

# Arthroscopic Posterior HAGL Repair Using a Direct Transaxillary Portal



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**Abstract:** Humeral avulsion of the glenohumeral ligament (HAGL lesion) is a challenging problem in surgery for shoulder instability. Open and arthroscopic approaches and techniques have been described to address this issue. Especially posterior HAGL lesions increase the surgical complexity, as open anterior approaches provide limited visibility and access for successful repair. This article describes an alternative technique using an arthroscopic transaxillary approach to deploy the suture anchor with a perpendicular angle to the humeral bone, thus, improving the ability to perfectly position the anchor at the anatomic insertion of the inferior humeral ligament.

## Introduction

**A**vulsion of the inferior glenohumeral humeral ligament (HAGL lesion) results from post-traumatic shoulder instability with or without various injuries to the capsulolabral complex<sup>1-7</sup> (Fig 1).

As the lesion is often overlooked, it is only observed in 2.4% to 9.3% of the primary cases. However, analyzing revision stabilization procedures up to 18.2%, HAGL lesions were reported by Boker et al.<sup>2,4-6,8</sup>

Open and arthroscopic approaches and techniques have been described.<sup>1,2,5,8-18</sup> Visualization and surgical access to the anatomic insertion of the inferior humeral ligament is challenging, and different ways have been attempted to minimize morbidity of the surgical approach, while improving the quality of repair.

To improve visualization and localization of the repair site and the direction and angle of suture anchor placement, a direct transaxillary arthroscopic portal for HAGL repair will be described in this article.

## Surgical Technique

Inferior glenohumeral ligament and inferior capsule repair for a humeral avulsion of the glenohumeral

ligament (HAGL lesion) is performed in addition to repair of other compromised intra-articular structures such as the superior labrum (SLAP lesion), anterior labrum (Bankart lesion), posterior labrum (Kim lesion), and capsule-ligament complex to stabilize the shoulder. It is recommended to start the HAGL repair before the other procedures to avoid fluid loss into the soft tissue through the inferior capsular lesion and to allow visibility and access before tightening the joint capsule (Fig 1).

## Positioning, Portal Placement, and Instruments

The authors preferred method of positioning the patient is in a lateral decubitus position with double traction of the operated arm in the longitudinal and axial directions. This allows visualization of the anterior, inferior, and posterior joint and provides adequate space for suture manipulation in the 6-o'clock position. Two working cannulas are established (anterior and posterior) and a suture passing device is required. In a right shoulder with posterior HAGL lesion, the author prefers a left-angled 25° suture lasso (Arthrex, Naples, FL).

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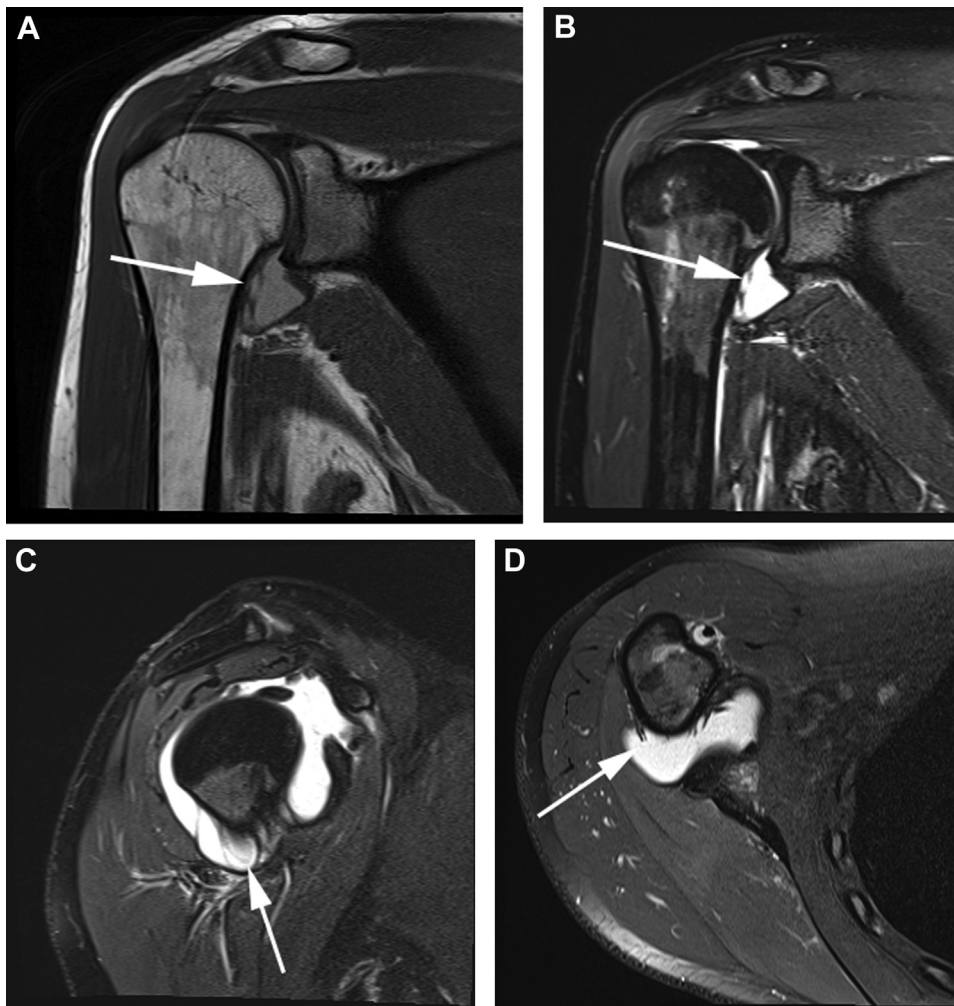
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**Fig 1.** MRI scans of the right shoulder of an 18-year-old female with a traumatic shoulder dislocation after a fall from a horse 4 weeks prior, who presented with generalized hyperlaxity (Beighton score 7/9). T1-weighted frontal image (A), T2-weighted frontal image (B), T2-weighted sagittal image (C), and T2-weighted axial image (D) show the detached posterior inferior glenohumeral ligament (pIGHL) (white arrows) from the insertion at the cartilage border of the inferior humeral neck. Increased overall capsular volume.

### HAGL Repair

Beginning with a standard posterior portal placed very inferiorly, an anterior portal is established, and a working cannula is inserted (Video 1). A lateral portal at the 12-o'clock position is established later after completion of the suture anchor deployment into the inferior humeral neck. After inspection of the insertion site of the inferior joint capsule at the inferior cartilage border of the humeral head anteriorly and posteriorly, the HAGL lesion is identified, and a decision concerning the repair technique is made. In the case of a more posterior lesion, direct visualization from the posterior portal is already established. Using a blunt instrument of the index finger, percutaneous probing and confirmation are made for the direct axillary approach to the humeral neck at the posterior part of the axillary fold. A stab incision is made, and the Wissinger rod is advanced to the HAGL lesion until it is visible. Advancing the blunt end into the joint through the remnants of the inferior capsule and posterior inferior glenohumeral ligament (pIGHL) allows direct placement at the

avulsion site. Careful control of perfect angulation is required at this point. The suture guide is gently and carefully passed over the Wissinger rod to avoid entanglement with neurovascular structures in the axillary fold. The guide is placed perpendicular to the bony surface directly at the edge of the cartilage surface of the humeral head. After gentle punching and breaking of the cortical surface a double-loaded 2.9-mm Juggerknot is inserted into the humerus. After placement of the all-suture anchor all 4 suture strands are shuttled to the antero-inferior portal.

Now, a lateral portal is established at the 12-o'clock position, and a camera is switched upward (lateral portal). The existing posterior portal is held open by a switching stick that is now checked for optimal position and replaced with another working cannula. The rest of the procedure can be carried out by using the 2 working cannulas anteriorly and posteriorly.

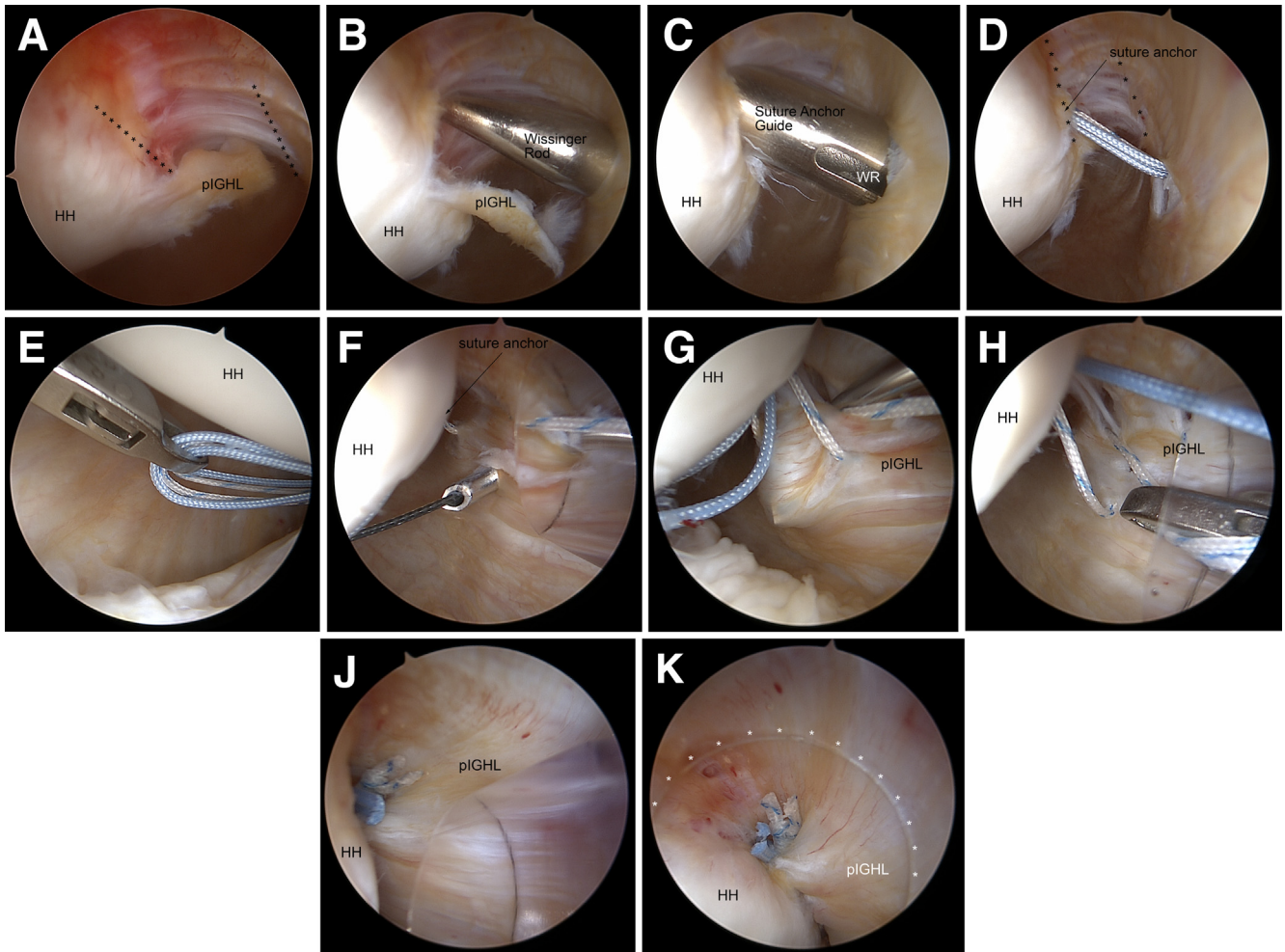
With a right shoulder, the left 25°-angulated Suture-Lasso (Arthrex) is first inserted into the inferior capsule coming from the posterior portal, and ~1 cm of tissue is

captured between the entrance and exit. The lasso is shuttled anteriorly, and one free end of the first suture pair (white tiger in Fig 2 E and F) is introduced into the loop. The lasso is retracted, and the suture strand is shuttled to the posterior portal.

Again, the 25°-left-angled suture lasso is used to perforate the inferior capsule with a certain distance to the first suture of about 10 mm. Care must be taken to keep the violation of the tissue as minimal as possible and to keep the tissue bridge between the 2 sutures intact. The free end of the lasso is shuttled anteriorly,

and the second corresponding free suture limb is introduced into the loop and shuttled to the posterior portal in a retrograde fashion (white tiger, Fig 2F). As a result, a simple mattress stitch is created incorporating the inferior capsule with the avulsed pIGHL.

The 25°-left-angled suture lasso is used to perforate the inferior capsule again halfway between the already made mattress suture with a certain distance to the connecting line of both penetration spots of about 5-10 mm. The free end of the lasso is shuttled anteriorly, and the first suture limb of the second suture pair



**Fig 2.** Arthroscopic view (A) from posteroinferior in a right shoulder into the glenohumeral joint. The inferior joint capsule is detached from the humeral head (HH), and the black asterisks mark the edges of the rupture, remnants of the posterior inferior glenohumeral ligament (pIGHL) are still attached to the humerus. (B) A Wissinger rod is placed perpendicular to the curvature of the proximal humerus at the insertion site of the pIGHL through a direct posterior transaxillary portal. (C) The suture guide is placed over the Wissinger rod in place through the direct posterior transaxillary portal. The Wissinger rod is removed and the 2.9-mm, double-loaded suture anchor (Juggerknot; Zimmer Biomet, IN) is deployed (D). A supero-lateral viewing portal is established, and the camera is switched (E); all suture strands are shuttled to the anteroinferior portal (E). The inferior capsule with the pIGHL is pierced with a 25° Suture Lasso (Arthrex, FL), and the sutures are placed through the pIGHL in a retrograde fashion (F). The suture configuration can vary, the Mason-Allen-configuration provides good cutting through resistance (G). All connected suture limbs are shuttled separately to the posteroinferior portal to avoid entanglement of the suture limbs (H). After subsequent tying and securing of the knots, the pIGHL is reduced to its natural insertion site at the inferior border of the humeral cartilage at the humeral neck without gap formation (J). Direct vision through the working cannula (white asterisks) confirms secure fixation of the pIGHL to the humerus with knots outside the contact area of the shoulder joint (K).



**Table 1.** Pearls and Pitfalls

Pearls	Pitfall
Complete arthroscopic procedure with excellent visualization of the lesion and the result of the HAGL repair	Neurovascular risk is potentially increased for the transaxillary passing of the suture guide.
Minimally invasive	Passing of the Wissinger rod is highly dependent on experience.
Subscapularis tendon remains intact and untouched.	No direct visualization of the axillary structures is possible.
Insertion angle of the suture anchor is perpendicular to the bone resulting in low risk for pullout.	Overtightening of the capsule can lead to stiffness and capsulorrhaphy arthropathy in the long term.
Posterior HAGL lesions can be easily addressed during surgery without need to change positioning of the patient.	No clear anatomical landmarks to define the entry point for the anterior and posterior transaxillary portal

HAGL, humeral avulsion of the glenohumeral ligament.

(blue in Fig 2G) is introduced into the loop and shuttled to the posterior portal in a retrograde fashion. The second remaining suture limb of the second suture pair is not transported through the capsule. As a result, a Mason-Allen-configuration stitch is created incorporating the inferior capsule with the avulsed pIGHL with a stable grasp of the tissue and improved cut-through resistance compared to simple mattress stitches alone.

The knot-pusher is used to tighten the construct beginning with the first pair of suture (white tiger in Fig 2, mattress stitch) followed by the second suture pair (blue suture in Fig 2, simple stitch). As a result, the capsular insertion of the inferior capsule and with the IGHL will be restored in its anatomic position closing the capsular gap at the humeral neck. The above-described technique can be adjusted to the size of the HAGL lesion with additional suture anchor placement from posterior or anterior.

Anterior HAGL lesions can be addressed in the same way as described above but with the viewing portal anteriorly for anchor deployment through the transaxillary approach, which would be at the anterior part of the axillary fold. As the antero-inferior portal is established above the subscapularis tendon direct vision of the HAGL lesion for suture anchor deployment can be difficult. In order to improve the viewing angle a 70° scope can be used or an additional 5-o'clock portal can be established.<sup>12,19</sup>

## Discussion

Arthroscopic HAGL repair has been previously described using standard anterior and posterior shoulder arthroscopy portals.<sup>12,13,20</sup> As the angulation of the guiding instrument for suture anchor deployment in relation to the insertion of the inferior capsule is not perpendicular, aslant placement of the suture anchor can possibly compromise the ideal spot for anchor placement and the stability and pullout strength. Anz et al.<sup>21</sup> described arthroscopic HAGL repair in a cadaver study with only 70% of the placed knotless suture anchors with a curved setting device using anterior 5-o'clock portals within the footprint of the anterior

band of the IGHL or at the articular margin and 6 events of anchor pullout in 12 specimens.

The surgeon can attempt to compensate for this circumstance by rotating the humerus or by using curved drill guides, but technical possibilities are limited.<sup>17,21</sup> Huberty et al.<sup>8</sup> describe this problem as being one most difficult and most unforgiving angles of approach to achieve in shoulder arthroscopy and referred to it as “the killer angle.”

Direct and perpendicular approach to the inferior humeral neck through a transaxillary approach comes at the cost of an increased risk to neurovascular structures in the axillary region (Table 1). The described technique with only a stab incision of the skin and gentle advance of the blunt Wissinger rod through the soft tissue is intended to keep all major anatomic structure intact even in the event of a collision during the placement. The described surgical technique with passing of the suture guide over the Wissinger rod without switching of instruments further minimizes the risk of neurovascular damage.

The alternative with uncompromised placement of suture anchors at the inferior humeral neck would be an open deltopectoral approach with complete detachment of the subscapularis tendon and exposure of the inferior shoulder capsule in a position with maximal external rotation for posterior lesions. Sufficient reattachment of the subscapularis tendon would then be the most important step of the procedure and the impact on shoulder function and the long-term result maybe more important than successful HAGL repair itself.

A mini-open HAGL repair has been described by Aman et al.<sup>14</sup> The authors did not detach but split the subscapularis tendon at the junction of the superior three-fifths and the inferior two-fifths, but in the presented case, an additional peel of the inferior subscapularis tendon was necessary. Repair of the subscapularis was achieved using a biodegradable suture anchor for repair of the inferior subscapularis peel and nonresorbable sutures in a figure-of-8 fashion for the horizontal subscapularis.<sup>14</sup> A comparable surgical technique has been published by Arciero et al.<sup>16</sup>

A true mini-open approach has been described by Bhatia et al.<sup>15</sup> using a 1-inch incision through the anterior axillary fold to directly access the humeral neck below the level of the subscapularis tendon and above the insertion of the pectoralis major tendon, which are retracted to enlarge the operating field. Not all cases were suitable to this minimally invasive method, but in about one-third, an L-shaped incision of the subscapularis was necessary.<sup>15</sup>

Most publications refer to a more anterior detachment, which are amenable to open or arthroscopic repair.<sup>1,2,5,8-17</sup> Posterior and inferior locations of the HAGL lesion present a different technical challenge, as described in this surgical technique, but successful arthroscopic refixation has been described as well.<sup>9,17</sup> Treating a posterior HAGL lesion in an open fashion would require a double incision approach, an anterior approach for the Bankart repair, and a posterior approach for the HAGL repair, which would not only be less favorable for the patient but require a significant additional effort in terms of positioning of the patient and operating time.

Since the first application of the transaxillary HAGL repair in a 30-year-old female vascular surgeon in September 2020, the author has successfully applied this technique in a number of shoulder stabilizations with good clinical results without any complication.

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