rotation. At 3 weeks, patients begin full passive range of motion. Active and active-assisted motion begins at 6 weeks, at which time patients wean from the sling. Full return to activities is expected at 3 months.

**Discussion**

In this Technical Note, we describe an all-arthroscopic surgical technique for HAGL repair using suture anchors. This procedure provides a safe and

**Table 1.** Pearls and Pitfalls of the Surgical Technique

Surgical Steps	Pitfalls	Pearls
Portal placement	Improper placement results in difficult visualization and instrumentation of the joint	Accessory posteroinferior portal is created under direct visualization using a spinal needle and switching stick and is located 2-3 cm inferior to the posterior portal
Joint manipulation	Difficulty with arthroscopic access and instrumentation of the humeral neck	A winged self-retaining cannula in the accessory posteroinferior portal is especially helpful in retracting the joint for easier manipulation
Suture management	Difficulty passing the repair suture to the anterior portal	A knot pusher may be used to assist passage of the repair suture

**Table 2.** Advantages and Disadvantages of Arthroscopic HAGL Repair Compared With the Open Technique

Advantages	Disadvantages
Minimally invasive	Technically challenging
Can better visualize and address concomitant intra-articular pathology	Accessory posteroinferior portal may put the axillary nerve at risk
Better cosmetic outcome	Long-term outcomes unknown
Positive results from short-term case series	

HAGL, humeral avulsion of the glenohumeral ligament.

comprehensive alternative option to other comparable reconstructive techniques for HAGL lesions.

In the literature, several arthroscopic and open techniques have been described to reconstruct HAGL lesions with studies limited to small series and case reports. Arthroscopic techniques are generally widely used; however, the details of each technique may differ significantly. Some authors prefer an axillary-pouch portal, which is placed approximately 2 to 3 cm directly inferior to the lower border of the posterolateral acromial angle and 2 cm lateral to the standard posterior viewing portal.<sup>10</sup> Still, others prefer a more anterior portal located along the edge of the IGHL at the 5 o'clock position in relation to the glenoid, approximately 1 cm inferior to the upper border of the subscapularis tendon and as lateral as possible.<sup>11</sup> Studies investigating the postoperative outcome after complete arthroscopic repair of HAGL lesions are generally rare and limited to case series. Kon et al.<sup>12</sup> reported that 3 patients were asymptomatic and had no recurrent instability at a minimum 16-month follow-up after treatment with an arthroscopic repair. Similar results were presented by Field et al.,<sup>13</sup> who reported on 5 patients treated with arthroscopic repair of combined HAGL and Bankart lesions with an average follow-up of 26 months.

As the axillary nerve might be in danger during creation of an arthroscopic posteroinferior portal, several authors prefer an open technique to treat anterior HAGL lesions.<sup>14</sup> In a recent study, Provencher et al.<sup>14</sup> reported excellent postoperative outcomes with no recurrent instability in 17 patients treated with an open HAGL repair using a 4-cm deltopectoral approach extending from the axillary fold toward the coracoid, which was originally described by Arciero and Mazzocca.<sup>15</sup> Bhatia and DasGupta<sup>16</sup> reported the outcomes of open HAGL repairs; however, all cases were associated with a concomitant Latarjet procedure as treatment for patients with anterior shoulder instability and glenoid bone loss. As a result, they reported excellent postoperative outcomes and significant improvement in functional scores at a short-term follow-up for combined reconstruction of HAGL lesions and the Latarjet procedure via a subscapularis-sparing approach.

Moreover, Bokor et al.<sup>1</sup> have also described an open technique for the treatment of HAGL lesions, but did not report clinical results. The advantages and disadvantages of the arthroscopic technique compared with the open technique are outlined in Table 2.

In summary, arthroscopic or open surgical HAGL repair is a reasonable treatment option for patients with humeral avulsion tears of the IGHLs wishing to avoid recurrent instability and pain. The advantages of an all-arthroscopic technique may include better cosmetic outcome and faster rehabilitation. However, higher level clinical trials are needed to further investigate and conclusively show the benefit of the arthroscopic technique.

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