

Original Research Article

An Assesment of the Severity of Knee Osteoarthritis in the University of Benin Teaching Hospital

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Abstract: Osteoarthritis is the most common arthritis affecting millions of people worldwide. Knee osteoarthritis calls for serious medical concern as severe cases/advance stages can impair mobility and lead to a poor quality of life. The objective is to assess the severity of knee osteoarthritis and to determine its association with demographic data. This descriptive consecutive study assesses the severity of osteoarthritis by the use of a questionnaire administered to patients visiting the Orthopedic and Rheumatology Departments of the Hospital. Data collected were entered into Microsoft excel and exported into the statistical package for social science which was used to assess the association between socio-demographic data and severity of the disease. *P*-value less than 0.05 was interpreted to be statistically significant. Only 209 patients were included in the study and the severe, very severe and extremely severe cases accounted for 17.6%, 23.7%, and 44.0% of the cases respectively. Females accounted for 69.9% of the study participants and they also had more severe cases than males. Sex, advanced age, a high body mass index and co-morbid disease condition (Hypertension) were highly associated with the severity of osteoarthritis (*p*-value <0.05). The majority of the cases of osteoarthritis were either very severe or extremely severe and these cases were mostly reported by females, older patients, overweight or obese patients and those that have hypertension as a co-morbid condition.

Keywords: Osteoarthritis, Knee, Severity, Patients, Pains, comorbidity.

INTRODUCTION

Osteoarthritis is a long term chronic disease characterized by the deterioration of the cartilage in joints which leads to the loss of smooth glide thereby resulting in joint pains, swellings, tenderness, crepitus, limitation in the range of motion and the reduction of articular joint space. Osteoarthritis can be described as use related joint pain experienced frequently without any other known cause [1]. It is the most common joint disease, a major cause of disability [2], the fourth most common predictor of health problems in women and the eighth most common predictor amongst men worldwide [3]. Osteoarthritis is the most prevalent form of arthritis affecting 12.1% of the adult population [4] and found to be the 10th leading cause of disability in the United States of America [5].

Osteoarthritis can be defined as radiological, clinical, or subjective. Radiological disease in osteoarthritis is most widely assessed in studies using the Kellgren and Lawrence score. The World Health Organization (WHO) adopted these criteria as the standard for epidemiological studies on osteoarthritis [6]. There are usually no known associations between

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severity of radiological stage of osteoarthritis and the pain intensity [2] since clinical symptoms have only been reported in only 40% of patients with moderate radiographic knee osteoarthritis and 60% of those with severe radiographic osteoarthritis [7]. Clinical osteoarthritis is based on presenting features on examination and history taking. These features may include osteophytes formation, swelling, crepitus, and bony enlargements. Subjective osteoarthritis is based on the signs and symptoms reported by the patient.

Several risk factors for the development of osteoarthritis have been identified and they include age, sex, body mass index (BMI), occupation etc. However, not all have been associated with its progression. An association has been shown between Body Mass Index and the risk of knee osteoarthritis. Jiang *et al.*, 2012 have demonstrated that for every 5 unit increase in BMI, the associated increased risk of knee osteoarthritis was 35% and this association was found to be stronger in women than in men (8). It's estimated that the lifetime risk of developing knee osteoarthritis to be about 40% in men and 47% in women and a BMI of $\geq 30\text{kg/m}^2$ appears to increase it to 60% [9].

Body mass index above 25kg/m^2 is a significant factor for the development of knee osteoarthritis. This is corroborated by a study by Fowler-Brown that an increase in BMI by 5kg/m^2 corresponds to a 32% chance of developing knee osteoarthritis and that the hormone leptin may account for half of the total effect of BMI on knee osteoarthritis [10]. This is because its expression was significantly increased in osteoarthritis patients than in normal persons [11]. These findings further prove that apart from the mechanical effect of obesity on knee joints there also exists a metabolic and biomechanical link between them [12]. More so, elevated level of leptin in synovial fluid and the presence of leptin receptors on cell surfaces are pointers to the fact that leptin may play a role in the pathogenesis of osteoarthritis [13].

An increase in the severity of knee osteoarthritis impacts significantly on the quality of life of individuals. This reflects in the inability or difficulty to undertake activities of daily living due to physical limitation and functional impairment [14] thereby leading to a loss in productive hours. Activities that require repetitive and arduous use of the knee such as certain sporting activities, kneeling, squatting, lifting, climbing and occupational mechanical loading can contribute to the severity of knee Osteoarthritis. Hence workplace interventions and policies to mitigate these hazards should be considered.

According to Lequesne algofunctional index, the severity of knee osteoarthritis can be classified into 5 categories as mild, moderate, severe, very severe and extremely severe [15]. Although Population-based data on severity of hip and knee osteoarthritis is largely lacking, Cross *et al.*, 2014 postulated that there are more moderate to severe osteoarthritis cases in low and middle-income nations and more mild cases in high-income nations [16].

OBJECTIVES

The aim of this study is to assess the severity of knee osteoarthritis and to investigate any relationship with demographic data.

ETHICAL APPROVAL

Ethical approval was obtained from the Ethics and Research committee of the University of Benin Teaching Hospital (UBTH), Benin City, Edo State with the approval number ADM/E 22/A/VOL. VII/14783.

METHODS

SETTING

This descriptive consecutive study was conducted at the Orthopedic and Rheumatology Departments of the University of Benin Teaching Hospital (UBTH). UBTH is a tertiary healthcare facility established on May 12th 1973. It has over 1000 bed space and several departments such as pediatrics, internal medicine, family medicine, radiology, orthopedic, surgery, ophthalmic etc.

SUBJECTS AND SAMPLE SIZE DETERMINATION

The subjects for this study were patients visiting the Orthopedic and Rheumatology Departments of the University of Benin Teaching Hospital who were diagnosed with knee Osteoarthritis by an orthopedic physician.

Sample size was calculated to be 384 using the Cochran formula. However, due to patients shortage only 209 patients were obtained for the study. Hence a statistical technique of resampling with replacement (bootstrap) was applied to create 1000 virtual patients for analysis to ensure that study is adequately powered.

INCLUSION CRITERIA

Patients diagnosed with knee osteoarthritis and willing to participate were included in the study. Those unwilling to participate and those with osteoarthritis of other joints were excluded.

CONSENT TO PARTICIPATE

Patients were assured of anonymity and informed consent was sought and obtained from them before they were enrolled in the study.

THE INSTRUMENT

The questionnaire consists of 2 sections. Section one consists of socio-demographic information which include sex, age, BMI, marital status, occupation, educational level, family history of osteoarthritis, comorbid condition, smoking, and alcohol consumption. Section 2 has 3 specific domains that assessed pain and discomfort, maximum distance walked and activities related to daily living. For example, patients were requested to respond to the following: “do you feel pains when walking?”, “what is the maximum distance you can walk?”, “are you able to climb up and down a staircase?” etc.

Data Collection

Data was collected by the use of a standard questionnaire (Lequense algofunctional index of severity for osteoarthritis of the knee) designed to assess the severity of knee osteoarthritis. All the patients were approached after consultation with the doctor at the orthopedic and rheumatology clinics and those that met the inclusion criteria were included. The items on the questionnaire were explained to patients unable to read and write and their responses were noted. Those that are able to read and write were unaided.

Data Analysis

Data collected were entered into Microsoft excel and exported into the statistical package for social sciences (SPSS) version 22 for descriptive statistics which was expressed in frequencies and percentages. Raw scores were obtained for each domain and were added up to get a total index score for each patient. The respondents’ scores from the questionnaire were classified as follows: ≥ 14 (extremely severe), 11-13 (very severe), 8-10 (severe), 5-10 (moderately severe), 1-4 (mild) and 0 (none). Chi-square analysis was done to assess the effect of socio-demographic data on the severity of the disease. Graph pad instat 3.10 was used to evaluate associations between severity and demographics and p-values ≤ 0.05 , was interpreted to be statistically significant.

The reliability of the 11 items in the questionnaire was explored through computation of Cronbach alpha. And factor loading was calculated using varimax rotation with Kaiser normalization to explore internal consistency.

RESULTS

Socio-demographic information of respondents is shown in table one. A total of 209 patients were included in the study. Females (146, 69.9%) were more affected than male (63, 30.1%) respondents. The age range most commonly affected by the disease is 60-69yrs (77, 36.8%). Participants were mostly self-employed (92, 44%) and retired (83, 39.7%). The majority of them were either overweight (58, 27.8%) or obese (99, 47.4%), married (172, 82.3%), and had primary (64, 30.6%) and secondary education (72, 34.4%). Only one patient (0.5%) smoked and 29 (13.8%) drink alcohol. Most of the patients (74.2%) had hypertension while only 22% had diabetes. The majority (126, 60.3%) reported a family history of osteoarthritis.

Table-1: Socio-Demographic data of patients. (N=209)

Socio-demographic data	Variable	Frequency	Percentage (%)
Sex	Male	63	30.1
	Female	146	69.9
Marital Status	Married	172	81.9
	Divorced	5	2.4
	Widowed	26	12.4
	Separated	5	2.4
	Single	1	0.5
Occupation	Student	1	0.5
	Government worker	20	9.5
	Self-employed	92	43.8
	Unemployed	5	2.4
	Private Sector worker	8	3.8
Age	Retired	83	39.5
	30-39	3	1.4
	40-49	20	9.6
	50-59	54	25.8

Socio-demographic data	Variable	Frequency	Percentage (%)
	60-69	77	36.8
	70-79	39	18.7
	≥80	16	7.7
BMI (Kg/m²)	<18.5	2	1
	18.5-24.9	50	23.9
	25-29.9	58	27.8
	≥30	99	47.4
Family History	Yes	126	60.3
	No	83	39.7

The reliability of the questionnaire as determined by Cronbach alpha was 0.74 and none of the 11 items had a factor loading less than 0.4 hence all the items were contributing to the summary severity scores.

Table-2 shows the frequency distribution of the Lequesne Algofunctional index categories of reported knee osteoarthritis severity from the resampled data. The majority (44%) of the patients reported extremely severe knee osteoarthritis, 23.7% reported very severe disease conditions while only 18 (1.8%) reported mild/minor disease.

Table-2: Frequency distribution of knee osteoarthritis severity based on Lequesne Algofunctional index of severity from resampled data (N=1000)

Lequesne algofunctional index of severity	Frequency (%)
Minor (0-4)	18 (1.8)
Moderate (5-7)	129 (12.9)
Severe (8-10)	176 (17.6)
Very severe (11-13)	237 (23.7)
Extremely severe (>14)	440 (44.0)

Table-3 shows that cases amongst females (517, 73.92%) were very severe/extremely severe as against (164, 53.6%) men. Patients between 50-69 years had a higher percentage of very severe and extremely severe cases (74.2%) of knee osteoarthritis while younger patients between 30-49 years had the lowest incidence of either very severe and extremely severe cases (55, 56.12%) or mild/moderate cases (5.7%).

Obese and extremely obese patients (BMI ≥ 25kg/m²) recorded very high cases of very severe/extremely severe cases (533, 71.17%) as against patients with BMI ≤ 24.9kg/m² (144, 57.37%). Patients with lower BMI also recorded lower cases of mild/moderate disease condition. Patients who had hypertension as a comorbid condition were found to have the highest proportion of very severe/extremely severe (562, 74.83%) knee osteoarthritis. Diabetic patients have the least number of either very severe/extremely severe cases (132, 60.87%) or mild/moderate cases (17, 7.83%). The *p*-value for all the demographic variables was less than 0.05 hence association between demographics and severity was considered to be statistically significant.

Table-3: An assesment of the association between severity and demographic factors. (N=1000)

Demographic Variable	Severity (%)					Total	P value
	Mild	Moderate	Severe	Very severe	Extremely Severe		
Sex							
Male	3(0.98)	72(23.53)	67(21.90)	57(18.63)	107(34.97)	306	0.0001
Female	15(2.16)	57(8.21)	109(15.71)	180(25.94)	333(47.98)	694	
Age(years)							
30-49	3(3.06)	2(2.04)	38(38.78)	23(23.47)	32(32.65)	98	0.0001
50-69	9(1.40)	95(14.73)	126(19.53)	150(23.26)	265(41.09)	645	
≥70	6(2.33)	32(12.45)	12(4.67)	64(24.90)	143(55.64)	257	
BMI(kg/m²)							
<18.5-24.9	3(1.20)	54(21.51)	50(19.92)	38(15.14)	106(42.23)	251	0.0001
≥25.0	15(2.00)	75(10.01)	126(16.82)	199(26.57)	334(44.60)	749	
Comorbid conditions							
Diabetes	3(1.38)	14(6.45)	68(31.34)	49(22.58)	83(38.29)	217	0.0003
Hypertension	11(1.46)	59(2.26)	118(15.71)	181(24.10)	381(50.73)	750	
Ulcer	3(1.15)	17(6.54)	46(17.69)	71(27.31)	123(47.31)	260	

DISCUSSION

The severity of knee osteoarthritis of patients visiting the Orthopedic and Rheumatology departments of UBTH was studied and a possible association with age, sex, body mass index and comorbid condition was also explored.

It is important to assess the severity of knee osteoarthritis and classify the different stages as it's helpful in determining the appropriate treatment options, monitoring patient's response to treatment as well as assessing disease progression [17]. This study showed that 85.3% of patients fall within the category of severe, very severe and extremely severe knee osteoarthritis. This appears to imply that subjects in this study with osteoarthritis don't usually seek medical attention or resort to self-help at the onset of the disease condition. Literature evidence confirms that medical attention is often sought only in severe or extremely severe stages [18, 19]. This attitude also portends a very poor prognosis for knee osteoarthritis as a significant/irreversible damage would have been done to the articular structures. However, a few patients had minor/moderate cases. These few cases could be on account of those who seek prompt medical attention at the early stage of the disease or as a result of a positive response to therapy as some of the patients have been on medication.

From the results, osteoarthritis of the knee is more prevalent and severe in females than in males. This is consistent with other studies [20, 21]. This could be as a result of reduced volume of cartilage, bone loss or lesser muscle strength in women [22]. Also, the loss of protective effect of estrogen after menopause has been reported to play a role as the disease prevalence usually increases dramatically around the time of onset of menopause. This is corroborated by data from women's health initiative which showed that women on estrogen replacement therapy were 15% less likely to undergo knee or hip arthroplasty than those not taking such therapy [23]. However, there is a comparable prevalence of osteoarthritis among male and female until menopause sets in for women.

Although osteoarthritis is majorly known to be a disease of the elderly, a few cases were recorded among participants aged between 30-49 years. Other factors such as regular use and arduous use of knee, injury, trauma, genetic factors etc. may be responsible for this. The disease was found to be more prevalent and severe in patients within the age bracket of 50-69 years. This is possibly use related over time as age is considered a major factor for the degeneration of knee articular structures [24]. Disease severity was found to be lower in younger patients (30-49 years). This further corroborates the fact that osteoarthritis is an age-related disorder. Although the causes of osteoarthritis are multifactorial, aging makes the musculoskeletal system to be more susceptible to other factors responsible for disease onset and progression [24, 25] such as degenerative changes in the meniscus and joint ligaments, increased bone turn over and calcification of joint tissues. Also, basic cellular mechanisms that maintain tissue homeostasis deteriorate with advancing age. This leads to an inadequate response to stress or joint injury and then resultant joint tissue destruction and loss.

The BMI which is defined as the body weight in kilogram (kg) divided by height in meter square (m²) is employed as a measure of obesity in individuals. Obesity is considered one of the strongest and well known risk factors of osteoarthritis [26, 27]. Majority (74.9%) of the patients in this study are obese (BMI \geq 30kg/m²) or overweight (BMI=25-29.9kg/m²). This buttresses the findings of several studies [9, 28]. However, finding normal/underweight patients (25.1%) with osteoarthritis appears to supports the evidence that in addition to mechanical factors, metabolic and other psychosocial factors may also play a role in the pathogenesis of the disease condition [29].

In addition to being a contributing factor in the pathogenesis of osteoarthritis [28], obesity is also seen here to play a role in the severity of osteoarthritis of the knee. Obese patients apart from having the highest number of cases also have a higher percentage of very severe and extremely severe cases. This further gives credence to the findings of a study by Grotle which established a strong relationship between body weight and knee osteoarthritis [30]. A strong relationship was also established between BMI and pain severity in knee osteoarthritis by Creamer *et al.*, [31]. Hence weight loss is considered one of the major strategies of reducing the risk of development of knee osteoarthritis [32]. Although underweight and normal-weight patients still recorded very severe and extremely severe cases, this was very low. Multifactorial nature of the causes of osteoarthritis could be responsible for the prevalence and severity of osteoarthritis in normal and underweight patients.

Results show that 60.3% of participants reported a family history of the disease which is in congruence with a previous report that between 50-65% constitutes the heritable component of osteoarthritis [33].

A high prevalence of hypertension among the patients may be due to the frequent and prolonged use of NSAIDs which are known to be a harbinger of hypertension [34]. Patients with hypertension were also associated with more severe cases of osteoarthritis of the knee. A possible explanation for this is the ability of NSAIDs to inhibit prostaglandin vasodilating effects on blood vessels and the inhibition of natriuresis thereby leading to the accumulation of sodium [35]. Since NSAIDs are highly associated with hypertension [36, 37], cardiovascular risks must be considered when

recommending them. However there is no way of confirming in this study if the higher cases of hypertension were as a result of NSAIDs use or idiopathic in nature.

CONCLUSION

In this study, it was discovered that the majority of the cases of knee osteoarthritis were either very severe or extremely severe. The incidence appears to be greater in females, older patients, overweight or obese and hypertensive patients, who also reported more severe cases of knee osteoarthritis. Patients should be encouraged to seek medical help early for their conditions.

DECLARATIONS

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Conflict of Interest

- There are no conflict of interest whatsoever with respect to this article.
- The authors have no relevant financial or non-financial interests to disclose.
- All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.
- The authors have no financial or proprietary interests in any material discussed in this article.

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