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RESEARCH ARTICLE

Magnetic Resonance Arthrogram Referrals by Subspecialist and Non-Subspecialist Orthopaedic Surgeons: What are the Findings?

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Abstract:

Background:

Although subspecialist orthopaedic surgeons usually request Magnetic Resonance Arthrogram (MRA) examinations, some orthopaedic surgeons may request this examination for a body part that is different from their subspecialty. The purpose of the study is to compare the MRA and the clinical findings in the subspecialist and non-subspecialist groups.

Method:

Retrospective analysis of MRA examinations over a 6-month period. Findings were compared with the clinical information.

Results:

There were 144 examinations (69 shoulder, 42 wrist and 33 hip). 85% of these were subspecialist referrals; 60% of them showed findings compatible with the clinical diagnosis. 15% of the MRA examinations were non-subspecialist referrals; 52% of them correlated with the clinical findings.

Overall, clinical information agreed with MRA findings for shoulder labral tears, hip labral tears and wrist triangular fibrocartilage complex tears in 63.3%, 64.5% and 61.5% respectively. The subspecialist group were more accurate than the non-subspecialist group in diagnosing hip labral tears (68% vs. 50%) and triangular fibrocartilage complex tears (62.5% vs. 50%). On the contrary, shoulder MRA and clinical findings correlated better in the non-subspecialist group (77.8%) compared to the subspecialist group (63.3%). However, the small number of requests generated by the non-subspecialist group may affect the results. Suspected scapholunate ligament injury showed low correlation with MRA at 26.7% (33.3% in the subspecialist group and 0% in the non-subspecialist group).

Conclusion:

Generally, the clinical findings are more accurate in the subspecialist referrals when compared to MRA findings and therefore a subspecialist referral is preferred. The low agreement between clinically suspected scapholunate ligament injuries and wrist MRA probably reflects the relative difficulty in establishing this diagnosis clinically.

Keywords: Clinical findings, Diagnostic accuracy, MR arthrogram, Non-subspecialist orthopaedic referrals, Radiological findings, Subspecialist orthopaedic referrals.

INTRODUCTION

Magnetic Resonance arthrogram (MRA) is a specialised diagnostic examination often requested by the orthopaedic surgeons when ligamentous injury/intra articular abnormalities are suspected. MRA is a sensitive [1 - 10] but invasive examination with a small risk of complications including pain [11] and rarely infection and allergic reactions [12].

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Although MRA examinations in our centre are usually requested by subspecialists, we occasionally get non-subspecialist referrals. The purpose of our study is to compare the MRA findings to the clinical findings in the subspecialist and non-subspecialist groups.

METHODOLOGY

Patient Archive and Communication System (PACS) was used to identify patients who had radiologically-guided joint injections over a period of 6 months (July 2014-December 2014). A total of 156 joint injections were identified. Seven patients had therapeutic injections and therefore were excluded. Five examinations were non-diagnostic and were excluded (4 MRA examinations were poorly tolerated by the patients mainly due to claustrophobia and 1 MRA examination had minimal intra articular contrast). All MRA examinations were reported by specialist musculoskeletal radiologists. The subspecialty of the referring orthopaedic consultant and the clinical diagnoses were obtained retrospectively from the electronic clinic letters and MRA referrals. Requests generated by subspecialists or members of their team after direct discussion were considered as “subspecialist referrals”. Requests generated by consultants but in a different subspecialty of orthopaedics were considered as “non-subspecialist referrals”. The radiological report and the clinical information were examined for correlation.

The mention of “tear” within the radiological report was considered positive for labral/ligamentous injury. The description of mild signal changes or degeneration was not considered as a tear. Injury to any component of the triangular fibrocartilage complex (TFCC) including its disc, dorsal or volar radioulnar ligaments, extensor carpi ulnaris tendon or tendon sheath was considered positive for a TFCC tear.

Our arthrogram procedures are fluoroscopically-guided and involve aseptic preparation, followed by injection of small volume of Omnipaque (Iohexol) 300 into the joint to confirm intra articular needle placement, followed by injection of Magnevist (Gadopentetate Dimeglumine) 2 mmol/L into the joint. The volume of injectate depends on the joint (usually 12-15 mls for shoulder, 10-15 mls for hip and 2-4 mls for wrist arthrogram examinations). We only inject the radioscaphoid joint when performing wrist arthrogram procedures. All MRA examinations were performed using the same protocol, which is summarised in Table 1, using either 1.5T Phillips scanner and an 8-channel dS coil, or 1.5T Siemens scanner with dedicated coils.

Table 1. MRA protocols.

Examinations	Protocol
Shoulder MRA	Coronal oblique T1 fat saturated
	Coronal oblique T2 fat saturated
	Sagittal oblique T1 fat saturated
	Axial oblique T1 fat saturated
	ABER (abduction external rotation) T1 fat saturated
Wrist MRA	Coronal T1
	Coronal T2 fat saturated
	Coronal T1 fat saturated
	Sagittal T1
	Axial T2
Hip MRA	Coronal oblique T1 fat saturated
	Coronal oblique T2 fat saturated
	Sagittal oblique T1 fat saturated
	Axial oblique T1 fat saturated

Findings

144 patients met the inclusion criteria. Patient’s age was 13-65 years (mean= 34 years). There were 84 males and 60 females. There were 69 shoulder, 42 wrist and 33 hip MRA examinations. Arthrogram requests were generated by 15 orthopaedic subspecialists (4 hip and knee, 4 hand and wrist, 3 shoulder, 3 spine and 1 foot and ankle).

123 (85%) of the MRA examinations were “subspecialist referrals”. The radiological findings in 74 of these (60%) were compatible with the clinical suspected diagnoses (Table 2). Table 3 summarises the findings in this group examinations where there is a difference between clinical and radiological findings.

Table 2. Clinically and radiologically compatible diagnoses in the “subspecialist referral” group. N= 74.

Examinations	Clinical and radiological diagnosis	Number of examinations
Shoulder MRA	SLAP tear	11
	Bankart tear (+/- Hill-Sachs lesion/glenoid involvement)	9
	Other labral tears	16
	Rotator cuff tear	2
Wrist MRA	TFCC tear	15
	SLL tear	4
Hip MRA	Labral tear	12
	Labral tear with cam deformity	5

SLAP= superior labral anterior to posterior, SLL= scapholunate ligament, TFCC= triangular fibrocartilage complex.

Table 3. Different clinical and radiological findings in the “subspecialist referral” group. N= 49.

Examinations	Clinical suspicion	Number of examinations	Radiological findings	Number of examinations
Shoulder MRA	Labral tear	17	No significant findings	9
			Supraspinatus tendinopathy	4
			Glenohumeral ligaments thickening	3
			Greater tuberosity fracture	1
	SLAP tear	4	No significant findings	3
			Old greater tuberosity fracture	1
Rotator cuff tear	1	No significant findings	1	
Wrist MRA	TFCC tear	10	No significant findings	6
			SLL tear	1
			Bone oedema	1
			Ganglion cyst	1
	SLL tear	8	No significant findings	7
			TFCC tear	1
Hip MRA	Labral tear	10	Mild degenerative labral signal changes	4
			No significant findings	4
			Hip joint degenerative changes	1
			Gluteus medius insertional tendinopathy	1

SLAP= superior labral anterior to posterior, SLL= scapholunate ligament, TFCC= triangular fibrocartilage complex.

21 (15%) of the MRA examinations were “non-subspecialist referrals”. These showed 52% clinical diagnostic compatibility (Table 4). Table 5 summarises the findings in examinations where there is difference between the clinical and radiological findings in this group.

Table 4. Clinically and radiologically compatible diagnoses in the “non-subspecialist referral” group. N= 11.

Examinations	Clinical and radiological diagnosis	Number of examinations
Shoulder MRA	Bankart tear (+/- Hill-Sachs lesion/glenoid involvement)	5
	Other labral tears	2
Wrist MRA	TFCC tear	1
Hip MRA	Labral tear	3

TFCC= triangular fibrocartilage complex.

Table 6 summarises the speciality of the requesting consultants in the “non-subspecialist” group arranged by MRA examinations.

DISCUSSION

MRA examination involves multiplanar magnetic resonance imaging of a certain joint after injection of intra-articular contrast material. It combines the inherent excellent soft tissue contrast on magnetic resonance imaging, and intra articular contrast enhancement and joint distension to give a detailed assessment for ligamentous injury and intra articular pathology. MRA is a highly sensitive and specific diagnostic study for various joints abnormalities and is often requested by orthopaedic surgeons prior to contemplating a management plan. In comparison to arthroscopy, shoulder

MRA has 92% sensitivity and specificity for diagnosing labral tears [1] with one study describing sensitivity as high as 96% [2]. Sensitivity and specificity for SLAP tears are described as 89% and 91% respectively [3]. It has 100% sensitivity for diagnosing rotator cuff tears [4, 5]. Hip MRA has 90% sensitivity for detecting labral lesions [6]. Wrist MRA examination has high sensitivity and specificity for detecting TFCC and scapholunate ligament (SLL) tears, with 97.1% sensitivity and 96.4% specificity for TFCC tears [7] and 99% sensitivity [8] and 100% specificity [7] for SLL tears. Another study showed slightly lower results with 90% sensitivity and 75% specificity for TFCC tears and 91% sensitivity and 88% specificity for SLL tears [9].

Table 5. Different clinical and radiological findings in the “non-subspecialist referral” group. N= 10.

Examinations	Clinical suspicion	Number of examinations	Radiological findings	Number of examinations
Shoulder MRA	Labral tear	2	No significant findings	1
			Thickened MGHL	1
Wrist MRA	SLL tear	3	No significant findings	2
			ECRL and ECRB tenosynovitis	1
	TFCC tear	1	Old ulna fracture	1
	Non-specified ligament injury	1	No significant findings	1
Hip MRA	Labral tear	3	Gluteus medius insertional tendinopathy	2
			No significant findings	1

ECRB= Extensor carpi radialis brevis. ECRL= Extensor carpi radialis longus. MGHL= Middle glenohumeral ligament. SLL= scapholunate ligament, TFCC= triangular fibrocartilage complex.

Direct arthrography involves injecting contrast material (usually gadolinium based) into a joint under fluoroscopic or ultrasound guidance. It is superior to plain MR examination in assessing intra-articular abnormalities [10]. However, it is an invasive procedure that often causes anxiety and pain to the patient. In one study, 66% of patients experienced moderate to severe delayed onset pain (average 16.6 hours) after an arthrogram injection, which completely resolved after few days (average 44.4 hours) [11]. Septic arthritis is a rare but potentially serious complication reported in approximately 0.002% of patients undergoing arthrogram procedures. Other rare reported complications include allergic reactions to contrast material or local anaesthetic and adverse reactions secondary to intravascular administration of contrast material [12].

Table 6. The speciality of the requesting consultants in the “non-subspecialist” group arranged by MRA examinations, N=21.

Examinations	Subspecialty of referring orthopaedic surgeon in the “non-specialist group”	Number of examinations
Shoulder MRA	Wrist	3
	Foot and ankle	2
	Hip and knee	1
	Spine	1
	Other non-consultant orthopaedic specialist	2
Wrist MRA	Shoulder and elbow	5
	Other non-consultant orthopaedic specialist	1
Hip MRA	Foot and ankle	4
	Spine	2

In most UK institutions, orthopaedic surgeons provide a subspecialist service depending on their training/experience in a certain body part/joint. Most of the referred MRA examinations are therefore received from orthopaedic surgeons according to their subspecialty. Intermittently, some surgeons request this examination for a joint different from their subspecialty (for example a spinal surgeon may request a hip arthrogram examination). Our study showed that most of the MRA examinations (85%) are generated by subspecialist orthopaedic surgeons. A good proportion of these subspecialist MRA referrals (60%) showed findings compatible with the clinical diagnosis. In 3 examinations, a ligamentous injury different from the suspected clinical diagnosis was identified, however this would require an MRA examination (1 shoulder MRA examination with suspected labral tear showed intact labrum but superior glenohumeral ligament injury, 1 wrist MRA examination with suspected SLL injury showed intact SLL but a full thickness tear of the TFCC, and another wrist examination with suspected TFCC injury showed intact TFCC but a full thickness SLL tear). As expected, a smaller proportion of the MRA examinations were “non–subspecialist referrals”. These showed slightly lower correlation with the clinically suspected diagnosis (52%).

A labral tear was the main clinical question in shoulder and hip MRA referrals. Overall, shoulder MRA examinations were compatible with the clinical findings in 63.3% of the subspecialist referrals and in 77.8% of the non-subspecialist referrals, resulting in overall correlation of 65.2%. However, it is important to mention the relative small number of shoulder MR requests received from the non-subspecialist group (9) compared to the subspecialist group (60), which could affect the results.

Most of these shoulder MRA examinations demonstrated labral tears (including variants like Bankart lesion, superior labral anterior to posterior (SLAP) tear, associated bony and articular cartilage involvement and Hill Sachs lesions). Similarly, hip MRA examinations showed good correlation with the clinical findings (64.5%). This is split into 68% in the subspecialist group and 50% in the non-subspecialist group.

Out of the 42 performed wrist MRA examinations, a TFCC tear was suspected in 26 of the examinations and a SLL tear was suspected in 15 examinations. While suspected TFCC injuries showed good correlation of 61.5% with MRA findings (62.5% in the subspecialist group and 50% in the non-subspecialist group), only 26.7% of the suspected SLL injuries were compatible with the clinical diagnosis. The subspecialist group referrals for suspected SLL injury showed 33.3% correlation while none of the 3 non-subspecialist referrals with suspected SLL injury was positive on MRA examination. When the MRA examination was negative for suspected SLL injury, it did not show significant abnormality to explain clinical findings in most of the examinations apart from 1 examination showed a full thickness TFCC tear and 1 examination showed tenosynovitis of extensor carpi radialis longus and extensor carpi radialis brevis tendons.

To our knowledge, there are no published studies comparing subspecialist and non-subspecialist orthopaedics clinical findings to MRA examination as most of the published studies compare clinical findings against surgical/arthroscopic ones or MRA to arthroscopic findings without taking in consideration the subspecialty of the referrer. One prospective study compared clinical diagnostic accuracy of an orthopaedic surgeon, a military physiotherapist and two orthopaedic residents against arthroscopic findings in 37 symptomatic patients with suspected acetabular labral tears and showed high clinical diagnostic accuracy of 80-85% with no significant difference between examiners [13]. The result of our study shows higher agreement between hip and wrist MRA examinations and clinical findings when a subspecialist orthopaedic surgeon refers the patient. Although the results show higher correlation between shoulder MRA examinations and clinical findings in the non-subspecialist group, the small number of patients in the non-subspecialist group restricts the significance of this. While a subspecialist referral is not always feasible, it should be sought to improve the clinical diagnostic accuracy and avoid unnecessary arthrogram examinations.

The low agreement between clinical and MRA findings in suspected SLL tears probably reflects the relative difficulty in establishing this diagnosis clinically. In one retrospective study assessing clinical diagnostic accuracy for wrist pathologies in 66 patients compared to arthroscopy, clinical assessment had 44% sensitivity and 92.7% specificity for diagnosing TFCC tears and 47.6% sensitivity and 66.7% specificity for diagnosing SLL tears [14]. Another prospective study of 105 patients presenting with wrist pain concluded that provocative wrist tests for SLL and midcarpal ligament injuries are only mildly useful with negative predictive value of 55% and 74% for TFCC and SLL tears respectively [15].

Limitations to our study include the retrospective nature of the study and the small number of examinations in the “non-subspecialist” group compared to the “subspecialist” group.

CONCLUSION

Apart from shoulder MRA, there is better correlation in the clinical findings of subspecialist orthopaedic referrals with MRA examination compared to non-subspecialist orthopaedics and therefore a subspecialist referral for an arthrogram examination is preferred. The results need to be highlighted to the non-specialist group to improve their referrals. Low agreement in the clinical and radiological findings in suspected SLL injury reflects the difficulty in establishing this diagnosis clinically.

LIST OF ABBREVIATIONS:

ABER	=	Abduction external rotation
ECRB	=	Extensor carpi radialis brevis
ECRL	=	Extensor carpi radialis longus
ECU	=	Extensor carpi ulnaris

MGHL	=	Middle glenohumeral ligament
MRA:	=	Magnetic Resonance arthrogram
PACS	=	Patient Archive and Communication System
SLAP tear	=	Superior labral anterior to posterior tear
SLL	=	Scapholunate ligament
TFCC	=	Triangular fibrocartilage complex

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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Declared None

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