MR arthrography in patients with shoulder instability: cartilage loss associated with labral tears and bone marrow edema

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OBJECTIVE. Magnetic resonance arthrography (MR arthrography) provides accurate delineation of intraarticular structures [1]. The purpose of this investigation was to determine the association between labral tears, bone marrow edema, and cartilage loss in the shoulder joint of patients with symptoms of instability using MR arthrography.

METHODS. Among 632 randomly selected patients who underwent diagnostic radiological and / or surgical interventions of the shoulder at our institution over 2 years, we identified 91 patients who had an MR arthrogram for evaluation of pain, mechanical symptoms or shoulder instability with clinical suspicion for a labral tear or rotator cuff defect.

MR arthrography (1.5 T) consisted of axial, oblique sagittal, oblique coronal fat saturated T1 weighted spin echo (TR 767 ms, TE 10 ms) with 3 mm-thick sections, a 0.5 mm intersection gap, 15.26 kHz bandwidth (BW), 2 numbers of excitations (NEX), a 14 cm field of view (FOV), 256 X 192 matrix; axial and oblique sagittal fast spin echo proton density weighted sequences (TR 2000 ms, TE 25 ms) with 4 mm-thick sections, a 0.5 mm intersection gap, 31.25 kHz BW, 2 NEX, a 14 cm FOV, 256 X 256 matrix; and oblique coronal fast spin echo inversion recovery sequences (TR 3017 ms, TE 9.3 ms, TI 160 ms) with 4 mm-thick sections, a 1 mm intersection gap, 15.63 kHz BW, 2 NEX, a 14 cm FOV, 256 X 192 matrix.

The frequency and severity (0 = normal, 1 = signal heterogeneity, 2 = fissuring, 3 = thinning <50%, 4 = thinning >50%, 5 = full thickness cartilage loss, 9 = not evaluable) of cartilage changes in the anterior, posterior, superior and inferior glenoid labrum and in the anterior, posterior, central, medial, and lateral humeral head were evaluated. The labrum was graded as 0 = normal, 1 = intrasubstance degeneration, 2 = simple tear, 3 = complex tear including SLAP lesions. Shoulder joints were also evaluated for bone marrow edema and other pathology. MR images were compared with arthroscopic findings in 85 patients. Data were analyzed using contingency tables, Fisher's exact test for discrete outcomes, Spearman's rank correlation for continuous outcomes, and both pooled and stratified analysis.

RESULTS. All cases demonstrated image quality adequate for evaluation of the cartilage. Labral tears were found in 66 patients (27 anterior, 11 posterior, 43 superior, 4 inferior, multiple tears in 17). 62 patients showed cartilage changes, 40 with changes in multiple areas. The prevalence of cartilage loss on MR arthrography of the shoulder joint was 68% in this cohort. The most common abnormal finding was full thickness cartilage loss in 20 regions in 15 patients (areas of damage measuring <1 cm in 18 regions, and 1-2 cm in 2 regions) most prominently in the central humerus and superior glenoid. Cartilage thinning >50% was seen in 23 areas in 12 patients. Cartilage thinning <50% was shown in 20 regions in 10 patients. We saw 4 areas of fissuring in 3 patients and 4 areas of signal heterogeneity in 4 patients.

The grade and size of cartilage abnormality correlated with the grade of labral tear (66 patients, $P \leq 0.0006$; $P \leq 0.0001$), and with the grade of bone marrow edema (23 patients, $P \leq 0.0001$; $P \leq 0.0001$), respectively. The grade of bone marrow edema in the glenohumeral joint correlated significantly with labral tears ($P \leq 0.0015$).

CONCLUSION. MR arthrography shows a high prevalence of cartilage abnormalities in patients with labral tears. Cartilage loss shows also a high association with bone marrow edema. Similar to published data in the knee joint [2], bone marrow edema may be a prognostic factor for progression of cartilage loss in the shoulder joint.

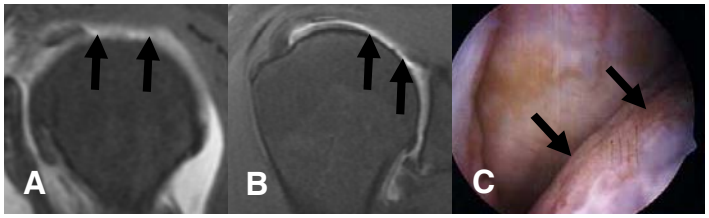

Figure1: 47 year old woman with cartilage defects and a labral tear in the anterior glenoid surface and humerus (arrows). A. sagittal, B. coronal plane, and C. arthroscopic presentation.

References [1] Guntern, D.V., et al. Radiology 2003; 226:165-170.
[2] Felson, D.T., et al. Ann Intern Med 2001; 134(7): 541-9.