MR Arthrography: Superior Labral Anterior-Posterior (SLAP) Lesions

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Learning objectives

To demonstrate the classification of SLAP lesions and corresponding anatomy of the biceps tendon anchor / superior labral complex in the glenohumeral joint.

SLAP lesions can lead to instability in the glenohumeral joint. Depending on the type of lesion conservative or surgical treatment is recommended. Several clinical tests show poor utility in the diagnosis of SLAP lesions, thus direct magnetic resonance arthrography (MRa) remains the most important step in diagnosis and further treatment.

This poster aims to demonstrate the advantages of magnetic resonance arthrography, which is currently considered the state of art in the diagnosis of SLAP lesions.
Background

The term "SLAP lesions" represents frequent injuries of the labral-bicipital complex, first described in 1990 by Snyder et al.

The labral-bicipital complex is defined as the superior part of the glenoid labrum, a fibrocartilaginous rim surrounding the margin of the glenoid fossa, and the interweaving fibres of the long biceps tendon. In combination with the glenohumeral ligaments, this complex plays an important role in sustaining stability of the glenohumeral joint.

Essential for accurate detecting of SLAP lesions in MRa is knowledge about the most common variations in anatomy of the labral-bicipital complex:

1. The sublabral hole: a small disconnection between the labrum and the glenoid
2. The sublabral recessus: a variation of the insertion of the long biceps tendon, creating a furrow between labrum and glenoid.

SLAP lesions are mainly caused by a fall onto the outstretched arm in a slightly inflected and abducted position or by repetitive micro-traumatic events due to overhead-sports.

Main symptoms range from pain and crepitation to instability in the glenohumeral joint.

According to Snyder et al. SLAP lesions are classified into four types:

- Type I: Fraying of the superior labrum and biceps anchor (without detachment);
- Type II: Detachment of the labrum-bicipital complex from the superior glenoid;
- Type III: Bucket-handle tear of the superior labrum (stable biceps anchor);
- Type IV: Bucket-handle tear with extension into the biceps tendon.

SLAP lesions Type 2 and Type 4 come along with an unstable biceps anchor.

Based on the type of the lesion either conservative treatment or arthroscopic surgery is recommended: Type 1 and 3 lesions are usually treated by arthroscopic debridement, although Type I lesions can also be treated conservatively depending on the severity of symptoms. Type 2 and 4 lesions are repaired arthroscopically.
The gold standard in detecting SLAP lesions is MR arthrography: Due to the pathognomonic contrast agent inflow, tears in the labral-bicipital complex are significantly better detected than in conventional magnetic resonance imaging (MRI); In addition, proper classification can also be achieved frequently.

It is important to distinguish both sublabral hole and sublabral recessus especially from a SLAP 2 lesion. Helpful criteria to diagnose a SLAP 2 lesion are:

- a contrast agent inflow into the labrum-tendon complex in upper and lateral direction
- an irregular bordered assumed recessus, as well as a wide gap between labrum and glenoid
- a contrast agent inflow under the superior labrum, located behind the biceps anchor.
Imaging findings OR Procedure details

At the General Hospital Linz, Department of Radiology, we perform MRa of the shoulder at 1.5T or 3T MR systems, depending on daily patient flow. First, 12-15ml of Gadopentetate-Dimeglumin is injected fluoroscopically-guided in the glenohumeral-joint via an anterior approach before MRa in external rotation of the patient's arm, using a shoulder coil is performed. Acquisition of T1- and PD-weighted turbo-spin-echo (TSE) sequences in axial, coronal oblique and sagittal oblique planes as well as a 3D T2w sequence is part of our standard shoulder magnetic resonance imaging.

We retrospectively reviewed selected patients with SLAP lesions diagnosed by MR arthrography during regular schedule at the General Hospital Linz between 2007 and 2011. In this report we want to demonstrate one representative MR Arthrography study of each SLAP lesion type with good surgical correlation.

MR arthrography protocols

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- **TE** Time of Echo
- **TR** Time of Repetition
- **TSE** Turbo Spin Echo
- **GE** Gradient Echo
- **SPAIR** Spectral Attenuated Inversion Recovery
Images for this section:

**Fig. 1:** SLAP lesions: Glenoid (light blue) and labral-tendon complex (right shoulder), lateral and coronar-oblique view.

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Fig. 2: SLAP lesion type 1: Slight superficial contour irregularities are seen at the superior labrum, but no linear contrast media inflow is present. Long biceps tendon anchor is intact.

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Fig. 3: SLAP Lesion Type 2: Linear contrast media inflow is seen at the basis of the superior labrum from the glenoid rim, representing SLAP lesion type 2. Additional rupture of the long biceps tendon (not shown)

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Fig. 4: SLAP Lesion Type 3: Contrast media inflow with both a vertical and horizontal orientation is seen at the superior labrum, forming a labral fragment. Long biceps tendon is intact.

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Fig. 5: SLAP lesions type 4: The morphology of contrast media inflow that can be seen at the superior labrum represents a bucket-handle-shaped labral tear with associated partial rupture of the long biceps tendon - typical for a SLAP lesion type 4.

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Conclusion

Adequate diagnosis and classification of SLAP lesions is often challenging due to anatomic variants of the labral-bicipital complex. MR arthrography has achieved a major diagnostic status in detecting and classifying SLAP lesions, compared to conventional MR imaging.
Personal Information

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References


T. Magee. 3-T MRI of the Shoulder: Is MR Arthrography Necessary?; ACR 2009; 192:86-92

Ch. W. A. Pfirrmann, J. Hodler: MRT der Schulter; Radiologie up2date 2001; 2:125-143