MR ARTHROGRAPHY OF THE SHOULDER JOINT IN SPORTS-RELATED GLENO-HUMERAL INJURIES

Michel Adel Mounir Gad, Ahmed Mohamed Monib, Yousra Abdel Zaher Abdulla and Menattallah Hatem Shalaby

Department of Radiodiagnosis, Faculty of Medicine, Ain Shams University, Cairo, Egypt.

Corresponding author
Michel Adel Mounir Gad,

Mobile: +20107881516

e.mail: michelgad86@gmail.com

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ABSTRACT:

Background: *Shoulder injuries are one of the common sports injuries among various kinds of sports, almost third of the shoulder injuries occurs during sports. Glenohumeral instability and rotator cuff injuries are the most common types of shoulder injuries related to sports' trauma.*

Aim of the work: *To highlight the role of MR arthrography over conventional MRI in evaluation of sports related labral, ligamentous and tendentious glenohumeral injuries.*

Patients and Methods: *In our study thirty-four patients suffering from shoulder pain after sport's related trauma, were referred to our radiology department to do conventional MRI as well as MR arthrography. Arthroscopy was done as a gold standard.*

Results: *In our study MR arthrography was nonspecific in diagnosis of HAGL lesion. Regarding ALPSA lesion, three patients were diagnosed as ALPSA lesion on MR arthrography however, they were not detected by conventional MRI and all of them were detected by arthroscopy. Two patients were diagnosed as ALPSA lesion however were not diagnosed by either arthrography or conventional MRI (false negative), and hence MR arthrography lesion has sensitivity of 75 % and specificity of 100%.*

Conclusion: *Both MR arthrography and conventional MRI were not accurate in diagnosis of HAGL lesions. MR arthrography is more accurate than Conventional MRI in diagnosis of SLAP lesions, Bankart lesions, partial supraspinatus tear, impingement, biceps tear, ALPSA and Hill sachs lesions. Both MR arthrography and conventional MRI had same accuracy in diagnosis of complete supraspinatus tear.*

Keywords: *Subscapularis tendon, humeral avulsion of the glenohumeral ligament*

INTRODUCTION:

The glenoid labrum is a fibro-cartilaginous ring that surrounds the periphery of the bony glenoid of the scapula. It serves as an attachment site for the capsule and broadens the base of the gleno- humeral joint to allow increase stability [1].

Tears or detachments of the glenoid labrum most commonly occur from, and result in, dislocation or instability of the humerus [1]

The glenoid labrum is best imaged on axial T2 WI or T2* WIs. T1 axial WI are not necessary to diagnose labral abnormalities and can be omitted from the shoulder protocol [1]

If no joint effusion is present, a labral tear can be difficult to see unless it is quite severe. If joint fluid extends between the

bony glenoid and the base of the labrum, a detached labrum can be well detected [1]

Fluid in the joint makes for easier assessment of the labrum, hence MR arthrogram has evolved into a routine exam in many centers [1]

Magnetic resonance arthrography is considered the gold standard for assessment of instability and pre-operative workup for shoulder ligaments and labral injuries [2].

MR arthrographic examinations were performed after the injection of approximately 8–12 ml of Gadolinium DTPA at a concentration of 2.5 mmol/l via an anterior approach [3].

Magnetic resonance arthrography is better than un-enhanced MR in detection of unstable labral tears [4].

MR arthrography is superior for the evaluation of intrasubstance ligamentous injuries and the extra-articular surface of the rotator cuff [2]

It can demonstrate the extent and configuration of rotator cuff abnormalities, suggest mechanical imbalance within the cuff, and document abnormalities of the cuff muscles and adjacent structures [5].

AIM OF THE WORK:

The aim of this study is to highlight the role of MR arthrography over conventional MRI in evaluation of sports related labral, ligamentous and tendentious glenohumeral injuries.

PATIENTS AND METHODS:

Thirty-four patients who had shoulder injuries which occurred during sports activities were included in this study. They were referred from the orthopedic clinic to the MRI unit in radiology department in Ain Shams University Hospitals. The MRI was done using 1.5 Tesla super conductive MR scanner (Philips Achieva-XR), before and after intra-articular joint injection of contrast medium.

Patient selection: Patients were referred from the orthopedic department after clinical diagnosis of recent sports related shoulder injury for MRI arthrography evaluation.

Inclusion criteria: Age group: adults and teenagers (12 – 40 years). Patients suffering from shoulder pain after sport related trauma.

Exclusion criteria: Patients suffering from shoulder pain without trauma. Patients suffering from shoulder pain with trauma not related to sports. Patients who underwent shoulder surgery, arthroscopy or replacement. Patients who suffers from claustrophobia. Patients who have pacemakers, MR non-compatible prosthetic heart valves or MR non-compatible metallic implants. Suspected septic arthritis.

Methods:

Pre-procedure: The following data were routinely recorded: Name, age and sex. History of trauma, previous shoulder surgery, arthroscopy, replacement or shoulder dislocation. Vital data. All metallic objects were removed from the patient's body. Explanation of the procedure to the patient in details.

Procedure:

Conventional MRI.

Machine: MRI shoulder was performed on 1.5 Tesla super conductive MR scanner (Philips – Achieva).

Coils: Shoulder coil.

Patient position: The patient was positioned supine on the MRI table.

MRI protocol included the following: T1-Weighted- TSE Fat-Suppressed - sagittal oblique. T1-Weighted Fat-Suppressed – Axial and coronal. T2WI – TSE – Coronal and sagittal. PDWI – Axial and coronal. T1-Weighted TSE SPIR– - sagittal oblique,

Axial and coronal are added for cases with shoulder joint effusion.

Contrast injection: Contrast injection was done under CT guidance. After proper sterilization of the shoulder, anterior shoulder injection was done under image guidance with: 2-3 ml of local anesthesia (Lignocain®), 1 ml of (Ultravist ®) and CT image was done to insure the proper capsule infiltration. Diluted gadolinium (Magnivest ®) (Concentration of 2 mmol/L). The patient was instructed to move the injected arm in rotating movement for about 2 minutes, to allow the contrast to spread inside the joint.

Post contrast MRI imaging.

T1-Weighted- TSE Fat-Suppressed – in sagittal oblique, axial and coronal planes.

Duration of the procedure: approximately 1 hour

Complications and how to deal with: Joint Pain: patients may suffer from joint pain after injection (maximum 48 hours) due to capsular expansion with contrast. Oral analgesics (e.g. NSAIDs) were prescribed to the patients for 48 hours after injection. Patients were advised also to move the arm frequently to relief pain. Injection site reaction: for patients who suffered from skin hypersensitivity reaction, antihistaminic were taken.

Image interpretation: Two experienced musculoskeletal consultant radiologists assessed the MR images for osseous, ligaments and tendon lesions

RESULTS:

Table 1: Variable causes of shoulder injuries among the examined population

Variables of shoulder injuries	No. of cases	Percent (%)
Fall on outstretched hand	11	32.3
Fall on the ground; direct shoulder trauma	8	23.5
Player to player contact trauma to the shoulder	5	14.7
Shoulder pain after pushing and lifting heavy weights	3	8.8
Overuse in training or playing	3	8.8
Shoulder dislocation, non-recurrent	3	8.8
Recurrent dislocation	2	5.8

After the assessment of studies' adequacy, two musculoskeletal radiologists reported each case separately and gave their diagnoses from the findings (different signs) and their interpretation as well as the possible underlying etiology according to the literature and practice. The inter observer's agreement in our study was 94 %. Almost the same MR protocol was applied to all patients with very few variations according to the case findings. The analysis performed was based primarily on the abnormal signs, comparing both conventionnal and arthrography images, followed by interpretation of the findings to reach possible diagnosis. Conventional MRI was performed for all patients, however, MR arthrography was performed for 32 out of 34 patients, as two patients had moderate to marked gleno-humeral joint effusion which was used as a natural contrast to visualize the glenoid labrum. No complications were encountered after the intra-articular contrast injection in MR arthrography. The visualization of the intra-articular anatomy was markedly improved in the MR arthrographic images as compared to the conventional images. Shoulder arthroscopy was considered the gold standard method to ensure accuracy of the conventional MRI and the MR arthrography. Shoulder arthroscopy was performed for patients whose MRI reports revealed significant findings.

Results of conventional MRI:

Out of thirty-four cases, fourteen (38.2 %) patients were reported as normal on conventional MRI while twenty (73.5 %) had abnormal findings on MRI reports, most of the twenty patients have more than one pathology as follows:

Joint effusion was reported in seven cases (20.5%), supraspinatus tendon tear and tendinopathy were seen in seven cases (20.5%), Superior Labral Antero-Posterior (SLAP) lesion six cases (17.6 %), Hill Sachs lesions were reported in five cases (14.7%), sub-acromion or sub-coracoid bursitis were seen in four cases (11.7%), Bankart lesion was seen in four cases (11.7 %), and reversed Hill Sachs lesion was seen one case (2.9%). Data are summarized in table 2.

Table 2: Lesions appeared in conventional MRI

Signs in conventional MRI	No. of lesions	Percent %
Normal	14	41.1
Effusion	7	20.5
Supraspinatus tear or tendinopathy	7	20.5
SLAP lesion	6	17.6
Hill Sachs	5	14.7
Subacromion or subcoracoid bursitis	4	11.7
Bankart lesion	4	11.7
Reversed Hill Sachs	1	2.9

Results of MR arthrography:

The results of eleven (32.3 %) arthrography cases were almost the same as the results of their conventional MRI, while twenty- three (67.7 %) cases had different MR arthrography results, so there were more abnormal findings on MR arthrography than on conventional MRI as shown in the following table:

Table 3: Findings appeared in MR arthrography

MR arthrography findings	**No. of lesions**	**Percent**
Bankart	11	32.3%
SLAP	16	47%
Supraspinatus injury tears and tendinopathy	9	26.4%
Hill Sachs	7	20.5%
Normal	6	17.6%
Subacromion /subcoracoid bursitis	4	11.1 %
Biceps tendon injury	4	11.1 %
HAGL	3	8.8%
ALPSA	3	8.8%
Capsular tear	3	8.8%
Reversed Hill Sachs	1	2.9%

Superior-anterior labral lesions (SLAP) injury was seen in sixteen MR arthrography results, on the other hand eleven of them were not seen or suspected in conventional MRI.

Arthroscopy was done to eleven patients who had been diagnosed by MR arthrography and it confirmed the diagnosis and the results were: three cases of type I SLAP lesion, four cases of SLAP II lesion, one case of type III SLAP lesion and three cases of type IV SLAP lesions. There was only one difference between arthrography and arthroscopy results regarding the types of SLAP lesions whereas one of the cases which was diagnosed as SLAP IV in arthroscopy had been diagnosed as SLAP I in MR arthrography.

Only five patients who had SLAP lesion by MR arthrography didn't proceed for arthroscopy, as they had a very minor injury and conservative treatment was decided by the orthopedic surgeon.

Those results indicated that the MR arthrography was more accurate in diagnosis of SLAP lesion by sensitivity and specificity of 100% than the conventional MRI which had sensitivity of 59 % and specificity of 100 %.

Soft tissue Bankart lesion was diagnosed by MR arthrography in eleven patients, of these eleven patients the diagnosis of Bankart lesion by conventional MRI was only seen in four.

Arthroscopy results confirmed the presence of Bankart lesion in all of the eleven patients, whereas ten of them were described as unstable labral tears and only one was described as stable labral tear, in keeping with the result of MR arthrography of mild form of Bankart.

Bony Bankart lesion was seen in two cases in MR arthrography while it was only seen in one case in conventional MRI, arthroscopy confirmed the presence of bony Bankart lesion in two cases.

Those results indicated that the MR arthrography was more accurate in diagnosis of soft tissue Bankart lesion by sensitivity of 100% and specificity of 95.8% than the conventional MRI which had sensitivity of 30 % and specificity of 95.8 %.

MR arthrography was more accurate in diagnosis of bony Bankart lesion by sensitivity and specificity of 95.8% than the conventional MRI which had sensitivity of 50 % and specificity of 100 %

Supraspinatus tendon tears were diagnosed in five patients by MR arthrography where three were diagnosed as partial tear and two as complete tear from all the five patients three of them were seen conventional MRI, one was suspected tear and one was not seen. All the five patients had arthroscopy done which confirmed the presence of supraspinatus tears.

The shape and extent of tears and the tendon retraction were explained in MRI and MR arthrography reports and the arthroscopy findings were different to the detailed conventional and MR arthrography findings as the arthroscopy revealed three complete tears, whereas a patient who was diagnosed as partial articular surface tendon avulsion (PASTA) type tear on MR arthrography, was suspected in conventional MRI, while in arthroscopy, the tear was seen as focal complete tear without retraction, so the arthroscopy revealed three complete tears and two partial tears.

Therefore, the conventional MRI and MR arthrography had same sensitivity, specificity and accuracy in diagnosis of complete tears, 67%, 100 % and 97% respectively, while in partial tear MR arthrography revealed a sensitivity of 100% specificity of 97% and accuracy of 97% compared to conventional MRI which revealed 50 % sensitivity, 97 % specificity, and accuracy of 94 %.

Supraspinatus tendinopathy was reported in three patients by conventional MRI and in four patients by MR arthrography, all the patients were described as supraspinatus impingement in arthroscopy.

Arthroscopy also detected one more patient with supraspinatus impingement syndrome however the impingement was not in MRI findings. Hence the MR arthrography has higher sensitivity, specificity and accuracy of 60%, 96.6 % and 91.2 % respectively, than conventional MRI which revealed Sensitivity of 40%, Specificity of 96.6% and accuracy of 88.3% in diagnosis of supraspinatus impingement

Biceps tendon tear was reported in two patients by MR arthrography however it was not seen in conventional MRI. Arthroscopy was done to both of them and confirmed the presence of biceps tear in only one of them.

Hence MR arthrography showed sensitivity of 100%, specificity 97% and accuracy of 97%.

ALPSA lesion was diagnosed in three patients by MR arthrography findings however the lesion was not seen on their conventional MRI. Arthroscopy was done to all the three and confirmed the presence of ALPSA lesion.

ALPSA lesion was seen in two more patients not described by either conventional or MR arthrography.

MR arthrography was more sensitive in diagnosis of ALPSA lesion by 60% compared to conventional MRI which couldn't diagnose ALPSA lesion (i.e zero percentage).

HAGL lesion of inferior glenohumeral ligament tear was diagnosed in two patients by MR arthrography as the images revealed passage of contrast below the ligament not seen on conventional MRI. Arthroscopy was done for both patients and revealed that there was no tear in either, but the surgeon recognized a redundant capsule, so the appearance on the MR arthrography images was most likely due to contrast extravasation. Hence MR arthrography was nonspecific in diagnosis of HAGL lesion.

Hill sachs lesion was reported in seven patients in arthrography however it was reported only in five patients. Arthroscopy was done and detected hill sachs in all the seven patients, and hence arthrography showed sensitivity and specificity of 100% compared to conventional MRI which showed sensitivity and specificity of 71% and 100 % respectively.

Reversed hill sachs lesion was reported in one patient in conventional and MR arthrography which is seen also in arthroscopy results. Hence conventional MRI and MR arthrography showed the same sensitivity and specificity of 100% in detection of reversed Hill sachs lesion.

Illustrative Cases

Case 1: A 35 years old male patient, suffering from right shoulder pain after repeated lifting heavy loads in the Gym. No history of shoulder dislocation. Conventional MRI of the shoulder was done, showed small high T2 signal in the supraspinatus tendon and no obvious labral abnormality is seen. Conventional MRI findings: Abnormal high T2 signal in the articular surface of the supraspinatus tendon in coronal T2 image (Images a and b).

MRI Arthrography findings: Fraying of the superior labrum (Image e). Contrast filling through the bursal surface of the supraspinatus tendon, running through the tendon. (Images c and d). Contrast filling about 7 mm of the distal biceps tendon. (Image f)

Diagnosis: Type I SLAP injury. Partial thickness tear of the biceps tendon.

Grade I articular surface partial thickness, and intrasubstance tear of the supraspinatus tendon. The patient was referred to the orthopedic surgeon for arthroscopy which revealed: Supraspinatus tendon tear from bursal surface, confirming the results of the MR arthrography. Superior labral tear reaching to the biceps (SLAP IV) consistent with the MR arthrography results. Repair of the tear was done successfully.

Case 2: A 21 years old male patient, suffering from left shoulder pain during fitness training in the military service. History of recurrent shoulder dislocation. Conventional MRI of the shoulder was done and no obvious labral abnormality is seen. The patient underwent MR arthrography

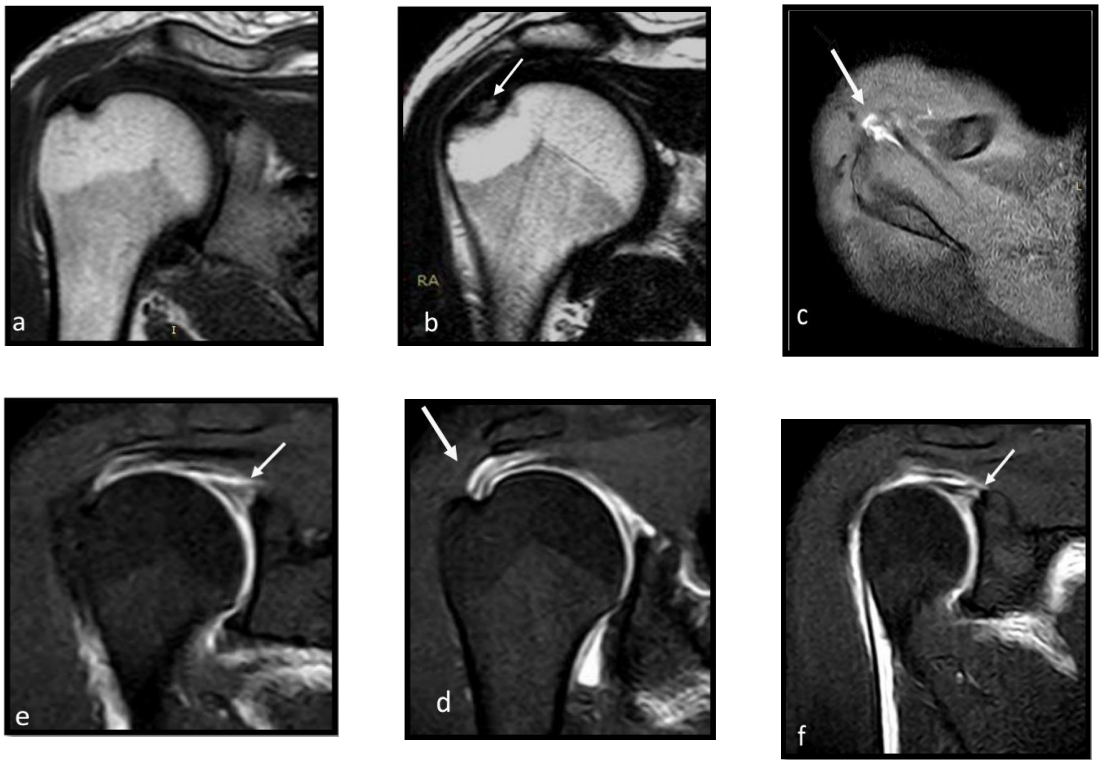

Figure (1): Conventional MRI: Coronal T1(a), coronal T2(b): showed abnormal signal in the articular surface of the supraspinatus muscle (arrow). MRI arthrography: axial T1 fat suppression(c) and coronal T1 fat suppression(d): showed contrast filling in the substance of the supraspinatus tendon (arrows), while in figure (e): coronal T1 fat suppression shows fraying of the superior labrum, fig (f): showed contrast filling about 7 mm of the intrasubstance of the humeral attachment of the biceps tendon.

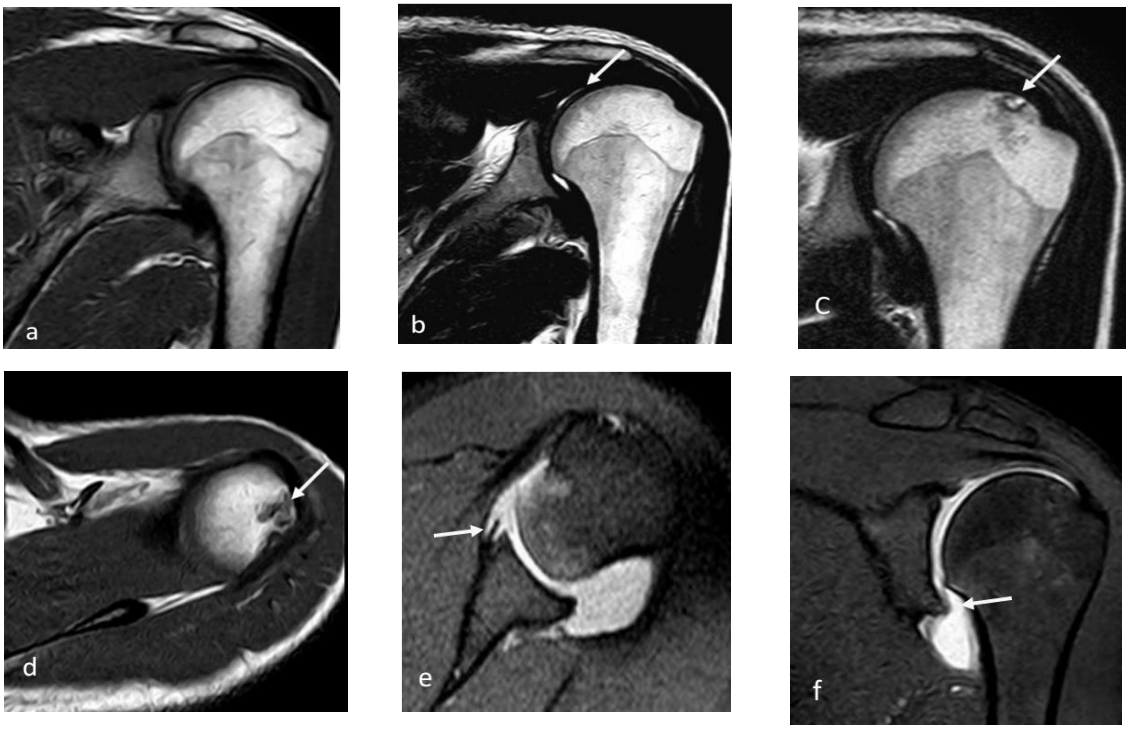

Figure (2): Conventional MRI: Coronal T1 (a) coronal T2 (b,c) and axial T1 (d) showing minimal joint effusion and abnormal low T1 and high T2 signal in the posterolateral aspect of the humeral head (arrows). MR Arthrography: Axial T1 Fat Sat (e) and coronal T1 Fat Sat (f) showed avulsion of the anterior inferior labrum glenoidal, with contrast filling under the scapular periosteum (arrows).

Conventional MRI findings: Minimal joint effusion. (Image b). Abnormal high T2 signal in the posterolateral aspect of the humeral head (hill sachs lesion). (images c and d)

MRI arthrography findings: Hill sachs lesion. Avulsion of the anterior inferior labrum glenoidal, with contrast filling under the scapular periosteum. (image e)

Diagnosis: Hill sachs lesion. Soft tissue Bankart lesion. ALPSA lesion.

The patient was referred to do arthroscopy which revealed: Soft tissue Bankart lesion. Mild form of ALPSA lesion. Hill Sachs lesion. Hence the results of the arthroscopy were consistent with the results of the MR Arthrography.

DISCUSSION:

Shoulder injuries are one of the common sports injuries among various kinds of sports, ***Enger, et al*** stated that almost a third of the shoulder injuries occurs during sports. Glenohumeral instability and rotator cuff injuries are the most common type of shoulder injuries related to sports' trauma ***(Enger et al., 2019).***[6]

Various types of injuries were noted as well as various mechanisms of injuries noticed like, external abduction force, compression force, overuse of shoulder in training (e.g: prolonged upright position of the arm in Basketball players), pushing heavy weights, direct trauma…etc.

The goal of our study is to highlight the accuracy of the MR arthrography over the conventional MRI to diagnose the glenohumeral injuries among sports related trauma.

In our study thirty-four patients suffering from shoulder pain after sport's related trauma, were referred to our Radiology department to perform both conventional MRI and MR arthrography.

As the evaluation of the labrum and undersurface of the rotator cuff muscles is usually limited in conventional MRI, we made a comparison between conventional MRI and MR arthrography, to prove the accuracy of the diagnosis is improved in the addition of the contrast medium.

Since their first description several years ago, SLAP lesions have increasingly gained attention, particularly as an important cause of sports-related shoulder disability. ***Snyder et al.*** reported an incidence of 5.9% of SLAP injuries in a series of shoulder arthroscopies, whereas in other series incidences of greater than 10% have been described. They can occur because of sudden force-ful traction on the long head of biceps tendon, such as when catching a heavy object, they can also result from a forward fall on an outstretched arm, in which a subluxating humeral head shears off a portion of the labrum, clinical diagnosis of SLAP lesions is difficult; most patients present with nonspecific shoulder pain, associated shoulder injuries, and no objective clinical instability ***(De Coninck et al., 2016).***[7]

In a study done by ***Waldt et al.*** comparing SLAP lesions by MRI and MR arthrography with arthroscopy as a gold standard, presented sixty eight SLAP lesions, (10%) were arthroscopically classified as type I, (60%) as type II, including SLAP type II lesions with coexisting Bankart lesions; (21%), as type III; and (9%), as type IV. MR arthrography showed an overall sensitivity and specificity regarding SLAP types I–IV lesions of 82% and 98%, respectively. With MR arthrography, the correct diagnosis of a SLAP lesion was established in fifty six of sixty eight patients ***(Waldt et al, 2004)***[8]

De Coninck et al stated that; Direct MR arthrography is useful in differentiating normal anatomic variants from SLAP lesions. When compared with the standard of reference—that is, arthroscopy—direct

MR arthrography yields sensitivities that range from 82% to 100%, specificities between 71% and 98%, and accuracies between 83% and 94% in detection of SLAP lesions. MR arthrography has also proven to be accurate in the differentiation of a sublabral recess from a SLAP tear ***(De Coninck et al., 2016).***[7]

In our study the exact agreement between arthrography grading and arthroscopy grading of subtypes of SLAP lesions were the same in in ten patients (90%); three SLAP I lesion, four SLAP II lesion, one SLAP III lesion and two SLAP IV lesions, however only one patient has different type of SLAP in arthroscopy result from arthrography result, as it was diagnosed as SLAP I in arthrography while in arthroscopy was diagnosed as SLAP IV. On the other hand, conventional MRI result was similar to arthroscopy in detection of SLAP subtype in only one patient.

The accuracy of MR arthrography in detection of different SLAP types was between 85%-100%. The average Sensitivity and Specificity of MR arthrography in detection of different SLAP was 91 % and 95 % respectively. However conventional MRI was not able to detect SLAP subtypes whereas only five SLAP type I lesions was detected among all cases. Among eleven patients who were diagnosed as Bankart lesion in MR arthrography, seven of them were not detected in conventional MRI.

Furthermore, five false-positive type I lesions were diagnosed on MR arthrography. Regarding SLAP type I lesions, our results are consistent with those of Hodler et al. Those researchers deduced that fraying of the superior labrum cannot be accurately detected on MRI. Because SLAP type I lesions represent degenerative changes of the superior labrum, which do not require surgical treatment.

Our study was almost similar to a study done by ***Waldt et al*** which had a sensitivity of 84% and a specificity of 99% for the detection of SLAP types.

Among eleven patients who were diagnosed as Bankart lesion in MR arthrography, seven of them were not detected in conventional MRI.

The classic Bankart lesion has been reported to be the most common lesion that results from a complete traumatic anterior dislocation and is a direct result of the anteriorly dislocated humeral head compressing against the labrum. It has been reported that the incidence of Bankart lesions in first-time dislocations is lower than initially thought. ***(De Coninck et al, 2016)***[7]

In a study done by ***Magee***, it was stated that forty-two patients had anterior labral tears on MRI. All lesions described on MRI were described on arthroscopy. Seventeen anterior labral tears showed a change in the position of the labral tear when comparing unenhanced MR images versus MR arthrogram.

In our study all findings detected by MR arthrography were detected by arthroscopy, and were described as unstable labral tears apart from, one tear which was reported as mild form of Bankert lesion whereas in arthroscopy it was described as stable labral tear, suggesting that arthrography could determine the instability of glenoid labrum which is important for the surgeon for the treatment plan.

MR arthrography was more accurate in diagnosis of Bankart lesion by Sensitivity = 100% Specificity = 95.8% and accuracy = 97% compared to the conventional MRI Sensitivity = 30%, Specificity = 95.8% and accuracy = 76.4%.

Bony Bankart lesion was seen in two cases in MR arthrography while it was only seen in one case in conventional MRI, arthroscopy confirmed the presence of bony

Bankart lesion in two cases, conventional MRI had one false negative result. Hence MR arthrography was also more accurate in detection of bony Bankart lesion with Sensitivity = 100% Specificity = 100% accuracy = 100% compared to conventional MRI, Sensitivity = 50%, Specificity = 100% and accuracy = 97%

Regarding rotator cuff injuries, five patients in our study were diagnosed as supraspinatus tears in conventional MRI and MR arthrography confirmed these results, three were described as complete tear where one of them had tendon retraction and the other two were described as partial tear.

In a study done by ***de jesus et al*** stated that: MR arthrography has sensitivity and specificity of 95.4 % and 98.9 % in diagnosis of full thickness tear and sensitivity and specificity of 85.9% and 96 % in diagnosis of partial thickness tears.[9]

In our study all of the tears were detected by arthroscopy with almost the same shape and type of tear apart from one of them was diagnosed as partial articular surface tendon avulsion (PASTA type tear) in MR arthrography while by arthroscopy was noted as focal complete tear without retraction.

Conventional MRI and MR arthrography had same sensitivity and specificity in diagnosis of complete tears, 67% and 100 % respectively, and high positive predictive value 100%, and accuracy of 97 %. While in partial tear MR arthrography revealed a sensitivity of 100% and specificity of 97% compared to conventional MRI which revealed 50 % sensitivity and 97 % specificity. The similarity of the exact type of lesion between MR arthrography and arthroscopy is about 80 %. Our results are almost similar to the results of the study done by ***de jesus et al***. [9]

Four patients were reported in MR arthrography as supraspinatus tendinopathy, however only three of them were seen in conventional MRI, all the four were described as supraspinatus impingement by arthroscopy in addition to another one more patient who was described as supraspinatus impingement by arthroscopy.

In our study conventional MRI had Sensitivity = 40%, Specificity = 96.6%, and accuracy = 88.3% in detection of supraspinatus tendinopathy. However, MR arthrography had Sensitivity = 60%, Specificity = 96.6%, and accuracy = 91.2% in detection of supraspinatus tendinopathy.

Biceps tendon tear was reported in two patients by MR arthrography however it was not seen in conventional MRI. Arthroscopy was done to both of them and confirmed the presence of biceps tear in only one of them. MR arthrography showed sensitivity of 100%, specificity 97% and accuracy of 97%.

Regarding HAGL lesion, two patients were reported in MR arthrography to have HAGL lesions of inferior glenohumeral ligament tear as the images revealed passage of contrast below the ligament in MR arthrography, however the arthroscopy revealed no tear in both patients, and recognized redundant capsule, thus the image appearance was probably due to contrast extravasation, and they were false positive cases.

In a study done by ***Wang et al*** to distinguish between true Inferior Glenohumeral Ligament Complex Tears and iatrogenic extravasation, there were thirty-five examinations with contrast material extravasation inferiorly through the IGHL complex. Of these thirty-five MR arthrograms, sixteen (45.7%) were true IGHL complex lesions and nineteen (54.3%) were cases of iatrogenic contrast material extravasation ***(Wang et al., 2018).***[10]

It has been previously suggested that extraarticular contrast material extravasation serves as a valid and reliable sign of HAGL and posterior HAGL lesions, in addition to the well-described J- sign. However, to our

knowledge, there are no studies in the literature that delineate MRI features that may aid in differentiating iatrogenic extravasation from pathologic IGHL extravasation ***(Wang et al., 2018).***[10]

In our study MR arthrography was nonspecific in diagnosis of HAGL lesion.

Regarding ALPSA lesion, three patients were diagnosed as ALPSA lesion on MR arthrography however, they were not detected by conventional MRI and all of them were detected by arthroscopy. Furthermore, two patients were diagnosed as ALPSA lesion however they were not diagnosed by either arthrography or conventional MRI MRI (false negative), and hence MR arthrography lesion has Sensitivity = 60%, Specificity = 100%, PPV = 100%, NPV = 93.5%, Accuracy = 94.1%

In a study done by ***Song et al*** on twenty-six cases of labral injuries who did conventional MR, MR arthrography and arthroscopy, seventeen of them were reported as ALPSA lesions in arthrography however arthroscopy revealed eighteen cases with sensitivity and specificity of 94.4 % and 60 %, respectively.

Hill sachs lesion was reported in seven patients in arthrography however it was reported only in five patients. Arthroscopy was done and detected hill sachs in all the seven patients, and hence arthrography showed sensitivity and specificity of 100% compared to conventional MRI which showed sensitivity and specificity of 71% and 100 % respectively.

Reversed hill sachs lesion was reported in one patient in conventional and MR arthrography which is seen also in arthroscopy results. Hence conventional MRI and MR arthrography showed the same sensitivity and specificity of 100% in detection of reversed Hill sachs lesion.

Conclusion:

Both MR arthrography and conventional MRI were not accurate in diagnosis of HAGL lesions. MR arthrography is more accurate than Conventional MRI in diagnosis of SLAP lesions, Bankart lesions, partial supraspinatus tear, impingement, biceps tear, ALPSA and Hill sachs lesions. Both MR arthrography and conventional MRI had same accuracy in diagnosis of complete supraspinatus tear.

Conflict of interest:

The authors declare that they have no conflict of interest.

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دور الرنين المغناطيسى المحقن صبغة فى المفصل فى تشخيص إصابات الملاعب لمفصل الكتف

ميشيل عادل منير وأحمد محمد منيب ويسرا عبد الظاهر عبد الله ومنة الله حاتم شلبى

قسم الأشعة التشخيصية, كلية الطب, جامعة عين شمس

الخلفية: تعد إصابات الكتف من الإصابات الرياضية الشائعة بين أنواع الرياضات المختلفة، وتحدث ثلث إصابات الكتف تقريبًا أثناء ممارسة الرياضة. يعد عدم ثبات غضروف الشفا الحقاني العضدي وإصابات عضلات و اوتار الكفة المديرة أكثر أنواع إصابات الكتف شيوعًا المتعلقة بالإصابات الرياضية.

الهدف من العمل: تسليط الضوء على دور تصوير المفاصل بالرنين المغناطيسي المحقن صبغة فى المفصل مقارنة بالتصوير بالرنين المغناطيسي التقليدي في تقييم الإصابات الشفاوية والرباطية والعقبية العضدية المرتبطة بالرياضة.

المرضى و الطرق: في دراستنا ، تمت تحويل أربعة وثلاثين مريضًا يعانون من آلام في الكتف بعد إصابة مرتبطة بالرياضة ، إلى قسم الأشعة لدينا لإجراء التصوير بالرنين المغناطيسي التقليدي وكذلك تصوير المفاصل بالرنين المغناطيسي المحقن صبغة فى المفصل. كما تم إجراء منظار المفاصل كمعيار ذهبي.

النتائج: في دراستنا كان تصوير المفاصل بالرنين المغناطيسي المحقن صبغة فى المفصل غير محدد في تشخيص آفة HAGL. فيما يتعلق بآفة ALPSA ، تم تشخيص ثلاثة مرضى على أنهم آفة ALPSA على تصوير المفاصل بالرنين المغناطيسي المحقن صبغة فى المفصل ، ومع ذلك ، لم يتم اكتشافهم بواسطة التصوير بالرنين المغناطيسي التقليدي وتم اكتشافهم جميعًا عن طريق منظار المفاصل. تم تشخيص مريضان على أنهم آفة ALPSA ولكن لم يتم تشخيصهم بواسطة التصوير بالرنين المغناطيسي المحقن صبغة فى المفصل او التقليدى (سلبي كاذب) ، وبالتالي فإن آفة تصوير المفاصل بالرنين المغناطيسي لديها حساسية ٧٥ ٪ وخصوصية ١٠٠٪

الخلاصة: لم يكن كل من تصوير المفاصل بالرنين المغناطيسي المحقن صبغة فى المفصل والتصوير بالرنين المغناطيسي التقليدي دقيقين في تشخيص آفات HAGL. يعتبر تصوير المفاصل بالرنين المغناطيسي المحقن صبغة فى المفصل أكثر دقة من التصوير بالرنين المغناطيسي التقليدي في تشخيص آفات SLAP ، وآفات BANKART ، والتمزق الجزئي فوق الشوكة ، والاصطدام ، وتمزق العضلة ذات الرأسين ، وآفات ALPSA و Hill sachs. كان لكل من تصوير المفاصل بالرنين المغناطيسي المحقن صبغة فى المفصل والتصوير بالرنين المغناطيسي التقليدي نفس الدقة في تشخيص تمزق كامل لوتر عضلة فوق الشوكة.