

Humeral Avulsion of the Glenohumeral Ligament in an Adolescent: A Case Report of a Relatively Rare but Clinically Relevant Orthopedic Entity

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Abstract: Humeral avulsion of the glenohumeral ligament (HAGL) is defined as a disruption of the fibers of the inferior glenohumeral ligament at its humeral insertion. It is a relatively rare but important entity, given its diagnostic and clinical implications and growing debate around the treatment of adolescent patients particularly those who participate in sports. While well described in the orthopedic literature, HAGL has not been often discussed in the radiology literature. This case report presents classic imaging characteristics of HAGL in an adolescent football player. In addition, this case report addresses the epidemiology, the causes, the subtypes, and some aspects of treatment of HAGL.

Keywords: HAGL, glenohumeral ligament, shoulder injury

Case Presentation

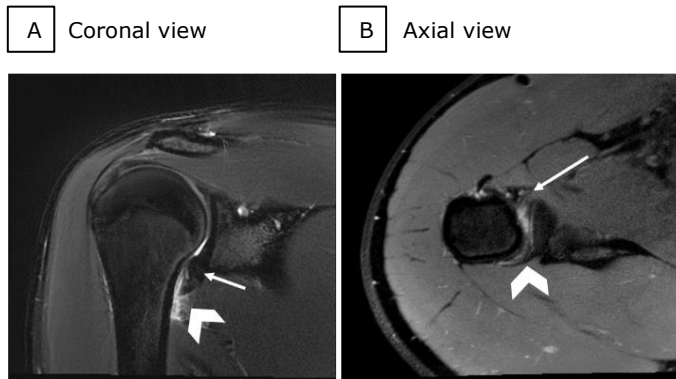
A 17-year-old boy presented with right shoulder pain started during a football game, immediately after a fall with his arm outstretched and externally rotated. The result of the apprehension test administered shortly after the patient's fall was mildly positive. Findings from urgent 3-view radiographic examination appeared normal. A noncontrast magnetic resonance imaging (MRI) was performed to evaluate soft tissue structures of the shoulder. The examination showed fluid signal at the humeral attachment of the glenohumeral ligament, suggesting humeral avulsion of the glenohumeral ligament (HAGL) (Figure 1 A, B). The patient was treated conservatively with rest. During a follow-up visit, physical examination of the shoulder revealed no

Key Points

- Humeral avulsion of the glenohumeral ligament (HAGL) is a disruption of the fibers of the inferior glenohumeral ligament at its humeral insertion.
- HAGL typically affects young athletes and adult males with shoulder overuse.
- HAGL is rare but critical to identify as it causes a high rate of recurrent shoulder instability.
- HAGL is easily overlooked; high index of suspicion is necessary to identify HAGL on imaging and during operation.
- HAGL can be difficult to visualize on imaging; it is best evaluated by MR arthrography, which may demonstrate J sign, the leakage of contrast or joint fluid across the tear of the axillary pouch.

abnormalities, and the patient was allowed to resume playing football the following week.

Figure 1. MR Images of a 17-Year-old Adolescent with HAGL



T2-weighted fat-suppressed MRI, coronal view (A) image shows a subtle, characteristic J sign as a signal void (A, arrow), which represents the torn inferior glenohumeral ligament (IGL) drooping inferiorly from its humeral insertion. Periligamentous edema is also present (A, arrowhead). Proton density fat-suppressed MRI, axial view (B) shows the lost shape of the normal axillary pouch and disruption of the fibers connecting the anterior band of the IGL to its humeral insertion (B, arrow). The posterior band remains intact (B, arrowhead).

Discussion

While well described in orthopedic literature, HAGL has not been routinely discussed in the radiology literature.¹ As its name implies, HAGL is defined by a disruption of the fibers of the inferior glenohumeral ligament (IGHL) at its humeral insertion. Figure 2 shows a schematic² and MR arthrograms of the normal anatomy of the shoulder ligaments. HAGL is classified into four types: (1) HAGL with torn insertion of the anterior band of the inferior glenohumeral ligament (ABIGL), (2) axillary pouch HAGL with intact ABIGL, (3) bony avulsion of the IGHL (BHAGL), and (4) detached floating HAGL, the combination of HAGL with Bankart lesion.³ Based on these descriptors, our patient's lesion is classified as HAGL with torn insertion of the ABIGL.

HAGL is a relatively rare entity. A review of 1000 consecutive MRI studies of the shoulder reported a low prevalence of HAGL, only 1.6% of all cases.⁴ The lesion occurs predominantly in males aged 20 to 50 years, up to 4% of whom have anterior shoulder instability.³ HAGL was first described in 1942, with a mechanism of injury being identified

as hyperabduction and external rotation of the arm,⁵ similar to the mechanism of injury in our patient. Other mechanisms include anterior glenohumeral instability and tension in the inferior joint capsule caused by repetitive microtrauma, occurring most frequently in athletes with shoulder overuse: volleyball, rugby, football, and basketball players.^{1,3} Most patients with HAGL, including our patient, present with shoulder pain, apprehension in abduction and external rotation, and decreased external rotation.³

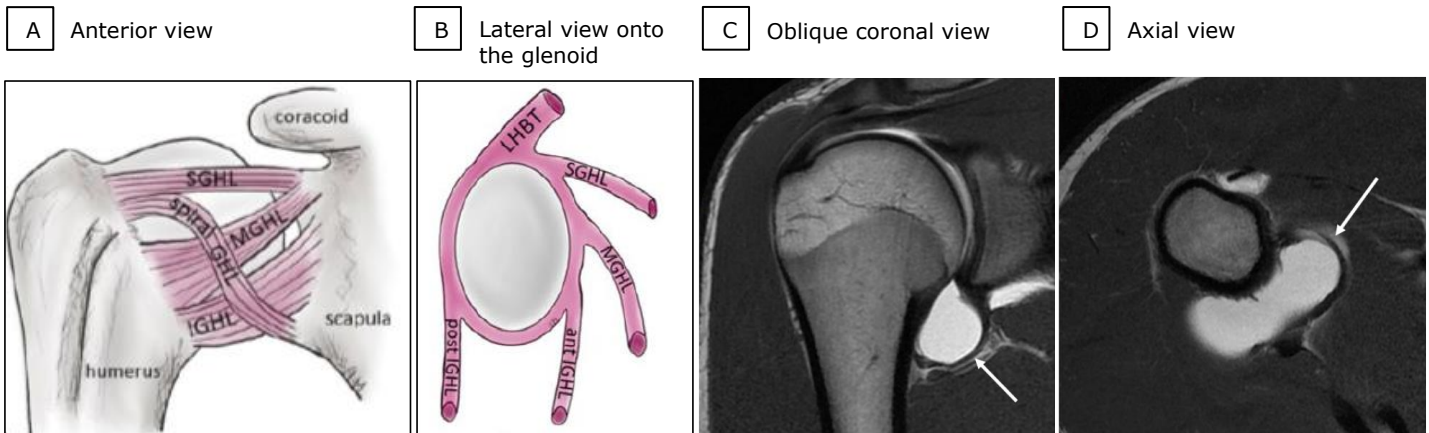
Radiographic evaluation, although typically is the first step in the work-up of patients with suspected HAGL, usually does not show the abnormality, as it occurred in the evaluation of our patient, unless the trauma involves a BHAGL.¹ If there is a BHAGL, findings include an "avulsion fracture from the medial cortex of the humeral neck [with a] thin radiolucency. . . inferior to the anatomic neck of the humerus, the donor site of the bony HAGL."^{1(p.650)}

Although the rationality of preoperative MRI in diagnosing HAGL is debated, the procedure, especially as it relates to MR arthrography, remains the most reliable modality to detect this lesion.⁶ In addition to high intensity signal, MRI characteristics of HAGL, seen on oblique coronal T2-weighted images, include a transformation of the normally fluid-filled U-shaped axillary structure into a J-shaped axillary pouch, a J sign, and extra-articular contrast or joint fluid leakage into the axillary region.¹ According to Maldjian et al,⁶ contrast leakage into an extra-articular space may be the most reliable diagnostic sign of HAGL. In noncontrast MRI, the nonspecific J sign may be the only sign in subtle HAGL cases.⁶ Although our patient did not receive contrast, the typical J sign was present (Figure 1 A, B). Yet, HAGL may be difficult to visualize on MRI, even if the tear is large.⁴ One study⁴ reported that severe HAGL cases were not seen on retrospective MRI review even after being confirmed arthroscopically. Because of scarring, which may appear as the inferior glenohumeral ligament thickening, HAGL evaluation can be more difficult if imaging does not occur soon after the initial injury.⁴ Relative to surgery, MRI has a 70% sensitivity and 100% specificity for HAGL detection.⁴ In cases where HAGL is not seen on MRI, but suspicion of the lesion presence remains high, MR arthrography

can be used for its superior sensitivity, specificity, and the ability to provide better joint distension.⁴ The recognition of HAGL is gaining traction, given its clinical implications for patient care. Typically,

patients with small tears are treated conservatively, whereas patients with large tears or tears with failed nonoperative treatment are treated surgically.⁷ In patients whose lesions were

Figure 2. Schematic and MR Arthrograms of the Normal Anatomy of the Shoulder Ligaments.



A and B, Schematic Illustrations of Normal Anatomy of the Shoulder. The anterior ligaments of the shoulder (A) and lateral view onto the glenoid (B). (SGHL, superior glenohumeral ligament; MGHL, middle glenohumeral ligament; IGHL, anterior band of the inferior glenohumeral ligament; spiral GHL, spiral glenohumeral ligament or fasciculus obliquus; LHB, long head of biceps tendon; SGHL, superior glenohumeral ligament; MGHL, middle glenohumeral ligament; IGHL, inferior glenohumeral ligament).² Republished under the Creative Commons Attribution (CC BY-NC 3.0). (<https://creativecommons.org/licenses/by-nc/3.0/legalcode>). C and D, T1-weighted MR arthrogram of a normal shoulder. Oblique coronal view (C) shows the inferior glenohumeral ligament (IGL) seen as a thin hypointense band bordering the normal contrast-distended U-shaped axillary pouch (C, arrow). Axial view (D) shows an intact anterior band of the IGL (D, arrow). The posterior band (not shown) was also intact.

treated surgically, no differences in outcomes were seen between arthroscopy and open restoration.⁷ Overall, surgical repair has good clinical and functional outcomes as well as low recurrence rates compared with conservative treatment.^{7,8} Some advocate a more aggressive treatment approach for specific patient populations,^{7,9} particularly young adolescent patients, given the risk of recurrent shoulder instability with unrepaired HAGL. However, in skeletally immature patients, the question whether to operate remains debated.⁹ Our patient's age was at the upper limit of the pediatric range, but on radiographs, the patient was qualified as skeletally mature. Given the patient's desire to return to sports, one could advocate for surgical repair of the patient's lesion. However, the patient quickly recovered following conservative treatment.

Although HAGL can be recognized arthroscopically or during open stabilization, it can be easily

overlooked.¹⁰ Patients with unrepaired HAGL may have recurrent postoperative shoulder instability despite restoration of an associated lesion.¹⁰ Accordingly, a high index of suspicion for HAGL should guide the evaluation of both postoperative imaging of failed surgical repair of shoulder instability and preoperative imaging of shoulder instability.⁸

Conclusion

We presented a classic case of HAGL, a relatively rare but clinically relevant entity, with some highlights of the lesion diagnosis and treatment. Specifically, this was a case of a full-thickness traumatic tear of the IGHL at its humeral insertion in an adolescent football player, presumably with atraumatic shoulder overuse. The lesion was treated conservatively per practice guidelines. Reporting HAGL in a relatively young athlete who

has the risk of recurrent shoulder instability contributes to an ongoing discussion of whether surgical treatment of HAGL should be considered. In surgical planning, radiologic identification of HAGL is critical for ensuring proper surgical evaluation and repair to optimize postoperative shoulder stability. The gold standard imaging modality is MR preferably with arthrography, although delay in imaging following the injury can make visualization of the lesion difficult.

Author Contributions

Conceptualization, J.C. and T.T.Y.; Writing – original draft preparation, T.T.Y.; Review and editing, J.C. and T.T.Y.; Supervision, J.C. All authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Disclosures

None to report.

References

- Bui-Mansfield L, Taylor D, Uhorchak J, Tenuta J. Humeral Avulsions of the Glenohumeral Ligament: Imaging Features and a Review of the Literature. *AJR Am J Roentgenol.* 2002;179(3):649-655. DOI: [10.2214/ajr.179.3.1790649](https://doi.org/10.2214/ajr.179.3.1790649)
- Kadi R, Milants A, Shahabpour M. Shoulder Anatomy and Normal Variants. *J Belg Soc Radiol.* 2017;101(S2):3. doi.org/10.5334/jbr-btr.1467
- Gyftopoulos S, Tuite M. HAGL Lesion. STATdx - App.statdx.com. <https://my.statdx.com/document/hagl-lesion/702e5645-f08c-4f35-b718-56af4c335a90/print> Published online 2019. Accessed October 19, 2019.
- Magee T. Prevalence of HAGL lesions and associated abnormalities on shoulder MR examination. *Skeletal Radiol.* 2013;43(3):307-313. doi.org/10.1007/s00256-013-1778-1
- Nicola T. Anterior dislocation of the shoulder: the role of the articular capsule. *J Bone Joint Surg.* 1942;24(3):614-616. Located at: UCLA Young Research Library, Los Angeles, CA, USA
- Maldjian C, Khanna V, Bradley J, Adam R. Evaluation of Contrast Extravasation as a Diagnostic Criterion in the Evaluation of Arthroscopically Proven HAGL/pHAGL Lesions. *Radiol Res Pract.* 2014;2014:1-9. doi.org/10.1155/2014/283575
- Bozzo A, Oitment C, Thornley P. et al. Humeral Avulsion of the Glenohumeral Ligament: Indications for Surgical Treatment and Outcomes—A Systematic Review. *Orthop J Sports Med.* 2017;5(8):232596711772332. doi.org/10.1177/2325967117723329
- Longo U, Rizzello G, Ciuffreda M. et al. Humeral Avulsion of the Glenohumeral Ligaments: A Systematic Review. *Arthroscopy.* 2016;32(9):1868-1876. doi.org/10.1016/j.arthro.2016.03.009
- Longo U, van der Linde J, Loppini M, Coco V, Poolman R, Denaro V. Surgical Versus Nonoperative Treatment in Patients Up to 18 Years Old With Traumatic Shoulder Instability: A Systematic Review and Quantitative Synthesis of the Literature. *Arthroscopy.* 2016;32(5):944-952. DOI: [10.1016/j.arthro.2015.10.020](https://doi.org/10.1016/j.arthro.2015.10.020)
- Field L, Bokor D, Savoie F. Humeral and glenoid detachment of the anterior inferior glenohumeral ligament: A cause of anterior shoulder instability. *J Shoulder Elbow Surg.* 1997;6(1):6-10. [doi.org/10.1016/S1058-2746\(97\)90064-1](https://doi.org/10.1016/S1058-2746(97)90064-1)