Anterior shoulder instability: Evaluation using MR arthrography.

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Learning objectives

We present a pictorial review of the evaluation of anterior shoulder instability with MR Arthrography. The dominant patterns of osseous and soft tissue pathology are described along with key imaging findings.

The following pathologies are shown:

- Bankart
- Perthes
- ALPSA
- HAGL
- SLAP
- Hill Sachs

Background

- The shoulder is the most mobile joint of the body and in consequence the most commonly dislocated [1].
- The vast majority of traumatic shoulder dislocations are anterior, typically affecting younger male patients [1,2].
- The injury typically occurs when the arm is held in external rotation and abduction or following a direct blow, leading to anterior migration of the humeral head and variable damage to the supporting structures of the joint [3].
- Stability of the shoudler is maintained by a complex interdependence between static and dynamic elements.
- Static stabilisers consist of the labrocapsular structures including the glenohumeral ligaments, negative intracapsular pressure, and articular congruence within the joint [1,3].
- Dynamic stabilisers comprise of the rotator cuff, scapular muscles, and biceps tendon. Damage to one or a combination of these components can be caused by acute traumatic dislocation or chronic injury leading to instability [1,3].

Findings and procedure details
• 57 patients (46 males, 11 females, age range: 16-64) presented with a history of acute traumatic and recurrent dislocation over a one year period. MR arthrography was performed on a 1.5 T MR scanner. T1wFS in three planes, PD, T2FS in two planes (axial and coronal), and 3D Gradient echo sequences were obtained. In addition, when tolerated patients were scanned in the abduction external rotation (ABER) position.

• Using imaging from these patients we present the characteristic bone and soft tissue injury patterns affecting the anterior labro-ligamentous complex and humeral head associated with anterior instability.

•  

    **Bankart:**

A Bankart lesion occurs when shearing forces from anterior dislocation of the humeral head cause traumatic avulsion of the anteroinferior labrum and ligamentous complex from the glenoid rim (Fig. 1 on page 4) [1,5]. A "bony" Bankart lesion describes the combination of this anteroinferior labral detachment with an associated impaction fracture of the underlying glenoid (Fig. 2 on page 6).

•  

    **Perthes:**

A variant of the Bankart lesion occurs where the displaced anteroinferior labrum remains attached to the glenoid rim by intact periosteum. The labrum is often minimally displaced and detection depends on the presence of contrast tracking between the scapula and elevated periosteum (Fig. 3 on page 8 / Fig. 4 on page 10). However, this sign is not invariably present and Perthes lesions can be occult on standard sequences. The ABER position places tension on the inferior glenohumeral ligament (IGHL) increasing sensitivity in detection [4].

•  

    **Anterior Labroligamentous Periosteal Sleeve Avulsion (ALPSA):**

Similar to the Perthes lesion the displaced anteroinferior labrum remains attached to the glenoid rim by a sleeve of periosteum however traction from the IGHL causes medial displacement of the labroligamentous structures along the scapular neck (Fig. 5 on page 12) [5].

•  

    **Glenolabral articular disruption (GLAD):**

Shearing forces and impaction from the humeral head during dislocation cause an anteroinferior labral tear with associated damage to the adjacent glenoid articular
cartilage [6] which manifests as a variable thickness chondral defect (Fig. 6 on page 14). Fragments of cartilage may detach to form intra-articular loose bodies.

• **Humeral Avulsion of the Glenohumeral Ligament (HAGL):**

The inferior glenohumeral ligament is a key passive stabilising structure of the shoulder [1,7]. Following anterior dislocation there is damage to the IGHL at its humeral insertion with stripping of the fibres away from the humeral head/neck (Fig. 7 on page 16). Retraction of the ligament alters the morphology of the inferior glenohumeral recess from a 'U' shape to a 'J' shape [7] and is characteristic sign on coronal images (Fig. 8 on page 18 / Fig. 9 on page 20).

• **Superior labrum anterior posterior (SLAP)**

A tear of the superior glenoid labrum is a less common but recognised sequela of shoulder dislocation. These injuries occur at the biceps anchor and can propagate a variable extent anteriorly and posteriorly through the labrum (Fig. 10 on page 22 / Fig. 11 on page 24 / Fig. 12 on page 26 ) [8].

• **Hill Sachs lesion:**

As the humeral head relocates into the glenoid fossa impaction on the glenoid rim often causes a bony defect in the posterosuperior humeral head (Fig. 13 on page 28) [9]. Acutely, accompanying subcortical bone marrow oedema may be seen (Fig. 14 on page 30). This defect frequently coincides with an injury to the anterior labro-ligamentous complex and can magnify instability on external rotation due to a reduction in articular congruence [1,9].

Images for this section:
Fig. 1: Axial T1FS demonstrating the avulsed anterior labrum (arrowed) without underlying bony injury

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Fig. 2: Axial T1FS shows a bony Bankart lesion with avulsion of the glenoid labrum and an associated fracture of the glenoid rim with bony fragments (arrowed).

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Fig. 3: Axial T1FS shows an avulsion of the anteroinferior labrum which remains attached by intact periosteum, identified by contrast insinuation between the glenoid and periosteal layer (arrowed).

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**Fig. 4:** Axial PDFS demonstrating a perthes lesion. Contrast is seen tracking between the scapula and elevated periosteal layer (arrowed).

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**Fig. 5:** Axial T1FS shows an ALPSA lesion with medialisation of the displaced glenoid labrum which remains attached to the glenoid by an intact periosteal layer (arrowed).

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Fig. 6: Axial T1FS demonstrates an anteroinferior labral tear (straight arrow) with an associated chondral defect overlying the adjacent anterior glenoid (curved arrow) in keeping with a GLAD lesion.

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Fig. 7: Coronal PDFS images show stripping of the fibres of the inferior glenohumeral ligament (curved arrow) with deepening of the inferior glenohumeral recess (straight arrow).

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**Fig. 8:** Coronal PDFS with a HAGL shows characteristic 'J' morphology of the inferior glenohumeral recess (straight arrow) and contrast entering the subscapularis muscle (curved arrow).

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**Fig. 9:** Axial PDFS in the same patient shows altered morphology of the axillary recess and contrast pooling in the subscapularis muscle (arrowed).

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**Fig. 10:** Coronal PDFS demonstrates a Type II SLAP tear with contrast entering the space between the superior labrum and insinuating anteriorly towards the biceps tendon (straight arrow). The biceps tendon is intact (curved arrow).

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Fig. 11: Coronal PDFS in a different patient demonstrates a type III slap tear with contrast extending anteriorly towards the biceps tendon and surrounding the superior labrum (arrowed).

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Fig. 12: Sagittal T1FS demonstrating a sagittal high signal contrast cleft (short arrow) between the superior labrum (long arrow) and biceps anchor (curved arrow) in keeping with a SLAP tear.

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**Fig. 13:** Axial T1FS demonstrates a large defect in the posterosuperior humeral head in keeping with a Hill Sachs lesion (arrowed).

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Fig. 14: Axial PDFS demonstrates a Hill Sachs defect in the humeral head with associated subcortical bone marrow oedema in keeping with a recent injury (arrowed).
Conclusion

- A spectrum of characteristic osseous and soft tissue pathology arises from anterior instability as described.
- In the context of anterior instability MR arthrography is an excellent tool for delineating these key anatomical and pathological features to aid operative planning.
- For operative planning CT Arthrography can also be a useful alternative particularly for the evaluation of osseous injury.

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References


