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Original Research Article

Relationship between pain, stiffness and function of knee osteoarthritis with occupational physical activity

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ABSTRACT

Background: Osteoarthritis (OA) is a multifactorial disease with strong genetic and occupational components. Although published studies have described several risk factors for OA, very few studies have investigated the contribution of occupational physical activity in debilitating pain, stiffness and physical function of knee OA patients.
Methods: This is a hospital based cross-sectional observational study and was carried out in the Medicine department of Chittagong Medical College Hospital (CMCH). Total 200 patients with knee OA were approached for inclusion. Subjects were selected by appropriate inclusion criteria. A thorough history of every case and face to face interview was taken by a predesigned questionnaire after getting the written informed consent of the patient.
Results: Among 200 subjects, majority were in age group 51-70 years (86%). Male female ratio was 1:1. Mean duration of exposure of standing, walking, seating, squatting, lifting weight, climbing and kneeling was 27.88±8.105 years, 26.59±9.37 years, 30.63±7.36 years, 27.21±7.95 years, 23.18±9.35 years, 27.42±9.93 years, 35.4±.52 years accordingly and Mean doses of exposure was 3.41±2.71 hours/day, 2.55±5.21 miles/day, 3.13±2.46 hours/day, 1.34±1.53 hours/day, 2.70±6.42 kg/day, 73.66±16.64 flights/day, 2.57±1.33 hours/day. Mean pain, stiffness and physical function score was 13.05 (±3.59), 2.58 (±2.68) and 59.66 (±6.96). Of all, 70% had moderate Western Ontario and McMaster university osteoarthritis index (WOMAC) score, 26% had severe and 4% had low score.
Conclusions: Significant association was found between Severity of WOMAC score and duration and dose of exposure to occupational physical activity in their life. However, further study with appropriate design is recommended before drawing a final conclusion.

Keywords: Knee osteoarthritis, Occupational physical activity, WOMAC score, Stiffness, Physical function

INTRODUCTION

Osteoarthritis (OA) is the most common disorder of the musculoskeletal system and the leading cause of functional incapacity and disability in adults. Degenerative diseases of the knee, such as OA, are prevalent. In the general American adult population, the prevalence was estimated at 14% which increases to 19% in those over 45 years of age and to 40% in those over 60 years of age.[1] While several risk factors have been identified, the causes of knee OA are not well established. Age, obesity, and being overweight (body mass index, >26), work-related

activities, playing sports at high levels, and malalignment of the knee joint are the most prominent risk factors.[1-4] There is probably also a genetic component and evidence suggests sex as a possible risk factor, with studies reporting higher prevalence of knee OA in women over the age of 45 years.[1] The limited number of treatment options, after the condition sets in, predominately consists of nonsteroidal anti-inflammatory drugs to reduce the pain and weight management to reduce mechanical stress. Finally, with advanced disease, total knee replacement is an option.[5,6] Combined with the irreversibility of the disease, it underscores the importance of preventative measures. Work-related physical activities, which increase pressure on the joint, are considered a risk factor by many authors. High mechanical stress at the knee joint due to kneeling, squatting, lifting, and climbing stairs indicate these occupational activities as a risk factor. This has also been concluded in a considerable number of studies that evaluated the risk of knee OA as a result of occupational activities.[7-10] In particular, several studies have suggested that risk is increased by work which entails prolong bending of the knee. If certain work causes or aggravates knee OA, then the move to prolong its duration could further swell the rising tide of morbidity, in which case the optimal design of work assumes a greater significance. This knowledge has been reflected in labor policy in Germany and Denmark, where OA is considered an occupational disease majority of this study has been done in western countries. No studies are available to assess relation between pain, stiffness and function of knee OA with occupational physical activity in our population.

METHODS

Cross sectional study was Department of Medicine, CMCH Six months August 2019 to January 2020 after approval of protocol. 200 subjects were included in this study due to time and resource constraints Patients who attended IPD and OPD of medicine, OPD of Orthopedics and Physical medicine of CMCH.

Inclusion criteria

Patients who were diagnosed as OA of knee 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 did not provide written consent to participate in this study, critically ill patients were excluded.

Study procedure

Subjects who attended OPD and IPD of medicine were encountered with collaboration of physical medicine department 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 responded positively were tested for ACR 1991 criteria for knee OA. Along with radiograph who fulfilled ACR 1991 criteria for knee OA were selected for the study. Around 200 patients were included following inclusion and exclusion criteria for the study. There were equal ratio of male and female, such as 1:1 to avoid the gender bias. These 200 patients were interviewed face to face with the prepared questionnaire. Detail history was taken from each patient and thorough physical examination was done. All information were recorded in a separate case record form and after collection of data all data were checked and analysed.

Ethical issues

Patients (subjects) and key relatives were clearly informed about the scope and limitations of the study. Informed Written consent was obtained from the patients (subjects). Confidentiality of the patients (subjects) about personal information were strictly maintained. This was not an interventional study. The study did no hazard to environment.

Data processing and analysis

Statistical analysis of the study was done by computer software device as the statistical package for social science (SPSS) version 23. An analysis plan was developed for interview. According to the plan, at first data were noted into Microsoft excel spread sheet and summarize the findings of the different variables of the questionnaire. Then all data were transcribed into the SPSS software and it was considered as master data sheet. Before final analysis, all data were interpreted with 95% Confidence Interval with accepting 5% error. The qualitative variables were expressed as frequency and percentage and the quantitative variables were expressed as mean with standard deviation. During analysis, chi-square test, Student's t and one way ANOVA test were considered whenever necessary. In all cases, $p<0.05$ was considered statistically significant.

RESULTS

This cross-sectional observational study was done in Department of Medicine, CMCH. Study population was 200 known patients of knee OA.

Majority respondents were in age group 61-70 years (44%, n=88) and followed by in decreasing order 51-60 years (42%, n=84), and >70 years (14%, n=28). Male and female respondents were equal in number (50%, n=100). Majority respondents hailed from rural area (56%, n=112). Majority respondents' monthly income was 10,000-25000 Tk (50%, n=100) and followed by in decreasing order 5000-10000 Tk (48%, n=96) and >25000 Tk (2%, n=4).

Majority respondents were studied up to primary school (44%, n=88) and followed by in decreasing order SSC

(18%, n=36), HSC (16%, n=32), illiterate (12%, n=24), graduation (8%, n=16) and the post-graduation (4%, n=8).

Table 1: Distribution of respondents by age, (n=200).

Variables	N	Percentage (%)
Age group (in years)		
51-60	84	42
61-70	88	44
>70	28	14
Total	200	100
Sex		
Male	100	50
Female	100	50
Total	200	100
Residence		
Urban	88	44
Rural	112	56
Total	200	100
Monthly income		
5000-10000 Tk	96	48
10000-25000 Tk	100	50
>50000 Tk	4	2
Education		
Post-graduation	8	4
Graduation	16	8
HSC	32	16
SSC	36	18
Primary	88	44
Illiterate	24	12

Among the components of ACR 1991 criteria, knee pain and osteophytes on X ray knee were present in 100% (n=200) patients, 90% patients (n=180) were aged more than 50 years, morning stiffness lasting ≤30 minutes was present in 88% (n=176) patients and crepitus with active motion joint was present in 76% (n=152) patients (Table 2).

Table 2: Presence of components of ACR 1991 criteria among study population.

Clinical features	N	Percentage (%)
Knee pain	200	100
Osteophytes on X-ray knee	200	100
Age >50 years	180	90
Morning stiffness lasting ≤30 minutes	176	88
Crepitus with active joint motion	152	76

Majority respondents' duration of OA knee was 2-4 years (37%, n=74) and followed by in decreasing order ≤1 year (34%, n=68), 8-10 years (16%, n=32), 5-7 years (9%, n=18) and 11-13 years (4%, n=8) (Table 3).

Table 3: Distribution of respondents by duration of disease, (n=200).

Duration of disease (in years)	N	Percentage (%)
≤1	68	34
2-4	74	37
5-7	18	9
8-10	32	16
11-13	8	4
Total	200	100
Mean±SD	3.60±3.52	

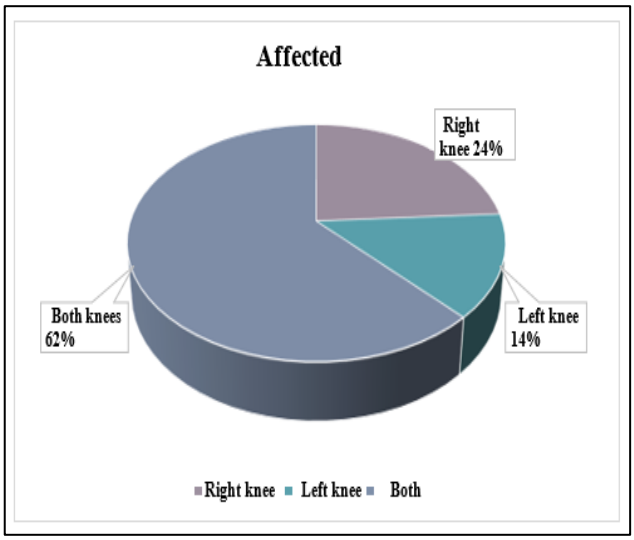

Figure 1: Distribution of respondents by affected side, (n=200).

Majority respondents had OA in both knees (62%, n=124) and followed by in decreasing order right knee (24%, n=48) and left knee (14%, n=28) (Figure 1).

Mean height of study population was 1.62 (±0.193) inches and mean weight was 68.18 (±8.43) kg. Mean BMI was 25.87 (±6.24) kg/m^2 (Table 4).

Table 4: Anthropometric measurement of respondents, (n=200).

Variables	Mean	SD
Height (m)	1.62	0.193
Weight (kg)	68.18	8.43
BMI (kg/m^2)	25.87	6.24

Majority respondents' had history of standing as occupational physical activity (88%, n=176), walking (76%, n=152), seating (56.5%, n=113), squatting (68%, n=136), lifting weight (46%, n=92), climbing (24%, n=48) and kneeling (8%, n=16). Mean duration and dose of exposure is mentioned in below Table 5.

Mean pain score was 13.05 (±3.59) with a minimum score of 6 and maximum score of 20. Mean stiffness score was

2.58 (±2.68) with a minimum score of 0 and maximum score of 8. Mean physical function score was 59.66 (±6.96) with a minimum score of 28 and maximum score of 68 (Table 6).

Severity of WOMAC score was significantly associated with duration of exposure of seating, squatting, kneeling, lifting weight and climbing ($p<0.05$). WOMAC score gets more severe when the duration of exposure gets longer (Table 7).

Severity of WOMAC score was significantly associated with doses of exposure of standing, walking, squatting, lifting weight and climbing ($p<0.05$). WOMAC score gets more severe when the duration of exposure gets longer (Table 8).

Among patients who had low WOMAC score, mean pain score was 6.5±0.53, mean stiffness score was 1.5±1.6 and mean physical function score was 31.5±3.74. Among the patients who had moderate WOMAC score, mean pain score was 12.54±3.17, mean stiffness score was 1.82±2.41 and mean physical function score was 59.38±3.4.

Among the patients who had severe WOMAC score, mean pain score was 15.42±3.10, mean stiffness score was 4.78±2.26 and mean physical function score was 64.73±2.41 (Table 9).

Table 5: Distribution of type of occupational activity among respondents with duration and dose of exposure, (n=200).

Variables	N	Duration of exposure (in years)	Dose of exposure (per day)
Standing	176 (88)	27.21±8.105	3.41±2.71hours
Walking	152 (76)	26.57±7.95	2.55±5.21 miles
Seating	113 (56.5)	30.63±7.36	3.13±2.46 hours
Squatting	136 (68)	27.21±7.95	1.34±1.53 hours
Lifting weight	92 (46)	23.18±9.35	2.70±6.42 kg
Climbing	48 (24)	27.42±9.93	73.66±16.64 flights
Kneeling	16 (8)	35.4±.52	2.57±1.22 hours

Table 6: WOMAC score among respondents, (n=200).

Variables	N
Pain score	
Mean±SD	13.05±3.59
Minimum	6
Maximum	20
Stiffness score	
Mean±SD	2.58±2.68
Minimum	0
Maximum	8
Physical function score	
Mean±SD	59.66±6.96
Minimum	28
Maximum	68

Table 7: Association of severity of WOMAC score with duration of exposure of occupational physical activity, (n=200).

WOMAC score (in years)	Low	Moderate	Severe	P value
Duration of exposure of standing	25.67±1.56	28.03±7.81	27.44±9.15	0.880^{ns}
Duration of exposure in walking	NA	26.31±8.64	27.44±11.61	0.534^{ns}
Duration of exposure of seating	NA	28.05±5.661	31.29±7.63	0.065^{ns}
Duration of exposure of squatting	23	25.33±6.39	30.80±9.76	0.001^{s}
Duration exposure of kneeling	NA	30.31±.56	34.62±1.38	<0.001^{s}
Duration of exposure of lifting weight	19.31±3.34	20.24±7.62	29.20±10.51	<0.001^{s}
Duration of exposure of climbing	NA	19.24±10.26	31.90±6.28	<0.001^{s}

*ns-not significant, s-significant

Table 8: Association of severity of WOMAC score with combinations of occupational weight lifting, kneeling, and squatting, (n=200).

Variables	With low WOMAC Score (<60)	With moderate WOMAC Score (60-80)	With severe WOMAC Score (>80)		P value
No kneeling/squatting or lifting weight	0	31	2	33	<0.001[s]
Kneeling/squatting but no lifting weight	0	45	23	68	
Lifting weight but no kneeling or squatting	3	8	3	14	
Both kneeling/ squatting and lifting weight	0	2	3	5	
Total	3	86	31	120	

*s-significant

Table 9: Distribution of pain, stiffness and physical function score of patients by severity of total WOMAC score, (n=200).

Variables	Patients with low WOMAC score	Patients with moderate WOMAC score	Patients with severe WOMAC score
Pain score			
Mean±SD	6.5±0.53	12.54±3.17	15.42±3.10
Minimum	6	6	11
Maximum	7	20	20
Stiffness score			
Mean±SD	1.5±1.6	1.82±2.41	4.78±2.26
Minimum	0	0	1
Maximum	3	8	8
Physical function score			
Mean±SD	31.5±3.74	59.38±3.4	64.73±2.41
Minimum	28	52	58
Maximum	35	68	68

DISCUSSION

OA is a chronic condition of the synovial joint including the progressive degeneration of cartilage and the excess growth of bone which leads to pain and functional impairment often.[11] Total 200 known patients of knee OA were taken as study population. It is one of the leading causes of global disability. OA involves inflammation and major structural changes of the joint, causing pain and functional disability. Pain and stiffness, particularly after exercise, are the major symptoms, resulting in considerable impact on ability to perform activities of daily living. There is discordance between symptoms and radiographic changes, with some sufferers not experiencing symptoms, but showing osteoarthritic changes on X-ray. OA of the hip and knee contributes the most to OA burden. Knee OA is considered as a chronic disease of the whole joint, including articular cartilage, meniscus, ligament, and periarticular muscle that may result from multiple pathophysiological mechanisms. It is painful and disabling disease that affects millions of patients.[12] Pain, stiffness and other symptoms of OA may have a profound effect on quality of life affecting both physical function and psychological parameters. In some research, evidence is accumulating that the disease is more common in people who have performed heavy physical work.[13-17] This study aimed to find out the pain, stiffness and function of knee OA and occupational physical activity. Majority of the study population were in age group 51-70 years. A similar study was done in Bangladesh and they found similar age distribution among patients with knee OA.[18] Another study concluded that prevalence of OA increases steeply with age.[19] Felson also stated old age is an established risk factor.[20] Male and female respondents were equal in number in this study. It is known that OA is more common in women than in men.[19] Though in a systemic review, evidence of change in age standardized prevalence was similar for males and females.[21] In present study, method of sampling was purposive sampling, male and female respondents were taken in equal number willingly to avoid gender role related bias. The study population were hailed from both rural and urban area but rural population are slightly predominant. Majority respondents were studied up to primary school (44%). The study was done in a Govt. tertiary level hospital situated in Chittagong. So, the patients visiting that hospital are mainly from the bulk lower-middle socioeconomic group people from surrounding area. Among the components of ACR 1991 criteria, knee pain and osteophytes on X ray knee were present in all patients. About 90% patients were aged more than 50 years, morning stiffness lasting ≤30 minutes was present in 88% patients and crepitus with active motion

joint was present in 76% patients. About 37% patients were suffering from knee OA for 2-4 years, 34% for ≤1 year, 16% for 8-10 years, 9% for 5-7 years and 4% for 11-13 years. About 62% respondents had OA in both knees, 24% in right knee and 14% in left knee. Mean height and weight of study population was 63.48 (±7.63) inches 68.18 (±8.43) kg. Mean pain score was 13.05 (±3.59) with a minimum score of 6 and maximum score of 20. Mean stiffness score was 2.58 (±2.68) with a minimum score of 0 and maximum score of 8. Mean physical function score was 59.66 (±6.96) with a minimum score of 28 and maximum score of 68. About 70% respondents had WOMAC score in moderate (60-80) (70%) 26% had severe WOMAC score (>80%) and 4% had low WOMAC score (<60). The WOMAC is a self-report functional status measure which professes to assess three health concepts, pain, stiffness, and physical functional.[22,23] It has received extensive use over the past 20 years, however, recent work has consistently revealed the WOMAC lacks factorial validity.[24] In a case-control study of Japanese men, physical work as the principal occupation remained independently and significantly associated with knee OA after controlling for other risk factors.[25] Occupations in which a considerable amount of time is spent in knee-straining positions (e. g., floorlayers, carpenters, and compositors) were shown to be a risk factor for the development of knee OA but only in workers above the age of 50 years.[26] Workers in several occupations are at increased risk for knee OA. They include workers in construction, firefighting, agriculture, fisheries, forestry, and mining.[24,27]

CONCLUSION

More than two thirds of the study population had moderate WOMAC score. Significant association was found between Severity of WOMAC score and duration and dose of exposure to occupational physical activity in their life. That means the severity of pain, stiffness and worsening of physical function increases when the duration of exposure gets longer and dose of exposure gets greater. However, as the study results were retrieved from a small sample size and collected from a single tertiary care center, therefore, further study with appropriate design is recommended before drawing a final conclusion.

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