Magnetic Resonance Arthrography in Recurrent Anterior Shoulder Instability as Compared to Arthroscopy: A Prospective Comparative Study


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Abstract:
AIM: To evaluate the accuracy of magnetic resonance (MR) arthrographic imaging in the diagnosis of glenoid labral and ligament tears in recurrent shoulder instability. SETTINGS AND DESIGN: Prospective, comparative study at a tertiary care centre. PATIENTS AND METHODS: Patients with three or more episodes of anterior shoulder dislocation were enrolled in the study. They were subjected to magnetic resonance arthrography (MRA) for delineation of abnormalities. The findings obtained at MRA were compared with those found at arthroscopy and surgical exploration. RESULTS: MRA detected glenoid tears in all 22 patients with 20 (90%) patients having antero-inferior tears, 3 (14%) patients had superior labral involvement and 2 (10%) patients had posterior labral abnormality. On arthroscopy, antero-inferior, superior and posterior labral tear were found in 21 (95%), 5 (22%) and 7 (32%) patients respectively. MRA showed a sensitivity of 95%, and a specificity of 100% for the detection of the antero-inferior labral tears. The sensitivity of MRA for the detection of superior, middle and inferior glenohumeral ligament tear was 83%, 80% and 86% with a specificity of 100%, 71% and 93% respectively. MRA was 100% sensitive for the detection of rotator cuff injuries and detection of bony lesions like Hill-Sach’s and bony Bankart’s lesion. CONCLUSIONS: MRA is a sensitive and specific modality for evaluation of anterior shoulder instability.

Key Words: MR arthrography, Glenoid labral tear, Shoulder instability

Shoulder is one of the most unstable and frequently dislocated joints in the body and accounts for nearly 50% of all the dislocations.¹ Prior to the advent of magnetic resonance imaging (MRI), plain radiography and cumbersome arthrography were the only tools for evaluation of the shoulder joint. MRI has changed the whole perspective of shoulder imaging. MR imaging allows visualisation of soft tissues and as well as osseous pathology in exquisite details that was not possible by conventional radiographs and arthrogram or even computerised tomographic (CT) scan. Although MR has been shown to be superior in imaging rotator cuff tears, there is some discrepancy in the role of conventional MR in detection of labral lesions.² The sensitivity of this new modality is sought to be improved by passive distension of the joint by positive MR contrast. This allows visualisation of the glenoid labrum, glenohumeral ligament, rotator cuff and other intracapsular structure in great details.²

We conducted a study to evaluate the accuracy of MRA imaging in the diagnosis of glenoid labral and ligament tears in patients with recurrent shoulder instability.

Patients and Methods
This prospective study was conducted over a 7-month period after obtaining clearance from the institution’s Ethics committee. Patients with recurrent anterior dislocation of the shoulder, defined as three or more episodes of anterior dislocations were enrolled. Patients with congenital habitual dislocation and those without any history of trauma were excluded from the study. Plain radiographs of shoulder joint in anteroposterior view (in neutral and internal position) were obtained and evaluated for the presence of any bony lesions. The procedure of shoulder arthrogram was performed using standard fluoroscopy guided anterior approach. 0.1 cc of gadopentate dimeglumine (Magnevist, Schering, Germany) and 2 cc of ioxaglate sodium meglumine (Hexabrix 320 Mallinckrodt, Guerbet, S.A.) mixed in 20 cc of normal saline was used as a contrast medium. The volume required ranged from 12-25 cc with average of 18 cc. Optimal images were obtained within 45 minutes of injection. MR imaging was later on performed on a 0.2 Tesla open MR system (Magnetom Open Viva, Siemens Medical Systems, Erlangen, Germany). Axial, oblique coronal and oblique sagittal images were obtained in all cases. Spin echo (SE) axial images were obtained with TR/TE/NA of 528/26/2 for T1 weighted images (WI) and 2840/102/3 for T2W images with 4 mm slice thickness and 1 mm intersection gap. Oblique coronal sections were obtained with SE 528/26/1 (TR/TE/NA) with 4 mm slice thickness and 1 mm intersection gap. Oblique sagittal images were also obtained with 528/26/2 (TR/
In MR Arthrography passive distension of the joint MR contrast allows visualisation of the glenoid labrum, glenohumeral ligament, and rotator cuff in exquisite details.

Results
Twenty two patients (all males, age ranging from 16 to 50 years) were enrolled in the study. The mean duration of shoulder instability prior to evaluation was 28 months (range 6-96 months). MR arthrogram detected glenoid tears in all the 22 (100%) patients of which 20 (91%) had antero-inferior tears, 3 (14%) had superior labral involvement and 2 (9%) had posterior labral ab-

ormality. The antero-inferior labrum showed Bankart’s lesion (Figure 1) in 12 (55%) patients, ALPSA (Anterior labrum periosteal sleeve avulsion) lesion (Figure 2) in 5 (23%) and GLOM (Glenoid labrum ovoid mass) lesion in 1 patient (5%). Two patients (9%) had absent or completely denuded labrum. Other abnormalities associated with anterior labral tears were severely truncated labrum (15%) and absent labrum (15%). Three patient with superior labral involvement had SLAP (Superior labrum anterior posterior) lesion. MRA further detected superior, middle and inferior GHL tears in 5 (23%), 14 (64%) and 7 (32%) patients, respectively.

Arthroscopy detected the antero-inferior labral tear in 21 (95%) patients, superior and posterior labral involvement in 5 (23%) and 4 (18%), respectively (Table 1). It also revealed superior, middle and inferior GHL tears in 6 (27%), 15 (68%) and 7 (32%) patients, respectively.

MRA showed a sensitivity of 95% and a specificity of 100% for the detection of the antero-inferior labral tears. Sensitivity was less for superior and posterior labral tears being 60% and 50% respectively. The sensitivity of MRA for the detection of superior, middle and inferior glenohumeral ligament tear was 83%, 80% and 86% with a specificity of 100%, 71% and 93%, respectively. MRA was 100% sensitive for the detection of the rotator cuff injuries and detection of bony lesions like Hill-Sach’s (Figure 3) and bony Bankart’s lesions.

MRA, however, missed loose bodies in the joint space in three patients, which were subsequently found on arthroscopy. Although we reported capsular abnormalities in 12 (55%) pa-
The pathological results of recurrent instability have been well documented.\(^9\)\(^{-12}\) The most common abnormality is the detachment of the antero-inferior labrum, the Bankart’s lesion.\(^9\) Other pathological findings in chronic shoulder instability include joint capsule stripping from the scapula, rotator cuff tears and disease of the biceps tendon along with the bony Bankart’s lesion and Hill-Sach’s defect.\(^13\)

We could successfully diagnose anterior and anteroinferior labral tears with a sensitivity of 95% and a specificity of 100%. This sensitivity compares favourably with the studies done by others.\(^7\)\(^,\)\(^14\) The most common appearance of a torn anterior labrum was visible as a linear signal intensity cutting through the substance of the labrum as seen in 60% of the cases. An additional interesting appearance of the torn labrum was the GLOM lesion. This represented a dark rounded mass of tissue and proton density on T2 W images, which was best seen at the base of the coracoid. GLOM is felt to represent the torn anterior labrum that had retracted superiorly. Other interesting injuries noted were ALPSA lesion seen in 5 (22%) patients. It is very similar to the classic Bankart’s lesion but here the labral ligament is complex, is displaced medially with an intact scapular periosteum.

Sensitivity of MRA diminished when it came to the diagnosis of the posterior and superior labral tears. The inferior labrum is not well visualised due to the redundant capsule overlying this region. Capsular stripping is well seen because of good distension of joint space by the contrast. Capsular stripping can be missed in a routine MR imaging unless the dislocation is acute or there is joint effusion.\(^15\) Capsular stripping without coexistent labral abnormalities is rare and will not require an arthrotomy. Therefore, the limitations of MRI in depicting this abnormality are not clinically significant.

### Table 1: MR Arthrography in Comparison with Arthroscopy

<table>
<thead>
<tr>
<th>Pathology (N=22)</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glenoid labrum:</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Antero-inferior (20/21)</td>
<td>95</td>
<td>100</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>Superior (03/05)</td>
<td>60</td>
<td>100</td>
<td>100</td>
<td>89</td>
</tr>
<tr>
<td>Posterior (02/04)</td>
<td>50</td>
<td>100</td>
<td>100</td>
<td>90</td>
</tr>
<tr>
<td>Glenohumeral ligaments:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superior (05/06)</td>
<td>83</td>
<td>100</td>
<td>100</td>
<td>94</td>
</tr>
<tr>
<td>Middle (14/15)</td>
<td>80</td>
<td>71</td>
<td>86</td>
<td>63</td>
</tr>
<tr>
<td>Inferior (07/07)</td>
<td>86</td>
<td>93</td>
<td>86</td>
<td>93</td>
</tr>
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<td>Biceps labrum complex (01/02)</td>
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<td>100</td>
<td>95</td>
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<td>Rotator cuff (01/01)</td>
<td>100</td>
<td>100</td>
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<td>100</td>
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<tr>
<td>Bony lesions:</td>
<td></td>
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<tr>
<td>Hill-Sach’s (18/18)</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Bankart’s (01/01)</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Figures in parenthesis indicate number detected on MR arthrography/number detected on arthroscopy. Results expressed in percent. PPV: Positive predictive value; NPV: Negative predictive value.

**Antero-inferior genoid labral tear was the commonest injury seen in recurrent anterior shoulder instability.**
Although our study shows MRA to be very sensitive to the anteroinferior labral tears, sensitivity for glenohumeral ligament tears was much less. This was especially true for MGL and MCL tears were missed in 20% (3/15) and were falsely detected in 29% (2/7) of cases. This is because of a number of anatomical variations of MGL that may mimic a ligament tear.

Loose body and joint space can occur in a chronic dislocation. These were most likely missed due to the error at the reading by the radiologists. The error in missing them was human and not technical. They were detected in retrospect on MRA after knowing the arthroscopy findings.

The high prevalence of labral abnormalities in predominantly young and athletic patients included in the study introduces an inherent bias. These results cannot be extrapolated to the elderly individuals in whom degenerative changes of the labrum may lead to false positive results. While this selection bias for our studies may slightly influence our results, we believe that the sensitivity and specificity of the study is fairly accurate.

The procedure of MRA was well tolerated by patients without any significant morbidity. Pain, if present lasted for a maximum duration of 24 hours and could be managed with analgesics.

In conclusion, it can be said that MRA is a valuable tool for the detection of tears in patients with recurrent shoulder instability. It is highly sensitive and specific in detecting anteroinferior labral tears (the commonest injury causing recurrent anterior shoulder instability).

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References

Expert’s Comments
The authors of this paper provide additional evidence that MR arthrography is very accurate for diagnosing anteroinferior labral tears, and is the best imaging examination for detecting Bankart tears and the Bankart variants. Although conventional MR is accurate for imaging rotator cuff tears, most authors are now reporting that conventional MR will only demonstrate about two-thirds of chronic labral tears. Some authors have shown a higher accuracy for conventional MR in selected populations with a high prevalence of patients with a known anterior dislocation, and conventional MR is probably adequate for imaging patients with acute injuries where the effusion and bone marrow edema can greatly assist in making the diagnosis.

MR arthrography of the shoulder provides even more information if the arm is scanned in the abduction-external rotation (ABER) position. Although the patient has to be removed from the center of the MRI scanner and the arm repositioned into abduction and external rotation, this has been shown to further increase the already high sensitivity of MR arthrography for labral tears. The ABER position can also demonstrate small tears of the anterior band of the inferior
Recurrent Bleeding from the Tip of Index Finger and Mucocutaneous Telangiectases

A 60-year-old male came to us with recurrent bleeding from the tip of the right index finger just underneath the nail of two years duration. He had history of recurrent nose bleeding, first noticed around the age of 15 years. He had no history of induration of skin, Raynaud’s phenomenon, sclerodactyly, melaena or seizures. No family member had similar complaints.

On physical examination, this averagely built healthy looking individual was normotensive. Cutaneous examination revealed the presence of a soft black crust over the hyponychium of the right index finger, just under the free edge of the nail (Figure 1). Multiple dark red punctate and spider telangiectasia were seen over the palmar aspect of the fingers and around the nail fold. Similar blanchable telangiectasia were observed over the lips, tongue (Figure 2), oral cavity, nasal mucosa and genitalia. No other abnormalities were detected in the nails or hair. His systemic examination was unremarkable.

His haematological and biochemical parameters were within normal limits. Urine examination revealed the presence of microscopic haematuria. Skiagram of the chest and ultrasonographic study of the abdomen did not show any abnormality.

What is the diagnosis?

Figure 1: Black crust over the hyponychium of the right index finger, just under the free edge of the nail and telangiectasia

Figure 2: Blanch-able telangiectasia over the lips and tongue

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