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Original Research Article

Relationship between pain, function and radiological findings in osteoarthritis of the knee

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ABSTRACT

Background: Osteoarthritis (OA) is the most common degenerative joint disorder and a major public health problem throughout the world. Knees are the most commonly affected joints. There is ongoing debate on whether an association exists between radiographic and clinical features of OA. Purpose of this study was found out the relationship between pain, function and radiographic findings in OA.
Methods: At first subjects who attend OPD and IPD of CMCH with knee pain and fulfill ACR 1991 OA classification criteria, and also fulfilling preset inclusion and exclusion criteria, was interviewed and send to department of radiology to have three views of radiograph of index knee that is skyline, Rosenberg and lateral and to measure radiologic parameters across all three compartments of knee joint along with alignment.
Results: In this study, out of 96 patients, mean±SD age of the patients was 59.59375±8 years, 55.2% was female and 47.1% had primary level of education, mostly female, urban, and over 50 years. All met ACR criteria with predominant right knee involvement and a mean disease duration of 6.2 years. Radiographic changes were common across compartments, mainly Kellgren-Lawrence (K-L) grades II-III. WOMAC pain, stiffness, and disability correlated significantly with disease severity, duration, age, and gender.
Conclusions: Radiographic findings were associated with pain in activity and functional status based on physical performance. Disability scores were associated with pain and stiffness. WOMAC index was statistically significant between KL grading. Varus angle and male gender were for risk of having predominantly OA.

Keywords: Osteoarthritis, Knee joint, Radiographic findings, WOMAC index, Kellgren-Lawrence grading, Subchondral sclerosis

INTRODUCTION

Osteoarthritis (OA) of the knee is a major public health issue.[1] It is the most common disorder of the musculoskeletal system and the leading cause of functional disability in adults. OA is a chronic degenerative disease that affects all structures of a joint. Primary or secondary OA represents a major problem in elderly.[2] The weakening of the metabolic balance between

the synthesis and degradation of cartilage and subchondral bone overcome catabolic over anabolic processes which causes progressive destruction of joint tissue.[3] OA is seen as a disease that affects the entire joint that is bone, cartilage and associated structures. Prevalence of OA increases with age and aging is associated with decreasing physiological functions, thus leading to major health problems. As a larger proportion of the elderly population in developed countries increasingly lives to an extreme old age, OA is in developed countries the leading cause of physical disability in the elderly, but also the fastest growing problem of health and disability.[4] Knee is divided into three major compartments that is medial compartment (the inside part of the knee), lateral compartment (the outside part), patellofemoral compartment (the front of the knee between the kneecap and thighbone).[5] OA is characterized by focal loss of articular cartilage, new bone formation in the area beneath the damaged cartilage resulting as a subchondral bone and developments of bone spurs called osteophytes.[6] Previously it has been shown that varus malalignment of the lower limb increases the risk of progression of OA in the medial compartment of the knee and that an increasing varus angle is associated with more severe progression of medial.[7,8] Similarly, valgus malalignment increases the risk of progression of lateral disease, and an increasing valgus angle is associated with more severe progression of lateral disease. However, acquiring full-length radiographs is not common in the clinical evaluation of patients with early knee OA. Instead, the physician usually obtains only knee radiographs (that is, radiographs that do not include the hip and ankle joints). Despite this common clinical practice, very little has been written about the relationship between local alignment (the distal femoral-proximal tibial angle measured on a short knee radiograph) and observed patterns and severity of OA.[7,9] Many authors have worked out over the matter. However, the previous studies had some limitations including relatively small number of study subjects, 9 and some author analyze only those people with advance knee OA and severe clinical symptom requiring total knee arthroplasty.[7,10] Ahmed et al reported that, the pain and physical function were associated with OA of the knee where the mean physical function score was 45.1±4.2 in patients who had pain score of >10.[1]

However, pain and physical function was not associated with the radiographic findings of the OA of the knee. Radiographic findings were associated with pain in activity and functional status based on physical performance, but not with clinical results based on patient reported outcome measures (PROMs).[11,12]

The purpose of this study was therefore to assess the risk of having compartment-specific knee OA on the basis of these three views along with effect of local alignment on compartmental patterns of knee OA.

Aim of this study is to determine any correlation between pain, disability, and radiographic findings in patients with knee OA.

METHODS

It was a cross-sectional study sample size for this study was 96. department of medicine, Chittagong Medical college hospital and department of radiology and imaging, Chittagong medical college hospital from November 2019 to April 2020. All patients who are attending IPD and OPD of medicine, CMCH.

Inclusion criteria

Patients who were diagnosed as OA of knee and hip and hand on the basis of ACR 1991 OA classification criteria were included in study.

Exclusion criteria

Patients who had other rheumatologic disease like SLE, RA soft tissue rheumatism and other connective tissue disease. Subjects who do not provide written consent to participate and critically ill patients will be excluded.

Procedure of data collection

Initially patients attending OPD and IPD of medicine were encountered with the question, "Have you had any pain in or around knee for at least 1 month at some time during past year?". Those who had responded positively was tested for ACR 1991 criteria for knee OA. Along with radiograph who had fulfilled ACR 1991 criteria for knee OA was selected for the study. Total 96 patients were included following inclusion and exclusion criteria for the study. All patient were thoroughly informed about the objectives and detail procedure of the study. They were interviewed face to face with the prepared questionnaire. After collection of clinical data, patient will be sent to for X-ray of symptomatic knee for 3 different views that is lateral, skyline and Rosenberg to department of radiology. Then measurement of radiological parameters by a questionnaire in different views. Then data will be compiled in common data set.

Data analysis

After data collection analysis was done to detect variation of WOMAC pain scale score among different subjects. Effort was made to show relationship of WOMAC functional score variation with specific radiological changes according to Kellgren-Lawrence (K-L) and Ahlback's grading scale. All statistical analyses were performed using SPSS version 25 (SPSS Inc, Chicago, IL) for Windows. Descriptive statistics were used to describe demographic characteristics. Spearman's rank correlation coefficients were calculated to determine the relationships between clinical parameters and radiographic grades in patients with knee OA. Kruskal Wallis test was used to analyze if there were any significant differences in the level of pain, disability and stiffness according to K and L grading scale. In all analyses, $p<0.05$ were considered statistically significant.

Data presentation

Suitable tables were presented the observation and results of the study and statistical analysis. In case of continuous variable mean, range, percentage and standard deviation (SD) was used. In case of categorized variable cross table and composite graph was used.

RESULTS

Table 1 shows that mean±SD age of the patients was 59.59375±8 years, 55.2% was female and 47.1% had primary level of education. Majority (43.8%) were from urban area. Most of the patients (96.9%) were Muslim. monthly family expenditure (taka in thousands) was within 20-50 thousand of 89.1% patients. Among them, 45.8% was smoker and 16.7% was alcoholic.

Table 2 represents that among 96 cases, mean±SD weight was 61±8 kg, height was 4.83±0.41 ft and BMI age was 24.93±2.65 kg/m^2. History of trauma was among 20.8% patients.

Table 3 shows that all the (100%) patients had knee pain+osteophytes on radiographs. Maximum (86.5%) patients were more than 50 years old. Morning stiffness lasting 30 minutes or less was among 88.5% and crepitus on monitor was in 95.8% patients. Right knee was involved in 62.1% patients. Mean±SD duration of disease was 6.1789±3.215 years.

Table 4 shows, detailed radiographic findings of the study subjects, osteophyte (minimal) was found among 3.1% (medial), 1% (lateral) and 3.1% (patellofemoral) patients, osteophyte (definite) was found among 86.5% (medial), 59.4% (lateral) and 89.6% (patellofemoral) patients, cyst was found among 6.2% (medial), 3.1% (lateral) and 6.2% (patellofemoral) patients, subchondral sclerosis was found among 16.7% (medial), 4.1% (lateral) and 22.9% (patellofemoral) patients, joint space narrowing (<3 cm) was found among 66.7% (medial), 58.3% (lateral) and 45.5% (patellofemoral) patients, bony attrition (5-10 mm) was found among 81.8% (medial), 71.4% (lateral) and 90.5% (patellofemoral) patients.

Table 5 shows, 34 (39.1%) patients were in grade III (medial), 23 (63.9%) patients were in grade II (lateral) and 37 (41.6%) patients were in grade III (patellofemoral). Combindly, 77 (36.3%) patients were in both grade II and grade III. According to WOMAC index, mean (±SD) WOMAC A (pain) was 13.04±2.05, WOMAC B (stiffness) was 5.80±0.82 and WOMAC C (function) 80.93±11.47.

Table 6 shows Ahlback's grading of the patients, 22 (40%) patients were in grade I (medial), 4 (50%) patients were in grade IV (lateral) and 21 (36.8%) patients were in grade IV (patellofemoral).

Table 7 shows WOMAC index according to the KL grading. According to p value, mean±SD WOMAC index was highly significant in both WOMAC A and B, with significant in WOMAC C between medial KL grading. Mean±SD WOMAC index was not significant in WOMAC A and B and C between lateral KL grading. Mean±SD WOMAC index was highly significant in both WOMAC A and B, with significant in WOMAC C between patellofemoral KL grading.

Table 1: Socio-demographic characteristics of the patients, (n=96).

Characteristics		N
Age (mean±SD) (in years)		59.59375±8
Sex	Male	43 (44.79%)
	Female	53 (55.2%)
Living status	Urban	42 (43.8%)
	Semi urban	26 (27.1%)
	Rural	28 (29.2%)
Monthly family expenditure (Taka in thousands)	<20	5 (10.9 %)
	20-50	41 (89.1%)
	>50	0 (0.0%)
Education	Primary	40 (47.1%)
	SSC	36 (42.4%)
	HSC	8 (9.4%)
	Graduation	1 (1.2%)
Religion	Islam	93 (96.9%)
	Hindu	3 (3.1%)
Smoking status	Smoker	44 (45.8%)
	Non smoker	52 (54.2%)
Pack per year (mean±SD)		9.2±2
Alcoholic or not	Alcoholic	16 (16.7%)
	Non alcoholic	80 (83.3%)

Table 2: Anthropometric and injury profile of the study subjects, (n=96).

Characteristics		N
Weight (kg)	(Mean±SD)	61±8
Height (ft)	(Mean±SD)	4.83±0.41
BMI (kg/m^2)	(Mean±SD)	24.93±2.65
History of trauma in knee	Absent	76 (79.20%)
	Present	20 (20.80%)

Table 3: ACR classification criteria for OA.

Characteristics		N
Knee pain+osteophytes on radiographs	No	0 (0%)
	Yes	96 (100%)
Patient age older than 50 years	No	13 (13.5%)
	Yes	83 (86.5%)
Morning stiffness lasting 30 mins or less	No	11 (11.5%)
	Yes	85 (88.5%)
Crepitus on monitor	No	4 (4.2%)
	Yes	92 (95.8%)
Involvement of knee site	Right	59 (62.1%)
	Left	25 (26.3%)
	Both	11 (11.6%)
Duration of disease (in years)	(Mean± SD)	6.1789±3.215

Table 4: Detailed radiographic findings in the studied patients.

Radiographic findings	Medial	Lateral	Patellofemoral
Osteophyte (minimal)			
No	93 (96.9%)	95 (99%)	93 (96.9%)
Yes	3 (3.1%)	1 (1%)	3 (3.1%)
Osteophyte (definite)			
No	13 (13.5%)	39 (40.6%)	10 (10.4%)
Yes	83 (86.5%)	57 (59.4%)	86 (89.6%)
Cyst			
No	90 (93.8%)	93 (96.9%)	90 (93.8%)
Yes	6 (6.2%)	3 (3.1%)	6 (6.2%)
Subchondral sclerosis			
No	80 (83.3%)	93 (96.9%)	74 (77.1%)
Yes	16 (16.7%)	3 (4.1%)	22 (22.9%)
Joint space narrowing			
0	0	1 (8.3%)	1 (3%)
<3 cm	22 (66.7%)	7 (58.3%)	15 (45.5%)
Obliteration	11 (33.3%)	4 (33.3%)	17 (51.5%)
Bony attrition			
0-5 mm	2 (9.1%)	2 (28.6%)	0 (0%)
5-10 mm	18 (81.8%)	5 (71.4%)	19 (90.5%)
>10 mm	2 (9.1%)	0 (0%)	2 (9.5%)

Table 5: KL Grading and WOMAC index of the patients.

KL Grading (multi)		N	Percentage (%)
KL grading (medial)	Grade I	3	3.4
	Grade II	30	34.5
	Grade III	34	39.1
	Grade IV	20	23.0
KL grading (lateral)	Grade I	3	8.3
	Grade II	23	63.9
	Grade III	6	16.7
	Grade IV	4	11.1

Continued.

KL Grading (multi)		N	Percentage
KL grading (patellofemoral)	Grade I	4	4.5
	Grade II	24	27.0
	Grade III	37	41.6
	Grade IV	24	27.0
KL grading (combined)			
KL com grading	Grade I	10	4.7
	Grade II	77	36.3
	Grade III	77	36.3
	Grade IV	48	22.6
WOMAC A (pain)	(Mean±SD)		13.04±2.05
WOMAC B (stiffness)	(Mean±SD)		5.80±0.82
WOMAC C (function)	(Mean±SD)		80.93±11.47

Table 6: Ahlback's grading of the patients.

Ahlback's grading (multi)		N	Percentage (%)
Ahlback's grading (medial)	Grade I	22	40
	Grade II	9	16.4
	Grade III	3	5.5
	Grade IV	18	32.7
	Grade V	3	5.5
Ahlback's grading (lateral)	Grade I	1	12.5
	Grade II	2	25
	Grade III	1	12.5
	Grade IV	4	50
	Grade V	0	0
Ahlback's grading (patellofemoral)	Grade I	19	33.3
	Grade II	11	19.3
	Grade III	4	7
	Grade IV	21	36.8
	Grade V	2	3.5

Table 7: WOMAC index according to the KL grading.

Variables	Grade I	Grade II	Grade III	Grade IV	P value
KL grading medial					
WOMAC B (stiffness)	16±0.00	14.433±1.83	12.58±1.73	11.75±1.59	<0.001hs
WOMAC C (function)	7±0.00	6.33±0.84	5.55±0.66	5.25±0.44	<0.001hs
WOMAC A (pain)	102±1.41	85.17±12.44	79.74±9.52	77±10.09	0.007s
KL grading lateral					
WOMAC A (pain)	13.00±2.65	13.04±2.25	12.83±1.83	12.75±2.06	0.956ns
WOMAC B (stiffness)	6.00±1.00	5.83±0.83	5.83±0.75	5.25±0.50	0.556ns
WOMAC C (function)	71.50±3.54	82.55±12.15	83.83±6.91	79.25±4.35	0.296ns
KL grading patellofemoral					
WOMAC A (pain)	14.50±3.00	14.46±1.79	12.73±1.87	11.96±1.60	<0.001hs
WOMAC B (stiffness)	6.50±1.00	6.46±0.78	5.57±.69	5.33±0.56	<0.001hs
WOMAC C (function)	87.67±24.85	87.00±11.01	78.78±10.00	77.75±10.5	0.014s

*hs-highly significant, ns-not significant, s-significant .

DISCUSSION

Knee OA is a degenerative joint disease characterized by functional impairment, pain and decreased quality of life. In the staging of knee OA according to radiological status, radiographic knee OA classification systems such as K and L, Ahlback radiographic classification, knee society radiographic scoring system etc. In this study, patients attending IPD and OPD of medicine was the study population. Total 96 samples were included in the study. In this present study, mean±SD age of the patients was 59.59375±8 years. A recent study by Ahmed et al described the mean age was 55 (54.2±9.5) years with the range from 40 to 85 years.[1] Another recent study conducted by Ozden et al stated that mean age was 61.08±9.27 years (range, 38-81 years).[11] The age of the study participants ranged from 32-95 years in the study

done by Wang et al.[13] Similarity has found regarding the age distribution among the studies. Concerning the residence in present study, majority (43.8%) were from urban area. A study by Ozden et al found that, residence of the inhabitants was from rural area, 45.3% and from urban area, 56.7%.[11] In the present study, regarding religion, most of the patients (96.9%) were Muslim. Monthly family expenditure (taka in thousands) was within 20-50 thousand of 89.1% patients. Among them, 45.8% was smoker and 16.7% was alcoholic. That all the (100%) patients had knee pain and osteophytes on radiographs. Maximum (86.5%) patients were more than 50 years old. Morning stiffness lasting 30 minutes or less was among 88.5% and crepitus on monitor was in 95.8% patients. Right knee was involved in 62.1% patients. A study by Ozden et al revealed that, the number of patients diagnosed with bilateral knee OA was 32 (37.2%).[11] The 77.9% of the patients had the habit of sitting by bending their knees. In 45.3% of the patients, morning stiffness lasted more than 15 min, 15.1% of the patients stated that they were not able to walk more than 200 m. Cubukcu et al found that, seventy-three percent of the patients reported bilateral knee pain.[14] Detailed radiographic findings of the study subjects, osteophyte (minimal) was found among 3.1% (medial), 1% (lateral) and 3.1% (patellofemoral) patients, osteophyte (definite) was found among 86.5% (medial), 59.4% (lateral) and 89.6% (patellofemoral) patients, cyst was found among 6.2% (medial), 3.1% (lateral) and 6.2% (patellofemoral) patients, subchondral sclerosis was found among 16.7% (medial), 4.1% (lateral) and 22.9% (patellofemoral) patients, joint space narrowing (<3 cm) was found among 66.7% (medial), 58.3% (lateral) and 45.5% (patellofemoral) patients, bony attrition (5-10 mm) was found among 81.8% (medial), 71.4% (lateral) and 90.5% (patellofemoral) patients. Regarding KL grading and WOMAC index of the patients. It shows that 34 (39.1%) patients were in grade III (medial), 23 (63.9%) patients were in grade II (lateral) and 37 (41.6%) patients were in grade III (patellofemoral). Combindly, 77 (36.3%) patients were in both grade II and grade III. In their study report by Ahmed et al found that, the majority (45.6%) of the study populations were having the Kellgren-Lawrence radiographic features of grade 2, 25 (27.8%) were in grade 1, 20 (22.2%) were in grade 3 and 4 (4.4%) had features of grade 4.[1] Another study by Ozden et al reported that 25.6% of the patients are at stage 4 according to the K and L. Mahran et al found about 84 (33.60%) patients were from grade 3.[11,15] According to WOMAC index, mean (±SD) WOMAC A (pain) was 13.04±2.05, WOMAC B (stiffness) was 5.80±.82 and WOMAC C (function) 80.93±11.47. A recent study by Ozden et al reported, the mean±SD WOMAC (pain) was 9.09±2.45 (5-15), WOMAC (stiffness) was 2.40±1.61 (0-6) and WOMAC (physical functions) was 37.73±9.29 (20-58).[11] Another study by Mahran et al stated that the mean±SD WOMAC (pain) was 10.81±2.27 (1-19), WOMAC (stiffness score) was 2.18±2.18 (0-8) and WOMAC (physical function) was 23.28±13.49 (0-62).[15] Represents Ahlbach grading of the patients, 22 (40%) patients were in grade I (medial), 4 (50%) patients were in grade IV (lateral) and 21 (36.8%) patients were in grade IV (patellofemoral). WOMAC index according to the KL grading. According to p value, mean± SD WOMAC index was highly significant in both WOMAC A and B, with significant in WOMAC C between medial KL grading. Mean±SD WOMAC index was not significant in WOMAC A and B and C between lateral KL grading. Mean±SD WOMAC index was highly significant in both WOMAC A and B, with significant in WOMAC C between patellofemoral KL grading. Ozden et al showed, K and L and WOMAC score were positively correlated ($p<0.05$).[11] Present study shows, the risk of having predominantly medial or predominantly lateral OA to clinical parameters. It showed that, varus angle and male gender in case of univariate analysis, and male gender in multivariate analysis showed statistical significance for risk of having predominantly medial OA according to p value. Male gender showed statistical significance for risk of having predominantly lateral OA according to p value in both univariate and multivariate analysis.

CONCLUSION

Radiographic findings were associated with pain in activity and functional status based on physical performance. Disability scores were associated with pain and stiffness. WOMAC index was statistically significant between KL grading. Varus angle and male gender were for risk of having predominantly OA. Duration of disease was significantly associated with age, pain and stiffness. Hence it would be better to consider mainly the functional status of patients in addition to clinic and radiological findings while planning the treatment of OA.

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