Discrepancy of Magnetic Resonance Imaging Findings, Symptom Severity and Functional Status in Knee Osteoarthritis

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ABSTRACT

Objective: *In clinical practice, patients with discrepancy of radiological findings and symptom severity are frequent. Aim of this study was to investigate the possible discrepancy of magnetic resonance imaging findings, and symptom severity and functional status of patients with knee osteoarthritis.*

Material and Methods: *40 patients were included in the study. Patients were selected by searching the archives of the 2015, and by excluding the patients who didn't meet the criteria for our study. Patients without the diagnosis of knee osteoarthritis, who didn't have written consents for using their clinical data, who didn't have knee magnetic resonance images, who didn't fill WOMAC and SF-36 questionnaires, and who didn't have visual analog scale result for pain, were excluded. For evaluating WORMS, images are scored for 14 independent articular features. Correlations among the variables were analyzed.*

Results: *Mean age of the study group was 57.35±5.88 years, and mean BMI was 28.68±3.54. There was no difference between males and females according to mean age, and mean BMI (p>0.05). According to the other variables there was no difference between males and females, except the total and subscale scores of WORMS. Total and subscale scores of WORMS were significantly higher in females than males (p<0.05). When the correlations among the variables were analyzed there was significant and positive correlation between age, and BMI and total scores of WORMS (p<0.05). There was no significant correlation between the parameters showing the symptom severity, and WORMS (p>0.05).*

Conclusion: *Discrepancy of magnetic resonance imaging findings, and symptom severity and functional status is more frequent than the expected. Some factors like thigh muscle strength of the patients, or mental and the physical status, and pain threshold may affect the level of impairment of health or the aspect of the patient to the health, individually which may lead to discrepancy of radiological findings and symptom severity.*

Keywords: *functional status, knee osteoarthritis, magnetic resonance imaging, symptom severity*

ÖZ

Diz Osteoartritinde Manyetik Rezonans Görüntüleme Bulguları, Semptom Şiddeti ve Fonksiyonel Durum Arasındaki Uyumsuzluk

Amaç: *Klinik pratikte radyolojik bulgular ile semptom şiddeti arasında uyumsuzluk olan hastalar çok sıktır. Bu çalışmanın amacı diz osteoartriti olan hastalarda manyetik rezonans görüntüleme bulguları ile semptom şiddeti ve fonksiyonel durum arasındaki olası uyumsuzluğu incelemekti.*

Gereç ve Yöntemler: *Çalışmaya 40 hasta dâhil edildi. Hastalar 2015 yılının arşivi taranarak ve çalışmanın kriterlerini karşılamayan hastalar dışlanarak seçildi. Diz osteoartriti tanısı olmayan hastalar, klinik verilerinin kullanımı için yazılı onamı olmayan hastalar, diz manyetik rezonans görüntüleri olmayan hastalar, WOMAC ve SF-36 anketlerini doldurmamış olan hastalar ve ağrı için görsel analog skala sonucu olmayan hastalar dışlandı. WORMS değerlendirmesi için görüntüler 14 bağımsız eklem karakteristiği için puanlandı. Değişkenler arasındaki korelasyonlar analiz edildi.*

Bulgular: *Çalışma grubunun ortalama yaşı 57,35±5,88 yıl ve ortalama VKİ değeri 28,68±3,54'tü. Erkekler ve kadınlar arasında ortalama yaş ve ortalama VKİ açısından fark yoktu (p>0,05). WORMS toplam ve alt skala puanları hariç diğer değişkenler için erkeler ve kadınlar arasında fark yoktu. WORMS toplam ve alt skala puanları kadınlarda erkeklere göre anlamlı olarak daha yüksekti (p<0,05). Değişkenler arasındaki korelasyonlar analiz edildiğinde yaş ve VKİ ve toplam WORMS puanı arasında anlamlı ve pozitif korelasyon vardı (p<0,05). Semptom şiddetini gösteren parametreler ile WORMS arasında anlamlı korelasyon yoktu (p>0,05).*

Sonuç: *Manyetik rezonans görüntüleme bulguları ile semptom şiddeti ve fonksiyonel durum arasındaki uyumsuzluk beklenenden daha fazladır. Hastaların bacak kas kuvveti veya psikolojik ve fiziksel durum ve ağrı eşiği gibi bazı faktörler sağlığın bozulma derecesini veya hastanın sağlığa bakış açısını, kişisel olarak radyolojik bulgular ve semptom şiddeti arasında uyumsuzluğa neden olabilecek şekilde etkileyebilir.*

Anahtar kelimeler: *diz osteoartriti, fonksiyonel durum, manyetik rezonans görüntüleme, semptom şiddeti*

INTRODUCTION

Studies have shown that 10% of the population older than 55 years old own knee pain [1]. A frequent cause of knee pain, osteoarthritis (OA) increases steadily with age, affects 12.1% of the population from 25 to 74 years old, and it is the primary cause of physical disability after 65 years old [1]. Structural changes include articular cartilage damage, osteophyte formation and subchondral bone changes [2].

There are radiological classification methods for knee OA measuring the stage by roentgenogram (Kellgren-Lawrence), [3] or magnetic resonance imaging (Whole-organ Magnetic Resonance Imaging Score [WORMS]) [4]. Magnetic resonance imaging (MRI) provides a sensitive tool for examining all the structures involved in the knee OA process. For evaluating the symptom severity or functional status specific (Western Ontario And McMaster Universities [WOMAC]), [5] or generic instruments (Short Form-36 [SF-36]) [6] are widely used.

Often we are meeting patients with discrepancy of radiological findings and symptom severity that can surprise us in our clinical practice [7,8]. Aim of this study was to investigate the possible discrepancy of MRI findings, and symptom severity and functional status of patients with knee OA.

MATERIALS and METHODS

This study was designed retrospectively. Forty patients were included in the study. Patients were selected by searching the archives of the 2015, and by excluding the patients who didn't meet the criteria for our study. Patients without the diagnosis of knee OA, who didn't have written consents for using their clinical data, who didn't have knee MRI, who didn't fill WOMAC and SF-36 questionnaires, and who didn't have visual analog scale (VAS) result for pain, were excluded.

For evaluating WORMS, images (1.5 Tesla, axial T1-weighted, coronal T1-weighted, sagittal T1-weighted, sagittal T2-weighted) are scored for 14 independent articular features as stated below [4]:

Cartilage signal and morphology (0-6 points), subar-ticular bone marrow abnormality (0-3 points), cysts (0-3 points) and bone attrition (0-3 points), marginal osteophytes (0-7 points), medial and lateral meniscal destruction (0-6 points), anterior and posterior cruciate ligament (0-1 point), medial and lateral collateral ligament integrity (0-1 point), synovitis (0-3 points), loose bodies (0-3 points) and periarticular cysts/bursae (0-3 points). These 14 features are evaluated in 15 different regions divided by anatomical landmarks. Patella is divided into medial and lateral regions, femur and tibia are divided into medial and lateral regions. Also portion under the tibial eminences considered as another region. Femoral and tibial surfaces are divided into anterior, central and posterior regions for each medial and lateral region. For each articular compartments; patellofemoral joint (PFJ), medial femorotibial joint (MFTJ) and lateral femorotibial joint (LFTJ) scores were calculated (Maximum attainable scores are 88, 110 and 110, respectively). Also, a total score for whole knee joint was calculated (Maximum attainable score is 332).

For assessing the severity of pain, VAS (0 to 10) is used, and 10 point indicates the worst pain. Score of WOMAC range from 0 to 100, with lower scores representing better functioning and lower pain [5]. Short Form-36 is a generic outcome measure with eight domains, evaluating physical and mental function with Physical Component Score (PCS) and Mental Component Score (MCS) [6]. A higher score indicates better health. Validity of the Turkish version of SF-36 was studied and was found valid [9].

Statistical analysis

In this study, data analysis was made with SPSS 16 software package. While, in case of dependent variables, and not providing assumption of normality Wilcoxon signed test was used, in case of dependent variables and providing assumption of normality dependent t test was used. According to the assumption of normality, for assessing the correlations Pearson Correlation, and Spearman's Correlation test were used.

RESULTS

Mean age of the study group was 57,35±5,88 years, and mean body mass index (BMI) was 28,68±3,54.

There was no difference between males and females according to mean age (p=0,131), and mean BMI (p=0,180). According to the other variables there was no difference between males and females, except the total and subscale scores (MFTJ, LFTJ, PFJ) of WORMS. Total and subscale scores (MFTJ, LFTJ, PFJ) of WORMS were significantly higher in females

Table 1. Mean±Standard Deviation of variables for male and female patients, and differences between groups according to gender.

	Males N=14	Females N=26	P value
Age	55,43±5,854	58,38±5,749	0,131
BMI	27,64±3,153	29,23±3,680	0,180
VAS	6,36±0,427	6,50±0,209	0,737
WOMAC	44,50±13,541	42,58±9,803	0,608
PCS	30,21±8,789	31,07±6,644	0,729
MCS	38,35±8,399	43,34±9,511	0,108
MFTJ	12,57±4,553	18,73±4,904	0,000*
LFTJ	6,93±4,393	12,08±4,078	0,001*
PFJ	10,14±4,881	14,65±4,507	0,006*
Total	29,64±13,653	44,69±12,444	0,001*

*Significance level p<0,05, BMI: Body mass index, VAS: Visual analog scale for pain, WOMAC: Western Ontario And McMaster Universities score, PCS: Physical component score of Short Form 36, MCS: Mental component score of Short Form 36, MFTJ: Medial femorotibial joint score of Whole-Organ Magnetic Resonance Imaging score, LFTJ: Lateral femorotibial joint score of Whole-Organ Magnetic Resonance Imaging Score, PFJ: Patellofemoral joint score of Whole-Organ Magnetic Resonance Imaging Score, Total: Total joint score of Whole-Organ Magnetic Resonance Imaging Score.

than males (p=0,001, p=0,000, p=0,001, and p=0,006, respectively). Means of VAS, WOMAC, PCS, MCS, MFTJ, LFTJ, PFJ, and Total WORMS scores for male and female patients, and differences between groups according to the gender are given in Table 1.

When the correlations among the variables for whole patients (n=40) were analyzed there was significant and positive correlation between age and BMI, MFTJ, PFJ and total scores of WORMS (p values were 0,001; 0,043; 0,023; and 0,039, respectively). Body mass index was significantly and positively correlated with MFTJ, LFTJ, PFJ, and total scores of WORMS (p values were 0, 000; 0, 001; 0, 001; and 0, 001, respectively). Visual analog scale for pain was significantly and positively correlated with WOMAC score and negatively with PCS (p=0,000 for both), and WOMAC score was significantly and negatively correlated with PCS, too (p=0,000). There was negative and significant correlation between PCS and MCS (p=0,024). There was no significant correlation between the parameters showing the symptom severity (WOMAC, VAS, PCS, MCS), and WORMS. Correlations among the subscale (MFTJ, LFTJ, PFJ) and total scores of WORMS were positive and significant (p=0,000 for each correlation). Correlations among the variables for whole patients (n=40) are shown in Table 2.

Table 2. Correlations among the variables (n=40).

	AGE	BMI	VAS	WOMAC	PCS	MCS	MFTJ	LFTJ	PFJ
BMI	,520** ,001	1							
VAS	,123 ,448	,091 ,577	1						
WOMAC	,092 ,571	-,063 ,700	,757** ,000	1					
PCS	,005 ,976	,000 ,996	-,564** ,000	-,586** ,000	1				
MCS	,011 ,944	,247 ,124	-,093 ,567	-,039 ,810	-,356* ,024	1			
MFTJ	,322* ,043	,530** ,000	-,297 ,063	-,223 ,167	,132 ,418	,186 ,250	1		
LFTJ	,273 ,089	,506** ,001	-,223 ,166	-,139 ,394	,144 ,376	,212 ,188	,909** ,000	1	
PFJ	,360* ,023	,507** ,001	-,310 ,051	-,220 ,172	,200 ,217	,146 ,370	,942** ,000	,908** ,000	1
Total	,328* ,039	,497** ,001	-,268 ,095	-,193 ,232	,168 ,300	,145 ,372	,961** ,000	,964** ,000	,964** ,000

*Correlation is significant at the 0,05 level, ** Correlation is significant at the 0,01 level, BMI: Body mass index, VAS: Visual analog scale for pain, WOMAC: Western Ontario And McMaster Universities score, PCS: Physical component score of Short Form 36, MCS: Mental component score of Short Form 36, MFTJ: Medial femorotibial joint score of Whole-Organ Magnetic Resonance Imaging score, LFTJ: Lateral femorotibial joint score of Whole-Organ Magnetic Resonance Imaging Score, PFJ: Patellofemoral joint score of Whole-Organ Magnetic Resonance Imaging Score, Total: Total joint score of Whole-Organ Magnetic Resonance Imaging Score.

DISCUSSION

Rather than investigating the overall articular features separately, only taking into account the total and sub-scale scores of WORMS was the main difference of our study from the previous works. In generalizing these results to other populations, one should take into account the selection bias, the lack of a control group and the small number of subjects. Osteoarthritis is the primary cause of physical disability after 65 years old, 1 however in our study; despite the mean age was less than 65 years, mean of the VAS for pain was over 6, WOMAC score was over 40, and PCS was about 30 which can show the functional impairment. Absence of significant correlation between MRI findings and symptom severity and functional status showed the discrepancy which we frequently meet in clinical practice.

In a study conducted among 27 patients to assess the correlation of synovitis and knee OA, similar to our study researchers couldn't show a significant correlation between the MRI findings and WOMAC score and VAS for pain, except the correlation between synovitis grade and WOMAC score [10]. However, Lo et al. [11] reported a strong association between knee pain and bone marrow lesions and joint effusion. In a study conducted by Sowers et al. it is reported that finding on MRI of subchondral bone marrow edema could not satisfactorily explain the presence or absence of knee pain, but women with bone marrow edema and full-thickness articular cartilage defects accompanied by adjacent subchondral cortical bone defects were significantly more likely to have painful knee OA than painless one [7]. Cartilage does not have pain fibers, on the other hand, bone and bone marrow are rich in nociceptive fibers, suggesting that bone could contribute to the pain profile [7]. In painful osseous conditions, it is hypothesized that bone marrow edema represents the accumulation of extracellular fluid in the marrow and leads to increased intraosseous pressure [12], that could affect the increase of signaling from nociceptors, and in some cases mechanically reducing intraosseous pressure leads pain relief [13].

It is previously emphasized that bone marrow edema, synovitis and ligament injuries are more commonly associated with painful knee OA than the cartilage loss and meniscal lesions [14]. Findings of Zarins et al. [15] indicated that WOMAC scores were more strongly correlated with the meniscus than cartilage. These findings were explained by the fact that articular cartilage is avascular and aneural while the outer one-third of the meniscus is vascularized, contains nerves, and nociceptive fibers [16]. In a study which investigated the association of ligament injury with pain severity anterior cruciate ligament tear was found tended to have greater knee pain at baseline, over 30 months follow-up, and there was no differences in pain severity or degree of function between those who did or did not have a complete anterior cruciate ligament tear [17].

Illingworth et al. [18] found the Womac and Knee Injury Osteoarthritis Outcomes scores as poor indicators for cartilage loss. However, Torres et al. [19] found the severity of knee pain associated with meniscal tears additionally to subarticular bone attrition, bone marrow lesions and synovitis. Although there are studies which found association between osteophytosis and knee pain, [20,21] Sengupta et al. [22] did not find association between high-signal osteophytes and the presence of pain, pain severity or the self-reported location of pain.

Although there are studies stating the relationship between knee pain and psychosocial factors, [23-26] in our study there was no significant correlation between mental component of SF-36 and pain or scores showing the functional status of the patients like WOMAC and physical component of SF-36. Findings of a study conducted among 3809 participants suggested that the reduction in thigh muscle strength in knee OA could be associated with pain but not to the radiological findings [27].

As expected, there was significant correlation between BMI and total and subgroup scores of WORMS because we know that the increasing weight is leading to articular damage, [28] but we found no significant correlation between BMI and symptom severity and functional status.

There is strong evidence that age, ethnicity, BMI, comorbidity count, MRI-detected infrapatellar synovitis, joint effusion and both radiographic and clinical baseline OA severity are predictive for clinical knee

OA progression [29]. But observational studies on disease progression have various biases that may account for discrepancies found between risk factors for incidence and progression [30]. Also we should keep in mind the fluctuation of pain and physical limitations due to OA over time [31].

CONCLUSION

Discrepancy of MRI findings, and symptom severity and functional status is more frequent than the expected. Association between the causes of the knee pain and pain severity remain unclear, and needs to be investigated more. Some factors like thigh muscle strength of the patients, or mental and the physical status, and pain threshold may affect the level of impairment of health or the aspect of the patient to the health, individually which may lead to discrepancy of radiological findings and symptom severity.

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