

Comparing knee clinical examination and MRI findings with arthroscopy results in meniscus ruptures among 100 patients admitted at Qaem hospital from 2010 to 2012

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Abstract: To compare knee clinical examination and MRI findings with arthroscopy observations to show the compatibility of these two methods about meniscus ruptures. Between the years 2010 and 2012, 100 patients among 207 with knee injury who were suspected to have meniscus rupture became candidates for knee arthroscopy. Grades III and IV meniscal tears were considered as the true meniscal rupture. True meniscal ruptures were classified as meniscal rupture for medial or lateral meniscus or both. The arthroscopic findings were expressed as bucket handle tear of medial meniscus, other types of medial meniscus tearing (flap, radial or complete tear), lateral meniscus tearing and both medial and lateral meniscus tearing. Our patients were 89% male and 11% female and the mean age was 29.1 years old. The sensitivity and specificity of MRI for medial meniscus rupture is 79.7% and 58.5% respectively and it's PPV and NPV is 73.4% and 66.6%. The sensitivity and specificity of MRI for Bucket handle tear of medial meniscus is 83%, 58.5% respectively. Sensitivity and specificity of this test for lateral meniscus tear is 48%, 93%. McMurray test was more sensitive in medial meniscus tearing than bucket handle and lateral one. It was the most sensitive test for lateral and medial meniscus tearing except bucket handle type. Giving way symptom was less sensitive than Mc Murray test. Clicking was the most specific symptom for all types of medial meniscus tearing. Joint line tenderness was more specific in lateral meniscus than medial one. MRI imaging cannot give enough diagnostic information for meniscus rupture alone and for an accurate clinical decision, not only MRI imaging but also comprehensive physical examination is quite necessary.

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1. Introduction

Incidental meniscal findings on magnetic resonance imaging (MRI) of the knee are common in the general population and increase with increasing age (1-6). It is important to make an accurate diagnosis of meniscus tears so that the appropriate treatment can be given; thus, accurate diagnosis before performing any aggressive procedure leads to more favorable treatment outcomes. Magnetic resonance imaging (MRI) and clinical examination are tools commonly used in the diagnosis of meniscus tears (2, 4, 5, 7-11). Being relatively common meniscus tearing could lead to locking, popping as well as joint line tenderness; this predisposes the knee joint to further arthritis (4, 5, 7, 12). It has been suggested that arthrography is not sensitive and specific enough for the diagnosis of meniscus rupture. Its accuracy highly depends on who is reporting and interpreting the results (3,

13,14); On the other hand, arthroscopy is somehow aggressive and needs spinal or general anesthesia. The disadvantages of arthroscopy are intra-articular damage to surface, hemarthrosis, thrombophlebitis, infection, tourniquet paresthesia (12-16); Thus, despite being highly sensitive and specific, it cannot be considered as a first choice diagnostic method for all cases suspected to intra-articular injuries. It seems that MRI imaging could be a suitable first step for the diagnosis of meniscus injuries (2, 9,17). So comparison of clinical examination, MRI and arthroscopy becomes important as it could help us diagnose and treat lesions of knee in a better way.

The purpose of the present study was to determine the diagnostic efficacy of routine MRI and clinical examinations in detecting meniscal pathology among patients admitting with a history of knee injury. The diagnostic performance of MRI imaging and clinical examination was compared with that of

arthroscopy, which was proposed as the gold standard. Since MRI is neither invasive nor irradiative, in this study we tried to compare knee clinical examination and MRI findings with arthroscopy observations to show the compatibility of these two methods about meniscus ruptures (18,19).

2. Material and Methods

between the years 2010 and 2012, 207 patients with knee injury who were suspected to have meniscus rupture, diagnosed by general orthopedic surgeons, sport medicine specialist or general physicians was referred to the university referral hospital, Ghaem Hospital in Mashhad, for further evaluation. After physical examination and imaging studies evaluation, by the senior author of our study 124 patients became candidates for knee arthroscopy. The ethical approval to conduct the study was obtained from Mashhad University of medical sciences. Exclusion criteria were previous knee surgery, deformity or contracture. All the subjects had non-acute knee injuries with more than 3 weeks had passed from the accident. In order to avoid reporting bias caused by considerations, patients with bilateral knee injuries were considered as one patient and the more severe side was chosen.

All the patient's MRIs had been accomplished by two well-equipped MRI centers. Both of MR imagines studies were performed using a standard knee protocol on a 1.5-Tesla MR scanner with a phased array knee coil. All of the cases had T1 and T2 weighted coronal and sagittal plane images, without contrast. Parameters used were slice thickness of 3 mm with a 0.5 cm interslice interval, 14_20 cm FOV (field of view), 256_320 matrixes for all sequence. TR/TE was (400/30 ms) in T1 and (3500/90 ms) in T2 images respectively. MR pulse sequences included fast spin echo (FSE) and fast recovery.

Two blinded radiologists, who were experienced in musculoskeletal injuries, reported the MRI findings. Meniscal tears were graded from I to IV according to MRI images (16). Grades III and IV were considered as the true meniscal rupture. True meniscal raptures were classified as meniscal rapture for medial or lateral meniscus or both. We informed the remaining patients with meniscus rupture of our diagnosis, and asked them to sign an agreement, for undergoing arthroscopy to confirm the diagnosis and probable treatment. 24 of them disagreed to sign and were excluded from the study. 100 patients were elected to undergo arthroscopic pressure.

Before surgery, a senior resident in orthopedic surgery who was experienced in knee examination evaluated all the patients with knee

injury regarding the presence of meniscal rupture sign and symptoms (locking, popping or clicking and joint line tenderness) accurately. All arthroscopic procedures were performed in a standard manner by two experienced arthroscopic surgeon who were blinded to the MRI findings, using anterolateral and anteromedial portals. The arthroscopic findings were expressed as bucket handle tear of medial meniscus, other types of medial meniscus tearing (flap, radial or complete tear), lateral meniscus tearing and both medial and lateral meniscus tearing. The diagnostic findings were classified as: clinical finding regarding meniscus rapture versus arthroscopic findings, MRI finding for meniscus rapture versus arthroscopic findings and clinical finding regarding meniscus rapture versus arthroscopic. We evaluated positive predictive value (PPV), negative predictive value (NPV), sensitivity, and specificity.

To evaluate the sensitivity, specificity and accuracy of clinical examination and MRI results, the findings at arthroscopy were taken to be the true diagnosis. Sensitivity was calculated from the number of true positive results divided by the sum of the true positive results and the false negative results. Specificity was calculated from the number of true negative results divided by the sum of the true negative results and the false positive results. Accuracy was calculated from the sum of the true positive and the true negative results divided by the total number of patients who underwent arthroscopy. We used the chi-square test in the area of nominal variable and the Fisher exact test for comparison between accuracy, sensitivity, specificity, positive predictive value and negative predictive value. Data were finally analyzed using SPSS 17 software (20).

3. Results

Our patients were 89% Male and 11% female and the mean age was 29.1 years old (Age ranged: 17 to 60 years old).

Table 1. Frequency of meniscus tears in patients under arthroscopy

Meniscus tears in patients under arthroscopy	n
Medial meniscus Bucket handle rupture	12
Other medial meniscus rupture	36
Lateral meniscus	16
Lateral meniscus with meniscus Bucket handle	4
Medial meniscus with Lateral meniscus	7
No rupture	25
Total	100

Table 2. Consideration of meniscus tear in arthroscopy with meniscus tear in MRI

Miniscus Rupture			Arthroscopy with Bucket handle analysis						Total
			Medial meniscus Bucket handle rupture	Other medial meniscus rupture	Lateral meniscus	Lateral meniscus with meniscus Bucket handle	Medial meniscus with Lateral meniscus	No rupture	
MRI	Medial meniscus	n	10	28	4	3	4	10	59
		%	83.3	77.8	25	75	57.1	40	59
	Lateral meniscus	n	1	1	7	1	1	2	13
		%	8.3	2.8	43.8	25	14.3	8	13
	Medial meniscus with Lateral meniscus	n	0	0	2	0	2	1	5
		%	0	0	12.5	0	28.6	4	5
	No rupture	n	1	7	3	0	0	12	23
		%	8.3	19.4	18.8	0	0	48	23
	Total	n	12	36	16	4	7	25	100
		%	100	100	100	100	100	100	100

Table 3. Consider of meniscus tear in arthroscopy with report of Mc Murray test

		Meniscus rupture in arthroscopy								Total	
		Medial meniscus		Lateral meniscus		Medial meniscus with Lateral meniscus		No rupture		n	%
		n	%	n	%	n	%	n	%		
MC Murray	Positive	29	85.3	12	85.7	8	80	8	44.4	57	75
	Negative	5	14.7	2	14.3	2	20	10	55.6	19	25
Total		34	100	14	100	10	100	18	100	76	100

The peak age range of the patients was 21-25 which composed 36% of the sample. 61% of all the patients had right knee involvement and 39% in left (Tables 1 and 2). The sensitivity and specificity of MRI for medial meniscus rupture is 79.7% and 58.5% respectively and its PPV and NPV is 73.4% and 66.6%.

The sensitivity and specificity of MRI for Bucket handle tear of medial meniscus is 83%, 58.5% respectively, and its PPV and NPV is 28.5% and 75%. Sensitivity and specificity of this test for lateral meniscus tear is 48%, 93%, and its PPV and NPV is 72.2% and 82.9% respectively. The sensitivity, specificity, PPV and NPV of Mc Murray test for different kinds of meniscus rupture are demonstrated in Table-3 and -8. McMurray test was more sensitive in medial meniscus tearing than bucket handle and lateral one. It was the most

sensitive test for lateral and medial meniscus tearing except bucket handle type (Table 3).

The sensitivity, specificity, PPV and NPV of Mc Murray test for different kinds of meniscus rupture are demonstrated in Table-4 and Table-8. Giving way symptom was less sensitive than Mc Murray test (Table 4). The sensitivity, specificity, PPV and NPV of locking clinical symptom for meniscus rupture is shown in Table-5 and Table-8. It was the most specific symptom for bucket handle meniscus tearing (Table 5).

Clicking was the most specific symptom for all types of medial meniscus tearing. More details were shown in Table-6 and Table-8. About joint line tenderness, the result showed that it was more specific in lateral meniscus than medial one. The sensitivity, specificity, PPV and NPV for different kinds of meniscus rupture are demonstrated in Table-7 and Table-8.

Table 4. Consider of meniscus tear in arthroscopy with report of Giving way

		Meniscus rupture in arthroscopy								Total	
		Medial meniscus		Lateral meniscus		Medial meniscus with Lateral meniscus		No rupture		n	%
		n	%	n	%	n	%	n	%		
Giving way	Positive	29	60.4	11	68.8	7	63.6	15	60	62	62
	Negative	19	39.6	5	31.3	4	36.4	10	40	38	38
Total		48	100	16	100	11	100	25	100	100	100

Table 5. Consider of meniscus tear in arthroscopy with report of clinical symptom locking

		Meniscus rupture in arthroscopy								Total	
		Medial meniscus		Lateral meniscus		Medial meniscus with Lateral meniscus		No rupture		n	%
		n	%	n	%	n	%	n	%		
Locking	Positive	26	54.2	10	62.5	11	100	9	36	56	56
	Negative	22	45.8	6	37.5	0	0	16	64	44	44
Total		48	100	16	100	11	100	25	100	100	100

Table 6. Consider of meniscus tear in arthroscopy with report of clinical symptom click

		Meniscus rupture in arthroscopy								Total	
		Medial meniscus		Lateral meniscus		Medial meniscus with Lateral meniscus		No rupture		n	%
		n	%	n	%	n	%	n	%		
Click	Positive	9	18.8	2	12.5	2	18.2	3	12	16	16
	Negative	39	8.3	14	87.5	9	81.8	22	88	84	84
Total		48	100	16	100	11	100	25	100	100	100

4. Discussions

Our study showed that the most sensitive clinical finding for bucket handle tear of meniscus was locking symptom and for others was Mc Murray test. Clicking and joint line tenderness were the most specific exams for medial and lateral meniscus tearing respectively. Sensitivity of MRI for detecting meniscus tearing was 81% for medial meniscus and

48% for lateral one. So many studies like ours had shown that MRI imaging are more sensitive in medial meniscus rupture than lateral one (1, 2, 5, 6, 8, and 17) (Table 9).

The sensitivity of MRI among different studies ranged from 100 to 85% and 100 to 67% for medial and lateral meniscus respectively (1, 2, 5, 6, 8, 9, 17) which are superior to our result (Table 9).

Table 7. Consider of meniscus tear in arthroscopy with report of clinical symptom joint line tenderness.

		Meniscus rupture in arthroscopy								Total	
		Medial meniscus		Lateral meniscus		Medial meniscus with Lateral meniscus		No rupture		n	%
		n	%	n	%	n	%	n	%		
Joint line tenderness	Medial	15	31.3	4	25	3	27.3	7	28	29	29
	Lateral	3	6.3	5	31.3	1	9.1	3	12	12	12
	Medial with lateral	2	4.2	0	0	1	9.1	0	0	3	3
	no	28	58.3	7	43.8	6	54.5	15	60	56	56
Total		48	100	16	100	11	100	25	100	100	100

Table 8. Consider of meniscus tear in arthroscopy with report of clinical symptom joint line tenderness

	Medial Meniscus			
	Sensitivity	specificity	NPV	PPV
McMurray	84.1	37.5	63.1	64.9
Giving way	61	36.6	39.4	58
Click	18.6	87.8	42.8	68.7
locking	62.7	53.7	50	66
Tenderness	35.6	75.6	44.9	67.7
	Lateral Meniscus			
	Sensitivity	specificity	NPV	PPV
McMurray	83	28.8	78.9	35
Giving way	66.7	39.7	76.3	29
Click	14.8	83.6	72.6	25
locking	77.8	52.1	86.3	37.5
Tenderness	25	89	23.5	46.6
	Bucket handle			
	Sensitivity	specificity	NPV	PPV
McMurray	66.7	37.5	75	28.5
Giving way	56.3	36.6	68	25.7
Click	6.3	93.8	70.5	16.6
locking	81.3	53.7	88	40.6
Tenderness	-	-	-	-

Table 9. Sensitivity, specificity, PPV and NPV of McMurray test for different kinds of meniscus rupture regarding to clinical test and symptoms

Study	Year	Sensitivity		Specificity		PPV (%)		NPV (%)	
		MM	LM	MM	LM	MM	LM	MM	LM
Boeree et al (original article)	1991	96.7	96.1	91.3	98				
Spiers et al (original article)	1993	100	100	71	92	71	69	100	100
Oeiet al (review article)	2003	93.3	88.4	79.3	95.7				
Esmailjiah et al (original article)	2005	75	66.6	94.7	86.2	92.3	50	81.8	92.6
Crawford et al (review article)	2007	91.4	76.0	81.1	93.3	83.2	80.4	90.1	91.6
Vlychou et al (original article)	2010	93.7	85.7	92.6	93.1	88.2	85.7	95.8	93.1
Sharma et al (original article)	2011	92.3	84.6	100	96.4	100	91.6	88.2	93.1
Our study		80	48	59	93	73	72	67	83

Table 10. Comparing of physical examination sensitivity and specificity in different studies to arthroscopy (C=Click, L= Locking, GV= Giving way, MM= Mc Murray, JLT= JOINT line tenderness)

Study	Year	Sensitivity					Specificity				
		P	L	GV	MM	JLT	P	L	GV	MM	JLT
Boeree et al	1991			67.7					67.2		
				48.3					88.7		
Esmailijah et al	2005			100					95.6		
				84.6					91.2		
Sharma et al	2011			96.1					33.3		
				38.4					96.4		
Gupta et al	2012				91	100				63.1	73.8
Yan et al	2012		55.2	43.5	76			96	84	76.9	
Our study	2013	19	63	61	84	36	88	54	36	37	76
		15	78	67	83	25	84	52	40	29	89

Inversely, MRI imaging had more specificity for lateral meniscus tearing than medial one (93% compare to 59%). Many studies support our result (1, 2, 6, 9, and 17). Although specificity for lateral meniscus tearing was similar to other studies, but for media tearing it showed lower measurement (1, 2, 5, 6, 8, 9, 17). On the other hand MRI imaging, can give enough diagnostic information for meniscus rupture even though it is not invasive nor patients compliance dependent at all. Boeree et al (1), Esmailijah et al (5) and Sharma et al (8) found clinical evaluation is more sensitive in medial meniscus tearing than lateral one. It is right in clicking, MC murry and joint line tenderness tests in our study but not in giving way and locking tests. The most sensitive test for bucket handle tear of medial meniscus was locking and for other types of medial and lateral meniscus was Mc Murray test. Yan et al (10) found Mc Murray test as the most sensitive test for meniscal tearing too. Gupta et al express as high as 91% sensitivity for meniscal tearing (4).

Boeree et al detected more specificity in clinical examination for lateral meniscus tearing than medial one (1) (Table 10). It is in contrast with Sharma et al(8). The most specificity for medial meniscus tearing was shown clicking (91%) and for lateral one joint line tenderness (89%). Gupta et al found joint line tenderness as the most specific test too (Table 10). Eren in a specific survey on joint line tenderness test concluded that the test is sensitive (89%), and specific (97%), but, like our study, for medial meniscal tears, rates were lower (7). Finally it should be mentioned that examiner experience and radiologist accuracy could differ from person to person and the result may not generalize. MRI imaging devices are being promoted and by the way their sensitivity and specificity will promote too. MRI imaging, with sensitivity of 65% and specificity of 72%, cannot give enough diagnostic information for meniscus rupture alone. Our study supports the idea that for an accurate clinical decision, not only

MRI imaging but also comprehensive physical examination is quite necessary.

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