ORIGINAL ARTICLES

Prevalence of knee osteoarthritis in rural areas of Bangalore urban district

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Abstract

Background

Osteoarthritis is a common arthropathy of the knee. In India, the prevalence of the disease in the adult rural population is estimated to be 5.8%.

Aim

To measure the prevalence of knee osteoarthritis among adults in a rural area and to study the risk factors associated with knee osteoarthritis in the study population. To compare the EULAR 2009 criteria with the modified clinical criteria given by American College of Rheumatology (ACR) for the diagnosis of primary osteoarthritis of the knee joint.

Materials and methods

A cross-sectional study was conducted across seven villages coming under a sub-center, from December 2011 to January 2012. A total of 342 subjects were selected by stratified random sampling. An interviewer-administered questionnaire was used to estimate the prevalence and associated risk factors of osteoarthritis based on EULAR 2009, modified ACR criteria, anthropometry, and clinical examination of the knees. The data was analysed using standard statistical software.

Results

The mean age of the population was 42.56 ±16.5 years. The corresponding prevalence of osteoarthritis calculated using the ACR and the EULAR 2009 criteria were 17% and 5.6% in the adult population and 54.1% and 16.4% in the elderly. The etiological factors found to be associated with osteoarthritis are age (P <0.0001), poor education (P <0.0001), previous knee injury (P = 0.046), and regular climbing of stairs (P <0.0001).

Conclusion

Osteoarthritis is one of the most common rheumatologic problems. The risk factors of the disease are advancing age, lower socioeconomic strata, lesser education, previous knee injury, and regular climbing of stairs. Female predisposition was seen in the elderly, but not in younger patients with osteoarthritis. The epidemiological data reported should be interpreted based on the tool used since the criteria are moderately overlapping.

Introduction

Osteoarthritis (OA) of the knee is the most common arthropathy of the knee.[1] It is the fourth leading cause of years lived with disability.[2, 3] The American College of Rheumatology criteria (ACR) have been in use since 1981 for the clinical diagnosis of OA.[2, 6] The EULAR 2009 (The European League against Rheumatism) criteria were developed for the clinical diagnosis of OA in a

primary care setting.[1] Improvement in life expectancy and an increase in our geriatric population necessitates the need to study the prevalence and associated risk factors of OA. In India, the prevalence of knee OA in the adult rural population is estimated to be 5.8%.[4] OA of the knee is more common in women.[2] It is also more prevalent among those engaged in agriculture, manual labor (men) and household work (women).[2, 5] Studies done in Jammu using the ACR criteria demonstrated the prevalence to be 4.24% and the associated risk factors of knee OA to be age, female gender, and repeated bending of the knee.[7] The lack of imaging facilities and specialized orthopedic care in rural India causes a deferral in diagnosis and institution of treatment until late stages of the disease process. In order to institute preventive and therapeutic measures, it is necessary to estimate the burden of the disease. However, due to the lack of radiographic facilities, we relied on previously validated clinical criteria for the diagnosis of knee OA. Studies using the ACR criteria have been published from western countries as well as India, whereas published studies of the EULAR 2009 criteria as a screening tool are lacking in Indian population.[2, 3] OA is often under diagnosed and managed symptomatically with over-the-counter analgesics. We undertook this study to estimate the prevalence and identify the factors associated with OA of the knee among adults in rural population living under the jurisdiction of Bangalore Urban district of the State of Karnataka in India. We also compared the EULAR 2009 criteria with the modified clinical criteria given by the ACR for the diagnosis of primary OA of knee joints in an Indian population as a secondary objective.

Materials and methods

A cross-sectional interviewer-administered survey was conducted across seven villages under Mugalur sub-center under Sarjapura Primary Health Centre area, Anekal Taluk, Bangalore Urban District, between November 2011 and January 2012. The prevalence of OA in the adult population was taken as 6% and the adults required to participate in the study were taken as 360 with 95% confidence interval and 2.5% absolute precision, accounting for non-response. The sampling unit taken was an individual. The subjects were chosen using stratified random sampling from each of the villages. A list was prepared on the total number of households in each village and people in each household accounting for the elderly, non-elderly, and gender separately. Number of subjects from each village to be included in the study was calculated using stratification. Random numbers generated using Microsoft Excel was used to select the individual for the study. The selected subjects were visited at their residence and the questionnaire was administered after a written informed consent was obtained from the participants. Subjects residing in the village for 6 months or more were included in the study. Those who had an above knee amputation in either lower limb, neurological diseases such as hemiplegia, paraplegia, and monoplegia of either lower limb, and those who could not be contacted even after three visits were excluded. The questionnaire consisted of two parts. The first part included socio-demographic details such as type of family, marital status, religion, education, socio-economic status (according to the standard of living index and BG Prasad's classification), and per capita income. The second part consisted of the possible risk factors for developing OA of the knee such as age, gender, occupation, history of injury to the knee, climbing stairs regularly, and a family history of OA. It also included the tools used to diagnose OA namely the modified ACR criteria and the EULAR 2009 criteria.[1, 6] The questionnaire was validated by translation into the local language and reviewed by a group of experts. It was subsequently piloted among a small group of individuals to test their comprehension and suitable changes were made accordingly.

In accordance with the EULAR 2009 criteria, three symptoms and three signs were taken into account namely, persistent knee pain, limited morning stiffness, limitation of function, crepitus, bony enlargement, and restricted movement. All the six criteria had to be fulfilled for an adult (≥18) to be classified as having OA. If the person was of age ≥45, and had all the above symptoms, the presence of any one sign would classify him as having OA. The modified ACR criteria used includes (i) persistent knee pain, (ii) cepitus on active joint motion, (iii) morning stiffness <30 min. in duration, (iv) age ≥38 years, and (v) bony enlargement of the knee on examination. OA is considered to be present, if (i-iv) or (i, ii, v) or (i, iv, v) are present. Third part of the study comprised of clinical examination of the left and right knee and anthropometry, consisting of subject's height and body weight measured using standard measuring tape and calibrated weighing scale respectively. Body mass index (BMI) was calculated and classified according to the WHO classification for Body Mass Index.13

The data was coded and entered into Microsoft Excel and analyzed using standard statistical software package Epi info v3.5.1 for proportions, frequencies, and associations. Frequencies, measures of central tendency and dispersion, chi-square tests, regression analysis, and Fischer test were used to analyze the data.

Results

The total population of adults aged 18 and above in the villages covered under Mugalur sub-center is 4016. Of the 360 selected adults, consent was not given by 1 subject and another 17 could not be contacted even after three visits. Hence, the final sample size considered was 342.

A. Demographic details

Females comprised of 52.1% (178) of the total subjects and they outnumbered males (164, 47.9%) involved in the study (Table 1). This difference in the gender is attributed to many males not being present at the house at the time of the study. The mean age of the participants was 42.56 ± 16.5 years with the number of elderly (60 yrs and above) being 61 (17.8%). The number of uneducated subjects was 120 (35.1%). The status of 320 subjects (93.6%) was currently married. Most of the subjects (98.8%) were Hindus, and 58.5% (200) lived in a three generation family. 71.95% of male subjects (118) were agriculturists and 93.3% (166) females were homemakers. The standard of living index scale showed that 58.5% (200) of subjects had a high standard of living. The mean monthly per capita income was INR 1022 ± 862.5 with 306 (89.5%) subjects having a per capita income below INR 1926.

Table 1: Demographic chacteristics of the subjects

Demographic variables		**No. of subjects**		**%**	
Total number of subjects = 342					
Age	18-31	105		30.7	
	31-45	110		32.2	
	46-60	73		21.3	
	61-74	36		10.5	
	75- 88	17		5.0	
	89-102	1		0.3	
Gender	Males	164		47.9	
	Females	178		52.1	
Highest education attained	Uneducated	120		35.1	
	Primary (class 1-7)	75		21.9	
	Secondary (class 8-12)	132		38.6	
	Degree and higher	15		4.4	
Standard of living index	Low	9		2.6	
	Middle	133		38.9	
	High	200		58.5	
Per capita income	>12863	0		0	
	Rs 6431.5-12863	2		0.6	
	Rs 3858-6431.5	2		0.6	
	Rs 1926-3858	32		9.4	
	<1926	306		89.5	
Occupation		**No. of males**	**%**	**No. of females**	**%**
	Agriculture	118	71.95	3	1.7
	Laborer	3	1.82	-	-
	Homemakers	NA	NA	166	93.3
	Others	40	24.39	6	3.4
	Unemployed	3	1.82	-	-
	Unable to work	-	-	3	1.7

B. Symptoms and signs

Ninety-five (27.8%) subjects had persistent pain (rest pain) in the right knee, and 122 (35.7%) subjects complained of pain in the right knee on activity. The corresponding numbers with respect to the left knee were 86 (25.1%) and 99 (28.9%). The number of subjects with persistent bilateral knee pain and bilateral usage-related knee pain were 86 (25.14%) and 99 (28.94%) respectively. Crepitus was elicited in the right knee in 75 (21.9%) subjects and in the left knee in 73 (21.3%) subjects. Deformities such as genu valgus and genu varus and fixed flexion deformity were not encountered. (Table 2)

C. Prevalence of OA and associated factors

Using the modified ACR criteria, the overall prevalence of OA was found to be 17% in the population studied, with a gender-specific prevalence of 15.5% in males and 18.8% in females. As per the EULAR 2009 criteria, the prevalence was 5.6% in the population, 4.2% in males, and 6.8% in females (Table 3). The prevalence of OA was found to be 54.1% among the elderly (60 yrs and above) and 8.9% among the non-elderly as per the modified ACR criteria; and 16.4% among the elderly and 3.2% among the non-elderly using the EULAR 2009 criteria. The modified ACR criteria showed that the prevalence of OA was 23.1% among the elderly males and 77.1% among the elderly females. According to the EULAR criteria prevalence in elderly females was 22.22% and elderly males was 11.76%. The age specific prevalence was found to be highest in the age group 70 and above.

Following the modified ACR criteria, the factors associated with OA were age (P <0.001), low education (P <0.001) and regular climbing of a flight of stairs (P <0.001). Moderately significant association was present between history of previous knee injury and the development of OA (P <0.05) (Table 4). The EULAR 2009 criteria were used to analyze the factors associated with OA in adults and elderly subgroup. There was a significant association (P <0.01) between education and knee OA. No association was found between gender and OA in the adult population, whereas in the elderly population there was a significant association between female gender and OA (P < 0.001) (Table 5). No association between knee OA and body mass index or income was observed according to t-test (two sample assuming unequal variance).

D. Comparison of EULAR vs. modified ACR criteria

Using the modified ACR criteria, 58 of those who participated in the study were found to have OA and 18

Table 2: Distribution of symptoms and signs in the joints

Symptoms	Right knee No. (%) (N = 342)	Left knee No. (%) (N = 342)
Persistent knee pain	95 (27.8)	86 (25.1)
Usage-related pain	122 (35.7)	99 (28.9)
Feeling of giving away	53 (15.5)	42 (12.3)
Morning stiffness (<30min.)	48 (14.0)	43 (12.6)
Rest and night pain	5 (1.5)	7 (2)
Previous injury	22 (6.4)	7 (2)
Limited movement	24 (7.0)	19 (5.6)
Signs		
Crepitus	75 (21.9)	73 (21.3)
Bony enlargement	34 (9.9)	40 (11.7)
Limited movement	15 (4.4)	15 (4.4)
Effusion	7 (2)	15 (4.4)
Joint laxity	3 (0.9)	6 (1.8)
Periarticular tenderness	22 (6.4)	11 (3.2)
Patellofemoral tenderness	8 (2.3)	7 (2)
Palpable warmth	8 (2.3)	3 (0.9)

among them were also found to be positive by the EULAR 2009 criteria. The consensus between the two criteria for those negative for OA was much higher. Of the 284 who were negative for OA by the ACR criteria, 283 were also negative as per the EULAR recommendations (Table 6). The kappa value was 0.419 with a P value <0.01, showing a moderately significant association between the two tools used. In the elderly subgroup, the kappa value was 0.377 indicating only a fair agreement between the two criteria.

Discussion

In the present study, the prevalence of OA was found to be 17% in the total population with a prevalence of 15.5% in males and 18.8% in females by the modified ACR criteria,

Table 3: Age-specific prevalence of osteoarthritis

Age	No. of respondents	Prevalence of osteoarthritis (No (%)	
		Modified ACR criteria	EULAR criteria
18-39	165	4 (1.16)	0 (0)
40-49	64	9 (2.63)	2 (0.58)
50-59	53	12 (3.50)	7 (2.04)
60-69	29	12 (3.50)	3 (0.87)
≥ 70	31	21 (6.14)	7 (2.04)

Table 4: Factors associated with osteoarthritis of the knee

Associated factors		Modified ACR positive for knee OA		
		Frequency (%)	P value	OR(CI)
Age	Elderly(≥60)	33(54.1)	<0.0001	12.07(6.01-24.41)
	Non-elderly (<60)	25(8.9)		
Gender	Male	23(14)	0.165	0.67(0.36-1.23)
	Female	35(19.7)		
Education		19(8.5)	0.0001	5.23(2.75-10.05)
Knee injury		29(8.5)	0.046	3(0.91-5.68)
Regular climbing of a flight stairs		43(12.6)	0.0001	24.48 (6.75-96.77)

*** NS – not significant**

and 5.6% in the total population, 4.2% in males and 6.8% in females by EULAR 2009 criteria. As per the modified ACR and the EULAR 2009 criteria, the prevalence in the elderly (60 and above) population was 54.1% and 16.4% respectively. Among the total study population of 342 subjects, the females comprised of 52.1%. This was probably because many males were not present at the house at the time of the study. In the population studied, we found a discrepancy between the Standard of Living Index (SLI) and the per capita income. 58.5% of the population came under the high SLI category whereas 89.5% of the population reported a per capita income of less than Rs 1926. We concluded that the disagreement may be due to the SLI being an objective measure and the under-reporting of income. The percentage of uneducated subjects was 35.1%. The prevalence of OA in the adult population was found to be much higher using the modified ACR criteria as compared to the EULAR 2009 criteria. The prevalence of OA in the adult population according to the EULAR 2009 criteria was found to be 5.6%, which is closely correlated with previous studies reported from India.[4, 14] In the study by Chopra *et al.*, the prevalence of knee OA was found to be 5.8% in rural Bhigwan, whereas the study by Joshi *et al.*, done in urban Pune found the prevalence to be 6.46%.[4, 14] In the study by Chopra *et al.*, the prevalence of knee OA was found to be 5.8% in rural Bhigwan, whereas the study by Joshi *et al.*, done in urban Pune found the prevalence to be 6.46%.[4, 14] The studies done in Bhigwan and Pune used

Table 5: Factors associated with osteoarthritis of the knee in adults and the elderly

Associated factors			EULAR 2009 criteria	
			Frequency (%)	P value
Gender	Adults (>18)	Male	7 (4.2)	0.29
		Female	12 (6.8)	
	Elderly (>60)	Male	4 (11.76)	0.27
		Female	6 (22.22)	
Education	Adults (>18)	Educated	5 (26.31)	0.00025
	Elderly (>60)	Educated	1 (10)	0.2019
Occupation	Adults (>18)	Agriculture	6 (4.9)	0.64
		Homemaker	12 (7.2)	
		Labor	0 (0)	
		Others	1 (2.1)	
		Unemployed	0 (0)	
	Elderly (>60)	Agriculture	4 (13.3)	0.65
		Homemaker	6 (24)	
		Labor	0 (0)	
		Others	0 (0)	
		Unemployed	0 (0)	

Table 6: Comparison of EULAR vs. modified ACR criteria for classifying OA

OA Criteria	ACR-positive	ACR-negative	Total
EULAR positive	18 (94.7%)	1 (5.3%)	19
EULAR negative	40 (12.4%)	283 (87.6%)	323
Total	58	284	342

the modified ILAR COPCORD questionnaire and knee OA was diagnosed by the ACR criteria and symptomatically; and only a small percentage of those diagnosed were confirmed by radiography.[4, 14] A study done in a South Delhi using the ACR clinical criteria for the diagnosis of knee OA, measured the prevalence to be 47.3% in women ≥40 years.[3] In the current study, though the prevalence in the adult population was found to be slightly higher in females with both the criteria used, it was not statistically significant. In the elderly (60 and above), there was a significant association between OA and the female gender, which may be related to the increased risk of OA in postmenopausal women.[11] In compliance with the previous studies, a higher prevalence of OA with increasing age has been noted.[11] In a study done in Jammu and Kashmir, one third of the population above the age of 65 was found to have OA.[7]

On comparison of the two criteria used in the current study, it was found that the EULAR 2009 criteria is a simpler tool to arrive at a diagnosis and perhaps easier to use in a busy outpatient setting, since it required all the six criteria to make a positive diagnosis and did not involve the use of combinations. However, due to the above requirement, we have also observed that it missed out on many cases of OA, picked up by the ACR criteria. This could be the reason for EULAR 2009 criteria indicating a lower prevalence of knee OA as compared to the modified ACR criteria. However, the EULAR 2009 criteria are a highly specific tool for the diagnosis with very low false positivity, as validated by previous studies.[1] The EULAR 2009 criteria was developed on the basis of evidence-based review from 1950 to 2008 and expert consensus from different countries for the clinical diagnosis of OA. It focused on clinical diagnosis rather

than classification, and can be generalized to different populations.[1] The EULAR 2009 criteria had a specificity of 99% when all the six criteria were taken into consideration. Hence, diagnosis of OA can be confirmed without the need for radiographic investigations.[1] The ACR criteria, on the other hand, are a useful tool for classification of knee OA, developed using hospital-referred patients and a control group that comprised of patients with other arthritis (over 50% had rheumatoid arthritis), thus, making them useful for differentiation of knee OA from inflammatory arthritis.[1] The sensitivity and specificity of the ACR criteria are 91% and 86% respectively.[6] There was a moderate agreement between the two criteria for the diagnosis of OA in the adult population, while there was only a fair agreement in the elderly subgroup.

In the current study, we found a significant association between OA and advancing age, poor education, lower socioeconomic strata, previous history of knee injury and history of regular climbing of flights of stairs. This finding was similar to other studies conducted both in India as well as in western countries.[2, 3, 10, 11] Patients with poor education and from a lower socioeconomic strata have a greater predilection to develop OA, since they are more likely to take up occupations such as farming and manual labor. These occupations are known to be risk factors for OA due to the involvement of repeated knee bending.[2] Previous injury to the knee is another well-known risk factor for the development of secondary OA.[2, 8] We did not find a significant association of factors such as female gender in the non-elderly population, body mass index, and family history of OA, which have been found in other studies.[9,12] The low prevalence of obesity in the rural population could be the probable reason for not finding an association between body mass index and knee OA. We did not find an association with female gender and OA in the non-elderly population, although there was a significant association between the two in the elderly subgroups. The limitations of the study include the relatively small sample size, the absence of radiographic confirmation of the findings using the two criteria as also the failure to exclude other possible diagnoses.

Conclusion

The prevalence of OA in the rural population of Bangalore district is 17% according to the ACR criteria and 5.6% as per the EULAR 2009 criteria in adults. The factors associated with OA are advancing age, lower socioeconomic strata, lesser education, previous knee injury, and regular climbing of stairs. Female predisposition was seen in elderly but not in younger patients with OA. In rural population, high body mass index and a positive family history of OA showed no significant relationship with OA. There is a moderate agreement between the modified ACR and the EULAR 2009 criteria.

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Competing interests

The authors declare that they have no competing interests.

Citation

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