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Knee joint examinations by magnetic resonance imaging: The correlation of pathology, age, and sex

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Abstract

Aims: The aim of our study was to investigate the incidence and coexistence of multiple knee joint pathologies and the distribution of knee joint pathologies according to age and sex. **Patients and Methods:** A retrospective analysis was performed using the clinical data of patients evaluated with magnetic resonance imaging (MRI) of the knee joint. Data from 308 patients examined between August 2002 and July 2003 were included into this study. A Pearson correlation analysis was performed to examine the relationship between the pathological findings and the age and sex of the patients. **Results:** The ages of the patients ranged between 1 and 74 years (mean: 43.3 years). Age was significantly correlated with meniscal degeneration and tears, medial collateral ligament degeneration, parameniscal cyst, and chondromalacia patellae. There was a significant correlation between male gender and anterior cruciate ligament injury. Meniscal injury was significantly correlated with bursitis, as well as medial collateral ligament injury. Bone bruise was significantly correlated with medial collateral ligament injury, lateral collateral ligament injury, Baker's cyst, and anterior cruciate ligament injury. Chondromalacia patellae was significantly correlated with anterior cruciate ligament injury, patellae alta, and osteochondral lesion. Bursitis (in 53.2% of the patients) followed by grade-II meniscal degeneration (in 43% of the patients) were the most common knee pathologies observed by MRI. **Conclusions:** MRI findings of select knee pathologies are significantly correlated with each other and the age and sex of the patient.

Keywords: Knee joint pathologies, Magnetic resonance imaging, anterior cruciate ligament, posterior cruciate ligament, meniscus, Baker cyst, medial collateral ligament, lateral collateral ligament, joint effusion, osteochondral lesion.

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Introduction

Arthroscopy is considered "the gold standard" for the diagnosis of traumatic intraarticular knee lesions. However, arthroscopy is an invasive procedure that requires hospitalization and anesthesia, thus presenting all the potential complications of a surgical procedure. Since its introduction in the 1980s, magnetic resonance imaging (MRI) has gained in popularity as a diagnostic tool for musculoskeletal disorders. Many surgeons believe that MRI is an accurate, non-invasive method to diagnose knee injuries, and gives sufficient information to support decisions for conservative treatment and save a patient from unnecessary arthroscopy [1].

MRI is the most commonly used imaging modality in the evaluation of the knee joint, and has an acceptable accuracy in the detection of meniscal and anterior cruciate ligament (ACL) injury [2-7]. On the other hand, in case of coexistence of more than one knee pathology, decreased rates of accuracy of MRI have been reported [8-11]. The aim of our study was to investigate the incidence and coexistence of knee joint pathologies and their correlation with the age and sex of the patients.

Patients and Methods

This study was approved by local ethics committee of Marmara University. The data from a total of 308 patients (160 males, 148 females) who were evaluated with MRI examination of the knee joint using a 1.5 Tesla magnetic resonance unit (GE, Milwaukee, USA) between August 2002 and July 2003 were included in this retrospective study. The ages of the patients ranged between 1 and 74 years (mean = 43.3 years). The pathologic findings on the MRI examinations such as injuries of the menisci, medial and lateral collateral ligaments, and anterior and posterior cruciate ligaments, as well as parameniscal cyst, Baker cyst, osteochondral lesion, chondromalacia patellae, patellae alta, bone bruise, bursitis, and tumor were noted in all patients.

A Pearson correlation analysis was performed to examine the relationship between the pathological findings and patient's age and sex. The statistical analysis was performed with the SPSS computer program version 10.0. A *P* value <0.05 was regarded as significant.

Results

The total number of cases and types of knee joint pathologies found by MRI are shown in Table 1.

Table 1 Total number of cases and type of knee joint pathologies found by MRI

	Meniscal or ligament involvement			
	Grade-I degeneration[a]	Grade-II degeneration[b]	Tear	Total
Medial meniscus anterior horn	72	70	2	144
Medial meniscus posterior horn	16	150	94	260
Lateral meniscus anterior horn	58	122	16	196
Lateral meniscus posterior horn	40	170	32	242
Anterior cruciate ligament	0	10	12	22
Medial collateral ligament	14	6	2	22
Lateral collateral ligament	5	2	0	7
Other pathology				
Bursitis				164
Baker cyst				62
Osteochondral lesion				43
Bone-bruise				42
Chondromalacia patellae				17
Parameniscal cyst				12
Patellae alta				9
Tumor				3

[a]Grade I degeneration of the meniscus = one or several punctate signal intensities not contiguous with an articular surface; Grade I degeneration of the medial/lateral collateral ligament = subcutaneous edem; [b]Grade II degeneration of the meniscus = a linear intra-meniscal signal intensity without articular surface extension; Grade II degeneration of the medial/lateral collateral ligament = morphologic disruption and/or internal high signal intensity and/or fluid in the medial/lateral collateral ligament bursa; [c]Meniscal tear = signal intensity extended to at least one articular surface; Medial/lateral collateral ligament tear = discontinuity of the ligament.

Age was significantly correlated with meniscus degeneration/tear (*P*<0.01), medial collateral ligament (MCL) degeneration *(P*<0.01), parameniscal cyst (*P*<0.05), and chondromalacia patellae (*P*<0.01).

There was a significant correlation between male gender and ACL injury (*P*<0.01). Meniscal injury was significantly correlated with bursitis (*P*<0.01), as well as MCL injury (*P*<0.05).

Bone bruise was significantly correlated with MCL injury (*P*<0.01), lateral collateral ligament injury (*P*<0.05), Baker cyst (*P*<0.05), and ACL injury (*P*<0.01).

Chondromalacia patellae was significantly correlated with ACL injury (*P*<0.01), patellae alta (*P*<0.01), and osteochondral lesion (*P*<0.05).

Bursitis (in 53.2% of the patients), followed by grade-II meniscal degeneration (in 43% of the patients) were the most common knee pathologies observed on MRI examinations (Tables 2, 3, and 4).

Table 2 The percentages of meniscal pathologies

	Pathology n (%)			
Location	Normal	Grade-I degeneration[a]	Grade-II degeneration[b]	Tear[c]
Medial meniscus anterior horn	162 (52.9%)	72 (23.5%)	70 (22.9%)	2 (0.7%)
Medial meniscus posterior horn	24 (8.5%)	16 (5.6%)	150 (52.8%)	94 (33.1%)
Lateral meniscus anterior horn	112 (36.4%)	58 (18.8%)	122 (39.6%)	16 (5.2%)
Lateral meniscus posterior horn	58 (19.3%)	40 (13.3%)	170 (56.7%)	32 (10.7%)

n = number of cases; % = percent of total; [a]Grade I degeneration of the meniscus = one or several punctate signal intensities not contiguous with an articular surface; [b]Grade II degeneration of the meniscus = a linear intra-meniscal signal intensity without articular surface extension; [c]Meniscal tear = signal intensity extended to at least one articular surface.

Table 3 The incidence of anterior cruciate ligament injury and its distribution based on sex

Anterior cruciate ligament	Female	Male	Total
	n (%)		
Normal	192 (62.3%)	94 (30.5%)	286 (92.9%)
Grade-2 injury[a]	4 (1.3%)	6 (1.9%)	10 (3.2%)
Tear[b]	0	12 (3.9%)	12 (3.9%)

n = number of cases; % = percent of total; [a]Grade II injury of the anterior cruciate ligament = intra-ligamentous signal intensity corresponding to

partial tear, without discontinuity of the ligament; [b]Anterior cruciate ligament tear = discontinuity of the ligament.

Table 4 The incidence of knee pathologies and their distribution based on sex

	Female	Male	Total
Baker cyst	44 (22.4%)	18 (16.1%)	62 (20.1%)
Bone-bruise	26 (8.4%)	16 (5.2%)	42 (13.6%)
Bursitis	92 (29.9%)	72 (23.4%)	164 (53.2%)
Tumor	3 (1.9%)	0	3 (1.9%)

Discussion

Simultaneous injury to several supporting structures is relatively common in the knee. For example, in a study by Duncan et al. [12], of 317 skiers with ACL tears, 122 (38%) had concomitant MCL injuries, while 50% of the patients also had meniscal tears.

Meniscal tears in knees with ligament injuries deserve special attention because the combination of meniscal and ligament tears frequently changes management and prognosis [8]. Posterior and peripheral lateral meniscal tears are far more common in knees with an ACL tear. Physicians interpreting MRI studies should be aware of these associations. When an ACL tear is detected on the MRI study, special attention should be paid to the posterior horn of the lateral meniscus, where a subtle peripheral tear may be present [10]. In contrast, in our study, meniscal injury was significantly correlated with bursitis ($P<.01$), as well as MCL injury ($P<.05$), while no significant correlation was observed with ACL tear.

In a study by Miller et al. [13], no association was found between Baker cyst and ACL tear or MCL injury, while there were significant associations with effusion, meniscal tear, and degenerative arthropathy. In concordance with Miller et al., no association was found between Baker cyst and ACL tear or MCL injury in our study. However, we did not find a significant correlation between Baker cyst and effusion.

In our study, age was significantly correlated only with meniscus degeneration/tear, MCL degeneration, parameniscal cyst, and chondromalacia patellae. There was a significant correlation between male gender and ACL injury. Meniscal injury was significantly correlated with bursitis, as well as MCL injury. Bone bruise was significantly correlated with MCL injury, lateral collateral ligament injury, Baker cyst, and ACL injury. Chondromalacia patellae was significantly correlated with ACL injury, patellae alta, and osteochondral lesion. Bursitis and grade-II meniscal degeneration were the most common knee pathologies observed on MRI examinations.

Conclusion

Certain knee pathologies are significantly correlated with each other, and the age and sex of the patient. In cases of knee trauma, one should be careful to look for more than one pathology of the knee joint, owing to the significant coexistence of these pathologies.

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