Shoulder MR Update: Beyond Rotator Cuff Tears, SLAP Lesions and Instability…

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Cuff Delamination

Cuff delamination refers to a longitudinal tear or cleavage of the rotator cuff tendons. Cuff delamination is frequently seen at the posterior aspect of the supraspinatus or the infraspinatus tendon and also at the subscapularis tendon (1). Cuff delamination results in different degrees of retraction of bursal and articular tendon margins. Cuff delamination should be reported to the surgeon since it may be more difficult to repair a delaminated tendon especially using arthroscopy. Cuff delamination is important to recognize because it is associated with a poorer surgical outcome (2). Both the size of the tear in the sagittal plane and associated tendon delamination are considered poor prognostic factors for tendon healing(1). Cuff delamination may lead to intratendinous or intramuscular cysts. These cysts located within the sheath or substance of the muscles of the rotator cuff may not be palpable at arthroscopy. There is a strong association of these cysts with rotator cuff tendon tears, particularly supraspinatus tears (3). Identification of such a cyst should prompt a thorough search of a tendon tear, not only the muscle containing the cyst but also all the adjacent tendons of the rotator cuff. A delaminating component or intrasubstance propagation of a rotator cuff tear may explain the presence of a cyst in a muscle with an intact tendon (3).

Postoperative Shoulder

For the evaluation of the postoperative shoulder the MR imaging protocol should be adapted. To avoid susceptibility artifacts at MR imaging, inversion recovery may be used instead of fat saturation. Findings that are considered diagnostic or indicative of pathologic conditions in the preoperative shoulder may represent normal or improved conditions in the postoperative shoulder (4). Small residual defects of the rotator cuff are not necessarily associated with clinical symptoms. Subacromial bursitis-like MR abnormalities are almost always seen after rotator cuff repair even in patients without residual complaints. Subacromial bursitis-like MR abnormalities may persist for several years after rotator cuff repair and appear to be clinically irrelevant (5).

Acromioclavicular Joint

The acromioclavicular joint has been termed the “forgotten” or “overlooked” joint. The AC joint, consists of the lateral end of the clavicle and the medial end of the acromion, and is surrounded by a fibrous capsule that is reinforced at the superior aspect by the superior AC ligament (6). In the joint space a fibrocartilaginous disk is often present that may have a meniscus like structure (6). This disk is located in the anterosuperior aspect of the AC joint and often reveals degenerative changes that are believed to occur at the beginning of the third decade of life. High resolution MR may be able to demonstrate the intraarticular disk (7). Pain relief after intraarticular injection of local anesthetics is significantly related to the finding of a capsular hypertrophy. The sensitivity in predicting a successful injection with local anesthetics is highest for caudal osteophytes and capsular hypertrophy (8). Subchondral cysts, subchondral bone marrow edema, and joint effusion are specific for a painful AC-joint (8).

Articular Cartilage

Cartilage lesions of the glenohumeral joint are often not routinely diagnosed at MR imaging or MR arthrography, despite their large extent and clinical importance. The integrity of the cartilage surface of the glenohumeral joint has an influence on the differential diagnosis of shoulder pain and, many times, on the treatment plan. Primary osteoarthritis of the glenohumeral joint is considered rare compared with that in other joints, such as the knee or hip. However, glenohumeral cartilage lesions are found in up to one third of patients referred for MR arthrography for subacromial impingement syndrome (9). Early degenerative joint disease may simulate impingement syndrome (10). The effectiveness of MR arthrography with conventional sequences is moderate in the detection of glenohumeral cartilage lesions (9).

Rotator Cuff Interval

The rotator cuff interval lies between the superior border of the subscapularis tendon and the supraspinatus tendons. The rotator cuff interval capsule is composed of the coracohumeral ligament and the superior glenohumeral ligament. The rotator cuff interval contains the long head of the biceps tendon (11,12). MR arthrography is the procedure of choice for the assessment of the rotator cuff interval because of its superior depiction of ligaments with distention of the joint capsule (13). The major importance of the rotator cuff interval lies in the restraint to shoulder subluxation and shoulder instability (12).

Reflection Pulley of the Long Biceps Tendon

The reflection pulley is formed by the common insertion of the coracohumeral and the superior glenohumeral ligaments and the superior border of the subscapularis tendon. The pulley is the stabilizer of the long biceps tendon from its horizontal course into its vertical course. A pulley lesion leads to instability of the long head of the biceps tendon. Lesions of the biceps pulley and the rotator cuff have been associated with an internal anterosuperior impingement of the shoulder (14,15). Abnormalities of the superior border of the subscapularis tendon on axial and sagittal oblique images, extra-articular contrast collection, and biceps tendon subluxation are MR findings that may suggest the diagnosis of a pulley lesion (16). MR arthrography is valuable in detecting lesions of the reflection pulley of the long biceps tendon, although differentiation from an isolated lesion of the superior border of the subscapularis tendon may often not be possible(16).

Frozen Shoulder

Frozen shoulder is a painful condition of the shoulder that may be idiopathic, preceded by trauma, or associated with diabetes mellitus or conditions such as Dupuytren disease or with cardiac surgery. One of the characteristic findings of a frozen shoulder at surgery is synovitis within the rotator cuff interval. This finding may be seen at MR imaging or MR arthrography of the shoulder as partial or complete obliteration of the subcoracoid fat triangle (17). Complete obliteration of the fat triangle under the coracohumeral ligament and the coracoid process is a highly specific finding for a frozen shoulder. Other findings include thickening of the coracohumeral ligament and the capsule at the rotator cuff interval (18). In contrast to statements in many textbooks capsular thickening in the axillary recess and reduced volume of the axillary recess are both not reliable for the diagnosis of a frozen shoulder (18).

Long Biceps Tendon

Many causes of shoulder pain have been described, commonly related to rotator cuff pathology. However, the long head of the biceps (LHB) tendon may be an important pain generator. The association of shoulder pain with pathology of the LHB is currently accepted to be due to inflammation (synovitis), impingement, tendinosis or tearing, or instability of the tendon at the entry into the bicipital groove. There is s strong association of lesions of the long biceps and antero-superior cuff lesions (19). It is important to recognize that most of the bicipital lesions are localized at the supe-

rior horizontal part of the tendon. MR findings of tendinopathy and rupture of the biceps tendon may be subtle. MR arthrography with sagittal oblique images may be the best way to assess this intraarticular portion of the long biceps tendon (20). The most reliable MR findings for tendinopathy are caliber changes and signal abnormalities in the sagittal oblique plane. Absence of visualization of the tendon in the sagittal oblique plane is a reliable sign for a tear (20).

Hourglass Biceps

The hourglass biceps is caused by a hypertrophic intraarticular portion of the biceps tendon that is unable to slide into the bicipital groove during elevation of the arm (21). This condition is analogous to a trigger finger in the hand. The "Hourglass" biceps should be considered in cases of chronic anterior shoulder pain associated with a loss of shoulder elevation (22). Diagnosis is made at surgery. On MR imaging thickening of the tendon substance and changes in diameter may suggest the diagnosis.

Muscles of the Shoulder Joint

Tears of the rotator cuff are accompanied by muscle atrophy, which has direct implications on patient outcome after rotator cuff surgery. There is strong evidence that the residual function of the rotator cuff muscles depends on the degree of muscle atrophy and fatty degeneration. Preoperative assessment of the rotator cuff muscles and their residual function using advanced imaging techniques has been described as an important predictor for the operative and nonoperative outcomes. Fatty degeneration is irreversible even after structural reconstruction of the rotator cuff. There are severely possibilities to assess the muscle quality preoperatively. Goutallier developed a five-stage muscular fatty degeneration grading system based on CT scans (23) of the rotator cuff which can be used also on MR imaging (24). Thomazeau (25) and Zanetti (26) determined changes in cross-sectional areas of rotator cuff muscles on an MRI scan at the Y-shaped position. Proton MR spectroscopy is also a suitable in the assessment of apparent lipid content of rotator cuff muscles (27).

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