Comparison of magnetic resonance imaging (MRI) and arthroscopic findings in knee joint pathologies

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Arthroscopy and MR examination were performed 40 patients with symptoms of the knee joint. These two methods were compared for lesions of the hyalen cartilage, synovia, cruciate ligaments and menisci. Artroscopy confirmed MRI findings in 91% of anterior cruciate ligament tears and in 86% of meniscus tears. The MR diagnoses were confirmed by artroscopy in 71% of patients with chondral lesions. Although our results suggest that the evaluation of early stage cartilage lesions were less diagnostic the lesions of the cruciate ligament and meniscus on the other hand were found highly diagnostic by MRI. Oblique-sagittal fast-spin echo-T2 images increased diagnostic accuracy of anterior cruciate ligament tears. Diagnostic value was much lower in early stage chondromalacia. [Turk J Med Res 1997; 15(1):21-25]

Key **Words** : Arthroscopy, Imaging, Magnetic resonance, Knee joint

Radiological imaging and arthroscopy of knee joint lesions are usually performed since clinical evaluation alone is not sufficient. When compared with other diagnostic methods, magnetic resonance imaging (MRI) has the advantages of demonstrating the cartilage structure, bones, soft tissues and ligaments in the knee joint directly, in detail, and in different planes (1,2). Artroscopy on the other hand is a method for both diagnosis and treatment. However, it is an invasive method, it requires operative conditions and anaesthesia. In our study to determine accuracy of MR in knee joint pathologies we compared MR and arthroscopic findings.

MATERIAL AND METHODS

Arthroscopy was performed after a MRI examination in 40 of 254 adult cases complaining of knee joint. Six of the patients were female and 34 were male. The mean age was 24. MR examinations were performed with a 0.5 Tesla MR System (GE Signa) using quadriture extremity coil. Patients were examined without preparation, in supine position and feet first direction. The knee was placed in neutral position inside the coil and MR examination was performed by 10-50° external rotation.

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A routine MR examination protocol consisting of 4 sequences, named gradient-echo T1 axial and sagittal, T2 sagittal and coronal was carried out for each patient and oblique- sagittal fast spin-echo (FSE)-T2 images are added (Table 1) in cases where anterior cruciate ligament (ACL) could not be seen properly, .

Reliability of MRI and its correlation with arthroscopy results were discussed taking into consideration especially the tears of cruciate ligament and meniscal lesions, hyalen cartilage and synovial lesions. Lesions detected in MR but not found in visual field of artroscopy were excluded.

Cases with intact cruciate ligaments, but nonhomogenous signal or high signal recordings were described as ligament degeneration or partial rupture and cases in which anatomic integrity is lost with high signal intensity recordings were described as ligament rupture. Meniscal lesions were evaluated by MRI in four grades as grade-1,2,3,4 and according to increased signal intensity in the meniscal lesions (Grade 1: a nonarticular focal intrasubstance increased signal intensity, grade 2: a linear intrasubstance increased signal intensity, grade 3: area of increased signal intensity extendes to at least one articular surface, grade 4: meniscocapsular separation and multidirectional tear). Grade 1-2 chondromalacia were characterized by focal areas of decreased signal intensity without cartilage surface or subchondral bone extension and by areas of decreased signal intensity extending to the articular cartilage surface, respectively. Grade 3-4 chondromalacia were characterized by surface irregularity with focal areas of decreased signal intensity associated with loss of the sharp articular margin

"able 1. Knee joint MRI examination protocol

SEQUENCES	TR / TE/FA	FOV	MATRIX	NEX
^C3RE-T1	700/ 11 /90°	24	192x256	3
<3RE-T2	800/25 /30°	30	192x256	3
PSE-T2	3000/102/ 16	24	192x256	3

Table 2. Comparison of arthroscopic and MRI findings

FINDINGS	MRI	ARTHROSCOPY
Grade 1-2 meniscal degeneration	16	14
Grade 3 meniscal tear	28	24
partial rupture of ACL	9	10
Complete rupture of ACL	7	7
Grade 1-2 chondromalacia	4	8
Grade 3-4 chondromalacia	6	6
Synovial hypertrophy and PVNS	3	3

ACL: Anterior cruciate ligament;
pVNS: Pigmented villonodular synovitis

between the patellar surfaces and by cartilage defects, exposed subchondral bone, and undermining of fluid in subchondral bone, respectively.

RESULTS

Comparison of arthroscopic findings with MRI in knee joint pathologies is shown in Table 2. With MRI in 44 of

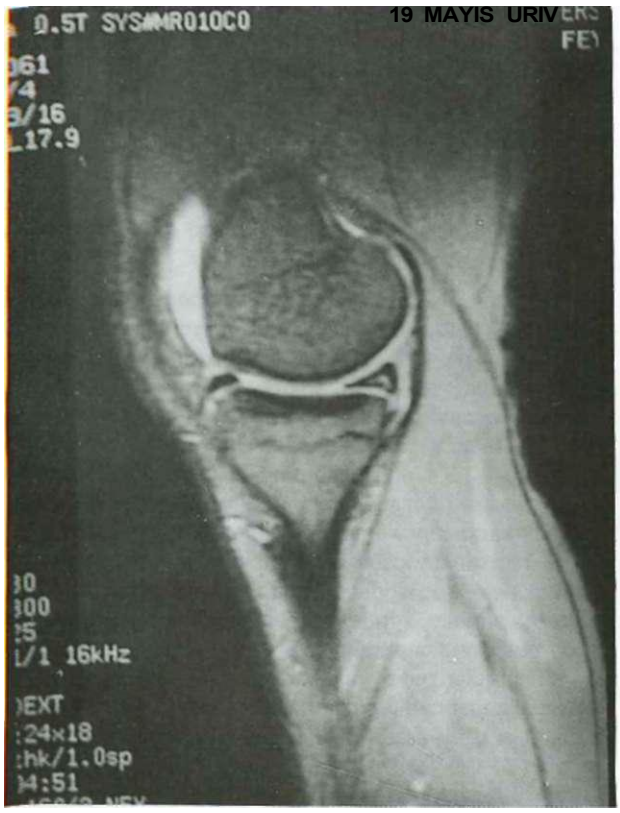

Figure 1. Grade-1 degeneration is seen at posterior horn of the medial meniscus on T2-weighted sagittal image.

Figure 2. Grade-2 degeneration is seen at posterior horn of the medial meniscus on T2-weighted coronal image. Note there is no extension to the cartilage surface.

80 menisci in 40 patients meniscal lesions were detected with MRI; 86% of meniscus lesions were found at the posterior horn. Twenty-eight of the 44 meniscal lesions were meniscal tears and 16 were meniscal degenerations (Figure 1-4). MR findings revealed 9 partial ACL tear, 7 complete ACL tear, 10 hyaline artilage lesions, 2 synovial hypertrophy with rheumatoid arthritis in two cases and 1 pigmented villous-nodular synovitis (Figure 5-6). Five of the hyaline cartilage lesions were on femoral surfaces, two were on patellar surface, one was on tibial surface."Four of the cases were considered as grade 1 and 2, and 6 were considered as grade 3 and 4 (Table 3).

Arthroscopic findings of these patients revealed 14 meniscus degeneration, 24 meniscus tears,10 partial ACL tears,7 complete ACL tears and 14 cartilage changes.In cases of synovial hypertrophy and pigmented villous-nodular synovitis, diagnosis was compatible with MRI. The diagnosis is confirmed by in 14 of 16 meniscal degenerations detected by MRI. Two cases were normal. In the arthroscopic evaluation of 28 meniscus that found to have tear by MRI, meniscal tear were confirmed in 24 cases and one case was normal and 3 were degenerated. Posterior cruciate ligament tear was not observed. Arthroscopy confirmed chondromalacia in 10 of 14 cases in which MR revealed chondromalacia. In 4 of the cases grade 1 and grade 2 cartilage lesions were detected on-

Figure 3. Grade-3 transverse tear is seen at posterior horn of medial meniscus.

Figure 4. Grade-4 vertical and transverse tears are seen at posterior horn of medial meniscus on T1-weighted sagittal image.

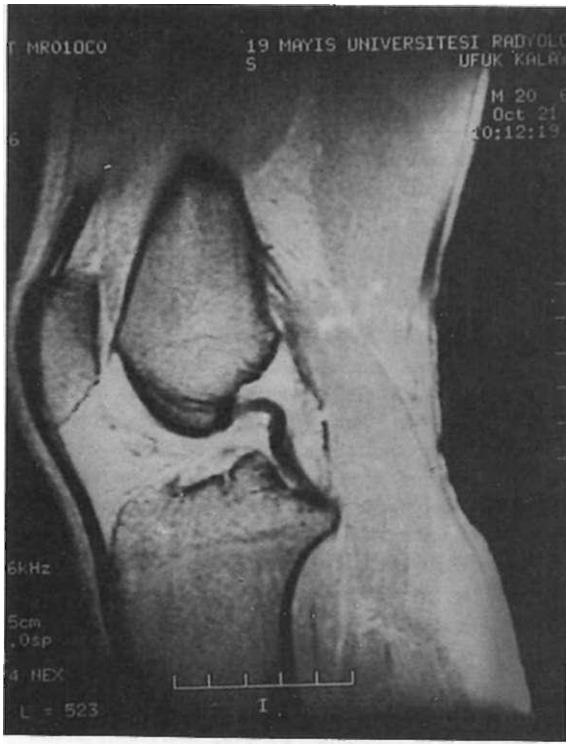

Figure 5. Buckling of posterior cruciate ligament secondary to the tear at anterior cruciate ligament is seen on T2-weighted sagittal image.

Figure 6. Low signal intensity is seen at synovial surfaces of knee joint on T1-weighted sagittal image (pigmented villonodular synovitis).

Table 3. Distribution of meniscal lesions on MRI

	MEDIAL MENISCUS		LATERAL MENISCUS	
	Anterior-Horn	Posterior-Horn	Anterior-Horn	Posterior-Horn
Grade-1	-	2	-	2
Grade-2	-	8	2	2
Grade-3	1	10	ş	6
Grade-4	1	6	1	2

ly by arthroscopy. Grade 1 and 2 cartilage changes were detected in 8 cases and grade 3 and 4 cartilage changes in 6 cases with arthroscopy. Arthroscopy confirmed MRI findings in 86% of cases in which meniscal lesion was detected and in 91% of cases in which anterior cruciate ligament tear was detected. MRI diagnosis was confirmed in only 71% of cartilage lesions detected by arthroscopy.

DISCUSSION

MRI is a highly accurate technique in detecting meniscal lesions and this accuracy rate was 86% in our study. This ratio is very similar to those of Mandelbaum et al. (3). The highest accuracy rates for meniscal lesions were between %90-95 by arthroscopy (4-5). It is suggested that the reason of false positive and false negative meniscal lesion diagnosis was related diagnostic errors in MRI as well as faults in arthroscopic evaluation (6-7). Lesions were most commonly encountered in the posterior horn (86%), which is consistent with literature. Grade 1 and 2 meniscal degenerations and tears in posteroinferior localisation of meniscal lesions detected by MRI may not be seen in arthroscopies in which anterior approach is used (1-8). For this reason, comparison of MRI and arthroscopy in meniscal degenerations and acceptance of MRI findings as false positive is controversal. In our study, false diagnosis in detecting meniscus degeneration by MRI was in 2 posterior horn lesion. This false positive ratio was thought to be due to disability of arthroscopy to reveal grade 1 and 2 degenerations while MRI can reveal easily.

MRI findings of ACL tears are distruption of anatomic integrity of the ligament.irregularity in ligament borders and increased signal inside the ligament.Tears are typically in the middle of the tendon or at the site of femoral attachment. Secondary findings of ACL tears are anterior displacement of tibia and anterior folding of PCL due to instability (figure 5). In literature it is suggested that 95-100% correct diagnosis could be made by MRI in ACL and PCL tears (9-12). In the present study group there is a correlation between arthroscopic and MRI findings of cruciate ligaments.In previous studies it is suggested that complete imaging of ACL was difficult in 5-10% of cases in sagittal planes because of its oblique course (11-12). In addition it is reported that partial volume effect was frequent in the proximal part of ACL and in close proximity of lateral femoral condyle,and in ACL lesions positive correct ratio would be increased by using coronal and axial scans in addition to sagittal scans or by obtaining 3D GRE sequence (13). We suggest that accuracy rate was increased by obtaining additional oblique sagittal FSE T2 scans during MR examination. Although isolated tears are present, in about 70% of cases ACL tears are present in association with meniscal lesions (7). In this study it is found that grade 2 and 3 medial meniscal degeneration accompanied ACL tears in 11 cases. PCL tears were rarely compared to ACL tears (10) and no PCL tear was found in the present study.

The sensitivity and specificity of MRI in detecting cartilage lesions were reported as 31 %, 50% and 100% according to different squences and studies (14-16). In addition, Reicht et al. suggest applying fat suppressions GRE squences of MRI to detect cartilage lesions and report that correct diagnosis ratio was 95% on cadaver studies (17). The accuracy of MRI to detect cartilage changes was 71% in this study which used GRE T1 and T2 squences, .and MRI revealed high staged cartilage lesions better than low stage lesions. The sensitivity of MRI was found to be low in detecting grade 1 and 2 cartilage lesions by using routine GRE T1 and T2 squences.

In. conclusion, the evaluation of grade 1 and 2 meniscal degenerations and accuracy in MRI is higher than arthroscopy. We can recommend that fat suppression GRE sequences need to be added to routine squences in evaluating low grade cartilage lesions where accuracy of MRI was inferior. Oblique FSE T2 scans increase accuracy in ACL tears. In evaluation of knee joint pathologies MRI is a noninvasive basic diagnostic method that can reliably show meniscus, cruciate ligament, soft tissue, cartilage and bone lesions.

Diz eklemi patolojilerinde MRG ve artroskopi bulgularının karşılaştırılması

Diz eklemi şikayeti ile manyetik rezonans görüntüleme (MRG) yapılan 40 olguya artroskopi yapıldı. Hiyalen kıkırdak, sinovyal lezyonlar, çapraz bağ ile menisküs yırtığı tanıları her iki yöntemde karşılaştırıldı. MRG'de menisküs lezyonu saptanan olguların %86'sında, ön çapraz bağ yırtığı saptanan olguların • %91 'inde artroskopi MR sonuçlarını doğruladı. Kıkırdak lezyonu saptanan olguların %71'inde MRG tanısı artroskopi ile doğrulandı. MRG çapraz bağ ve menisküs lezyonlarının tanımlanmasında güvenilir bir tanı yöntemi olup, çapraz bağların değerlendirilmesinde oblik-sagittal fast spin eko-T2 kesitler doğru tanı oranını arttırmaktadır. Özellikle erken evre kondromalazinin değerlendirilmesinde ise tanı değeri daha düşüktür. [T Klin Araştırma 1997; 15(1):21-25]

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