

Original Article

Relationship of Knee Specific Life-long Daily Activities with Radiographic Grading and Functional Disability in Patients Suffering from Osteo-arthritis of Knee

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Abstract

Aim: To identify the relationship of knee specific lifelong daily activities with radiographic grading and the functional disability in patients suffering from osteo-arthritis (OA) of the knee

Study design: Cross sectional study

Duration of the study: October 2011 to September 2013

Settings: Physical Medicine and Rehabilitation (PMR) Department, Regional Institute of Medical Sciences (RIMS), Imphal.

Study population: All patients suffering from OA knee, who fulfilled American College of Rheumatology (ACR) criteria for classification of idiopathic OA knee, who attended the department during the study period.

Materials and Methods: Functional disability status of the patients was assessed using a WOMAC questionnaire besides complete clinical examination, Kellgren and Lawrence radiological grades was used for radiographic grading. Life-long daily activities involving the knee in regards to the job, occupation, leisure activities were recorded using a pre-structured, validated format.

Results: A total of 80 patients were studied. The mean WOMAC score was 38.74 ± 14.36 . Majority of the patients (52.5%) had a grade II OA. There was statistically significant association between WOMAC score and squatting ($p < 0.01$), WOMAC and kneeling/knee bending activities ($p < 0.05$), WOMAC and VAS pain ($p < 0.01$). Multivariate regression showed significant association of WOMAC score with squatting (OR 0.09, 95% CI 0.01-0.83) and knee bending activities (OR 0.25, 95% CI 0.05-1.27). None of the knee activities were found to be associated with radiographic grades.

Conclusion: Time spent for knee activities such as squatting and kneeling or knee bending activities in a day caused higher functional disability in OA knee patients. No direct association could be established between knee specific activities and radiographic grades.

Key words: Knee specific lifelong daily activities, osteo-arthritis, WOMAC, Kellgren and Lawrence radiological grades.

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Introduction:

Osteo-arthritis (OA) is a chronic degenerative disorder of multifactorial aetiology¹. It is the most common joint disorder and can affect any joint in the body, but the disorder is more common in joints of knee, hip, fingers and spine, of which OA of the knee is the most common^{1,2}.

It is important to study the factors for development and disability associated with OA knee. Population based studies have been carried out elsewhere to identify the specific occupational, sports and certain life-long daily activities as risk factors for development of OA knee^{3,4}, and the association of certain risk factors with radiographic grades was also studied^{5,6}. Squatting, kneeling or knee bending activities, sitting on floor cross legs, carrying weight, climbing up and down the slopes

in hilly terrain, etc, are the main activities involved in day to day activities with the people living in this part of the country. These activities are all knee specific activities and are involved continuously over a period of time in such individuals. Hence, it is of great interest to find out any association of such factors with knee osteo-arthritis and the magnitude of functional disability of the patients, and the degree of radiographic grades.

The present study attempts to find out the relationship of knee specific lifelong daily activities with radiographic grading and the functional disability in patients suffering from primary osteo-arthritis of the knee.

Materials and Methods:

It was a cross sectional study, subjects were recruited from patients suffering from OA knee, attending the Department of Physical Medicine and Rehabilitation, RIMS during October 2011 to September 2013.

Inclusion criteria were based on ACR criteria for diagnosis of OA knee⁷. The criteria (clinical and x-ray) include:

- | | |
|----------------------------------------|------|
| a. Knee pain | plus |
| b. At least 1 of 3 | |
| - Age more than 50 years | |
| - Stiffness less than 30 minutes | |
| - Crepitus | plus |
| c. Osteophytes on x-ray of knee joint. | |

Patients with severe comorbid conditions, such as heart disease, stroke and vascular disease, inflammatory disease of joints like rheumatoid arthritis, recent knee trauma and patient with cognitive impairment were excluded from the study.

Informed consent was taken from the subjects before including them for the study. Approval of the Institutional Ethics Committee was also taken before starting the study.

Functional disability assessment:

Besides clinical examination, functional disability status of the patients was assessed using Western Ontario and McMaster universities index of Osteoarthritis (WOMAC) questionnaire⁸. The WOMAC Index is a disease-specific, self-administered questionnaire, for assessing functional status and outcomes in OA knee. It contains 24 parameters, targeting areas of pain, stiffness and physical function. The questionnaire was translated into the local language (Manipuri). Forward backward translation procedure was applied as recommendation made by Beaton *et al*⁹. Pre-testing of the Manipuri

version was done in 15 patients in a target population by using the probe technique¹⁰. The final accepted Manipuri version was then used for the study purpose.

Radiographic assessment:

X-ray of both knee joints: antero-posterior view (standing) as per recommended by Altman *et al*¹¹. The lateral view of knee joint in slight flexion in recumbent position was also taken to see patello femoral compartment. The severity of the disease was graded by Kellgren and Lawrence radiological grading¹² for OA of the knee joint.

Knee specific daily activity assessment:

Life-long daily activities involving the knee in regards to the job, occupation, leisure activities were recorded using a pre-structured, validated format⁴. This has been used in population based studies for identifying risk factors for OA knee in Asia – Pacific COPCORD studies in countries viz. Iran and Bangladesh¹³. The structured questionnaire contains daily time spending of squatting, knee bending and kneeling, sitting cross legs on the floor, sitting chairs, stairs climbing, standing, walking in plain and hilly terrain, carrying of weight, cycling, driving, etc. The patients were extensively interviewed by a trained interviewer (doctors /nurses) who noted down their lifelong daily activities based on life-course approach⁴, including job working hours and leisure time activities. The average time spent in a day for each knee activities, that patients had performed for majority of their life was noted and categorised based on hours or minute.

Statistical analysis:

Data collected were analysed using SPSS version 16. The relationship between knee specific daily activities, radiographic grading, WOMAC disability scores and clinical variables like duration of illness, VAS pain score and BMI were analysed using Chi-square test and Fisher's exact test. Association of time spending per day for knee activities with functional disability and radiographic grades were also analysed with multivariate regression method. Associations were expressed as odd's ratios (OR) with 95% confidence intervals (95% CI). P<0.05 was taken as significant for all tests.

Results:

A total of 80 patients suffering from OA knee were studied. The characteristic findings of study group are depicted in Table 1. The mean age of the patients was 56.24 ± 8.24 years. The mean duration of illness was

7.76 ± 4.98 months. Majority of the patients were female, comprising 77.5%. Number of patients having both knee involved was 43 (53.8%).

The mean WOMAC score was 38.74 ± 14.36 . The Kellgren and Lawrence radiographic grading of the study shown in population is shown in Fig 1. Majority of the patients (52.5%) had a grade II OA changes followed by grade III which was 37.5%.

Relationship between knee activities with WOMAC and radiographic grades:

The relationship between knee specific daily activities with WOMAC score and radiographic grades are shown in Table 2. There was statistically significant association between WOMAC score and squatting ($p < 0.01$), WOMAC and kneeling/knee bending activities ($p < 0.05$), WOMAC and VAS pain ($p < 0.01$), WOMAC and BMI ($p < 0.05$). The duration of illness was found to be significantly associated with the radiographic grades ($p < 0.01$).

After analysis with multivariate regression, after adjusting for BMI, age, duration of illness, it was observed that there was still statistically significant association of WOMAC score with squatting (OR 0.09, 95% CI 0.01-0.83) and knee bending activities (OR 0.25, 95% CI 0.05-1.27). None of the knee activities was found to be significant with radiographic grades as shown in Table 3.

Discussion:

In this cross-sectional study we observed that more time spent for squatting in floor per day and more time spent

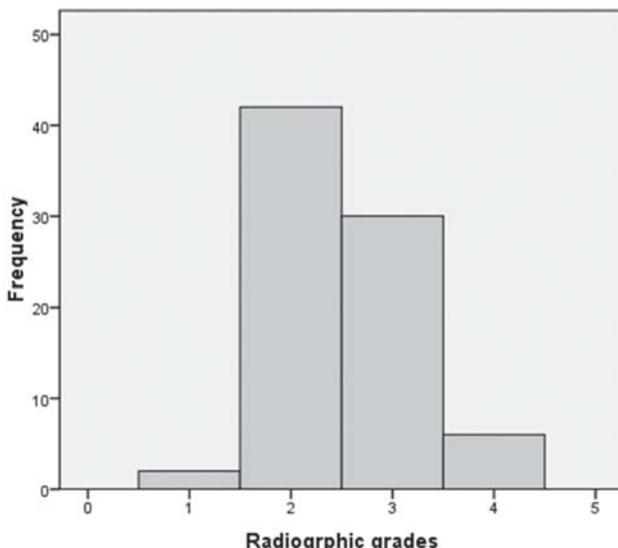


Fig 1- Kellgren and Lawrence Radiographic Grading

per day for activities involving kneeling and knee bending were positively associated with functional disability. We also found positive association between knee functional disability and BMI and also with severity of pain.

Since activities such as squatting, kneeling, stair-climbing, walking, sitting, are parts of WOMAC questionnaire, the difficulty in performing one or more items were expected to increase the overall WOMAC score. So we tried to find out if average time spent per day for such activity for the past years will affect the functional disability. But we could find only time spent

Table 1: Demographic, Clinical and Radiographic Characteristics of the Patients

Characteristics		Value
Mean age (in years)		56.24 ± 8.24
Male : female 18 :62		
Mean duration of illness (in months)		7.76 ± 4.98
Mean BMI (kg/m ²)		24.98 ± 3.94
Occupation	Housewife	42 (52.5%)
No of patients (percentage)	Sedentary occupation	9 (11.2%)
	Moderately sedentary	20 (20%)
	Farmer/labourer	9 (11.2%)
No of patients with knee involvement (per cent)	Left	18 (22.5%)
	Right	19 (23.8%)
	Both	43 (53.8%)
Mean WOMAC score		38.74 ± 14.36

Table 2: Association of Radiographic Grading and WOMAC Score with Knee Specific Daily Activities

Daily activities	WOMAC	Radiographic grades
Squatting 0.009 **	0.271	
Knee bending activities	0.038 *	0.398
Stairs climbing	0.981	0.854
Walking plain surface	0.496	0.771
Walking hill	0.274	0.213
Standing	0.910	0.910
Sitting chairs	0.221	0.232
Sitting cross legs	1.000	0.911
Lifting heavy objects	0.283	1.000
Driving	0.586	1.000
Pain (VAS)	0.003 **	0.588
Age	0.167	0.779
BMI	0.028 *	0.941
Duration of illness	0.373	0.001 **
WOMAC		0.207

* P<0.05, Significant; ** P<0.01, Highly significant

Table 3: Relationship between WOMAC and Radiographic Grades with Knee Specific Daily Activities Using Multivariate Regression Method

Activity		WOMAC OR (95 % CI)	Radiographic grades OR (95 % CI)
Squatting	>30 minutes (reference)		
	≤30 minutes	0.09 (0.01-0.83)*	1.66 (0.63-4.36)
Kneeling	>30 minutes (reference)		
	≤30 minutes	0.25(0.05 - 1.27)*	0.76(0.29-1.67)
Climbing stairs	>3 stories (reference)		
	1 storey	1.00 (0.10 - 9.97)	0.16 (0.01 -1.55)
	2-3 stories	0.90 (0.08 - 9.98)	0.10 (0.01-1.67)
Walking plain surface	>3 hours(reference)		
	<2 hours	1.08 (0.24 - 4.85)	1.21 (0.38 - 3.88)
	2-3 hours	0.60 (0.10 -3.44)	1.22 (0.35 - 4.21)
Walking hilly terrain	>30 minutes (reference)		
	≤30 minutes	0.42 (0.12 - 1.42)	1.76 (0.71 - 4.35)
Standing	>2 hours (reference)		
	≤2 hours	1.29 (0.38 - 4.38)	0.95 (0.39 - 2.30)
Sitting in chairs	≥3 hours		
	<3 hours	2.18 (0.61-7.78)	0.58 (0.23 - 1.42)
Sitting cross legs	≥1 hours(reference)		
	Nil	1.44 (0.25-8.16)	1.41 (0.40 - 4.87)
	<1 hour	1.20 (0.20 -7.05)	1.16 (0.33 - 4.06)
Lifting objects	≥5kg/day (reference)		
	<5 kg/day	0.46 (0.13-1.62)	1.71 (0.61-4.74)

* P<0.05, Significant

per day for squatting and kneeling or knee bending activities were significantly associated with functional disability score. Time spent for more than 30 minutes per day for squatting significantly increased the WOMAC score with OR 0.09, 95% CI 0.01-0.83 (p<0.05) while time spent for kneeling or knee bending activities per day for more than 30 minutes significantly increased functional disability with OR 0.25, 95% CI 0.05-1.27 (p<0.05). Cooper *et al*³ also observed significant increased risk in subjects whose job demanded more than 30 minutes squatting per day (OR 6.9, 95% CI 1.8-26.4), kneeling (OR 3.4, 95% CI 1.3-9.1), and climbing more than 10 flights of stairs per day (OR 2.7, 95% CI 1.2-6.1) in their study of 109 patients suffering from OA knee. Dahaghin *et al*⁴ in their population based COPCORD study with random selection of 480 OA patients from Stage 1, Phase 1, who were matched controlled with normal individuals (for age and sex), also found that two specific knee activities viz. squatting (OR 1.51, 95% CI 1.12-2.04), cycling (OR

2.06, 95% CI 1.23-3.45) were found to be risk factors for development of OA knee. Activities involving knee bending had borderline significance (OR 1.98, 95% CI 0.98-3.99).

Cooper *et al*³ observed no significant association of OA knee with activities involving heavy lifting, prolonged walking, standing, sitting or driving. Dahaghin *et al*⁴ also observed that there were no extra risks for OA knee with activities like climbing stairs, prolonged standing, sitting on floor and walking up/down hill. The present study also could not find any statistically significant association between WOMAC scores with time spent for walking hill and plain, stairs climbing, standing, sitting in chairs, and cross-leg sittings, and driving vehicle.

Thambyal¹⁴ showed that squatting created peak external moments that were more than 2.5 times greater than those during walking. Accordingly we expected that there would be an association between squatting and knee bending activities to have associated with disability and

radiographic changes. But we could find their association only with functional disabilities, but not with radiographic grades.

Zeng *et al*¹⁵ in their study found that the prevalence of both knee pain and knee OA had a two-fold increase in residents staying in multistoried buildings who required stairs climbing. Muraki *et al*¹⁶ had observed that kneeling, squatting, walking and lifting heavy objects were associated with more severe radiographic grades. In the present study too, we tried to evaluate if any relationship existed between knee specific daily activities which were more commonly involved in people living in this part of the country, such as squatting, kneeling, stairs climbing, walking, hill climbing, sitting cross legs etc, with severity of radiographic grades. But we could not find any significant association between these knee activities with the radiographic grades. The reason could be because of small sample size study. Moreover we did not find climbing stairs as a risk factor for OA knee as also reported by Dahaghin *et al*⁴. This could be because of socio-economic condition of this region where buildings with higher than 2 stories were uncommon as also shared by Dahaghin *et al*⁴.

There are some studies¹⁷⁻¹⁹ which attempted to assess the relationship between radiographic grades and functional disability. We found no association between functional disability with severity of disease graded from radiographic findings. This explains that the degree of functional disability varies widely with the same degree of OA as also shown by Thumboo *et al*²⁰.

Cubukcu *et al*¹⁸ found that none of the WOMAC subscores were related with Kellgren-Lawrence grading. In other studies^{17,19}, correlation between self-reported disability and radiographic change could not be established. This absence of association may be explained by the fact that pain which is the major complain in OA knee has great influence on the functional disability status and not on the radiographic grades. Association between pain and WOMAC score was highly significant ($p<0.01$) but we did not find positive association between pain and radiographic changes. These finding were in line with findings by Creamer *et al*¹⁷ and McAlindon *et al*¹⁹ who also observed that functional status in OA knee was determined by pain severity, age, obesity and psychological anxiety and not by bony changes in radiograph.

Majority of our patients were housewives (52.5%) whose main job was to look after household activities

in their family. In this part of the country, household activities such as cleaning utensils, clothes, cleaning floors, and cooking etc, involved mainly of squatting and knee bending activities. So while managing OA knee, we should give more importance on this particular patient group and consider lifestyle modification taking into consideration of sociocultural context of the society.

The limitations of this study include being a small sample size of the study. The lifestyle and activities can change throughout a person's life, this fact makes very difficult to find associations of knee activities with osteoarthritis, its functional disability and radiographic changes which develops only gradually. As Dalhagin *et al*⁴ also reported, a life-course approach helps reduce these problem by counting the years of exposure to each knee specific activities. Finally the study was conducted on a hospital based population of patients suffering from OA knee seeking medical care, this may not be generalised to the whole ethnic population.

A population based study representing the ethnic community would be desirable to further confirm whether or not these activities are associated risk factors for development of OA knee leading to functional disability and radiographic changes in the course of the disease. While recording these knee specific activities, a proper life course approach should be considered.

Conclusions:

From the present study it was observed that the functional disability caused by OA knee is influenced by the knee activities in day to day work and leisure time. Time spent for knee activities such as squatting and kneeling or knee bending activities in a day are risk factors for development higher disability on OA knee patients. No direct association could be established between knee specific activities and radiographic grades. Pain due to OA knee is associated with higher disability but not necessarily with higher radiographic grades. The functional disability does not correlate with the degree of radiographic grades in OA knee patients.

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