Research article

Prevalence and pattern of knee osteoarthritis in patients presenting at a rheumatology clinic of a tertiary hospital in north east Nigeria

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Abstract

Background: Osteoarthritis (OA) is the most common joint disease in the world and a major cause of morbidity and activity limitation. It is among the top 5 causes of disability especially in people aged 45 years and above.
Objectives: This study aimed to determine the pattern and radiographic features of knee OA and its association with pain, age and BMI in patients presenting at the rheumatology clinic of the University of Maiduguri Teaching Hospital, Nigeria.
Method: This was a descriptive cross-sectional hospital-based study. Consecutively presenting adults satisfying the 1986 American College of Rheumatology criteria for knee OA were recruited from March to October 2015. Detailed history, physical examination of the knee and anthropometric measurements were obtained. Pain and functional status were assessed using Visual Analogue Score (VAS) and Steinbrocker's criteria respectively. Blood samples for biochemical profiles were obtained. Standard radiographs of the knee in both anteroposterior and lateral views were taken.
Results: Four hundred and fifty-one patients with rheumatic complaints were seen at the clinic, out of whom 244 (54.1%) had knee OA. There were 63 (25.8%) males and 181 (74.2%) females with a male to female ratio of 1:2.9. The median age was 50 years (IQ range 45-57). All (100%) patients reported knee pain with a median duration of pain of 24 months (IQ range 12 -48) and mean VAS score 8.59±1.14. Two hundred (82%) had bilateral knee OA. The mean BMI was 32.20±5.95Kg/m^2. Two hundred and four (83.6%) were in functional class II and III. The median ESR was 13 (IQ range 5 - 29.5). One hundred and seventy-four (71.4%) patients' radiographs showed KL grade III (48.4%) and grade IV (23%). The combined medial and patella femoral compartment OA was observed in 93 (38%) patients. There was a significant association between age, BMI, functional class, pain severity and the KL grading.
Conclusions: Knee osteoarthritis is the most common rheumatic disease in our clinic. The commonest radiographic pattern is the combined medial and patellofemoral compartments. There is significant correlation between age, pain severity and BMI with KL grading of the knee.

Key words: Knee osteoarthritis, Prevalence, Pain, Kellgren-Lawrence grade.

Introduction

Osteoarthritis (OA) is the most common joint disease in the world, with an age-associated increase in both incidence and prevalence[1]. It is a major cause of morbidity, activity limitation, physical disability, excess health care utilization and reduced health-related quality of life and ranks among the top 5 causes of disability especially in people aged 45 years and above[1].

Diagnosis of OA is based on the combination of clinical findings and radiographic changes. Age is the strongest risk factor for knee OA. Other major risk factors for osteoarthritis are female sex, obesity, diabetes, geographic factors, occupational knee-bending, physical labour, genetic factors, race and joint trauma[2,3].

Although osteoarthritis occurs worldwide, both its pattern and prevalence vary among populations, and from place to place[4]. Knee joint is the commonest site affected by OA in Nigerians[5-8], with the prevalence of symptomatic knee OA ranging from 16.3 to 61.2%.

A study comparing radiographic features of knee OA in Beijing to the Framingham study showed gender difference in prevalence, with 42.8% in women and 21.5% in men in Beijing compared to 34% in women and 31%

in men in the Framingham cohort[9]. Osteoarthritis of the knee has significant functional impact and is associated with considerable medical costs. In the United States for instance, it accounted for 97% of the 455,000 total knee replacements for arthritis in 2004[10]. The burden tends to be higher in developing countries including Nigeria, due to delay in diagnosis and lack of access to specific interventions such as arthroplasty, joint replacement, and rehabilitation, among others[11].

Despite the global distribution of OA, there exists some geographic variation in occurrence and/or pattern of the disease. These variations can be exploited for a better understanding of the risk factors, aetiology and pathogenesis of the disease[12]. There are few epidemiological studies on the pattern of knee OA in Nigeria, and the sub-Saharan Africa. We performed a cross sectional study to determine the clinical, radiographic and biochemical profiles of patients with knee OA in a rheumatology clinic at a tertiary hospital in Nigeria.

Materials and Methods

The study area: The study was conducted at the Rheumatology Clinic of the University of Maiduguri Teaching Hospital (UMTH).

Ethical approval was obtained from the hospital ethics and research committee, and the HELSINKI declaration was adhered to. Informed written consent was obtained from each patient.

Study design: A cross sectional, descriptive hospital based study was conducted in consecutive adults presenting with clinical and/or radiological features satisfying the ACR criteria for knee OA[13] from March through October 2015. Inflammatory arthritis, previous knee surgery, congenital abnormalities of the knee and hip, traumatic injury to the knee, crippling arthritis and refusal of consent served as exclusion criteria. A sample size of 224 was arrived at using a community prevalence of 16.3% for knee OA[14,15].

Study procedure: Two hundred and forty-four patients satisfying the inclusion criteria were consecutively recruited. Information including biodata, medical history and clinical examination findings, laboratory parameters, and radiographic findings was collected using a pre-tested, interviewer-administered questionnaire. History of the presenting knee pain as well as its severity and duration, were obtained and the patient's functional status determined. Severity of pain was assessed using visual analogue scale of 0 to 10, with 10 being maximum pain experienced while 0 is no pain. Scores of ≤ 4, 5 to 7, and ≥ 8 were considered mild, moderate and severe respectively. Functional disability was assessed using Steinbrocker's criteria[16]. Blood pressure and anthropometric variables were measured using standard procedures, and Body Mass Index (BMI) in Kg/m^2 determined.

Each knee was examined separately for varus or valgus deformity, effusion, joint line tenderness and crepitus. The Range of Motion (ROM) and alignment of the knee joint was measured using an International Standard Goniometer. Quadriceps strength was graded using the medical research council grading scale. Blood samples were obtained for measurements of haematocrit, ESR and other biochemical parameters.

All patients had standard anteroposterior (AP) and lateral semi-flexed radiographs of their knees in weight bearing position taken by qualified radiographers. The radiographs were independently interpreted and graded by a radiologist and the first author using the Kellgren and Lawrence Criteria[17], and both agreed on the different grades. Grades 2 to 4 were considered diagnostic of radiographic OA while grades 0 and 1(with appropriate clinical features) were considered clinical OA.

Statistical analysis: Data was analyzed using SPSS version 22.0 software (SPSS Inc., Chicago, IL, USA). Normality of continuous variable was assessed using the Kolmogorov- Smirnov test. Normally distributed variables were expressed as mean ±SD while skewed variables were expressed as median and inter-quartile. Independent t-test was used in comparing means of continuous variables and Mann-Whitney test was used in comparing medians of skewed variables. Categorical variables were presented as percentages and compared using Fisher's exact Chi-square test of association. Spearman's ρ(rho) correlation coefficient was used in computing associations between age and BMI with various categories of KL grades. Kendall'sτ (tau) was used in correlating various categories of functional class and pain score with various categories of KL grades. A p value of <0.05 was considered statistically significant.

Results

Demographics: During the study period, 451 rheumatological cases were seen at the rheumatology clinic of UMTH, out of whom 244 (54.1%) met the ACR clinical and/or radiological criteria for knee OA. There were 63 males and 181 females with male to female ratio of 1:2.9. The baseline demographic and clinical characteristic of the patients is presented in Table 1.

Table 1: Demographic characteristic of patient with knee OA

Characteristic	n (%)
Age (years)	1 (0.4)
18 – 24	5 (2.0)
25 -34	35 (14.3)
35 - 44	95 (38.9)
45 – 54	78 (32.0)
55 – 64	30 (12.3)
≥ 65	
Gender	63 (25.8)
Male	181 (74.2)
Female	
Occupation	60 (24.6)
Civil servant	10 (4.1)
Teaching	6 (2.5)
Farming	82 (33.6)
Private skill workers	86 (35.2)
Unemployed	
Anthropometry	
Height (mean±SD)	1.64±0.07m
Weight (mean±SD)	86.72± 1.65kg
Waist circumference (mean±SD)	101± 12.65cm
BMI (Kg/m^2)	
18.50 - 24.90	18 (7.4)
25.00 - 29.90	72 (29.5)
30.00 - 34.90	72 (29.5)
35.00 - 39.90	59 (24.2)
> 39.90	23 (9.4)
Functional class	
Class I	38(15.6)
Class II	146 (59.8)
Class III	58 (23.8)
Class IV	2 (0.8)

The median age at presentation was 50 (IQ range 45 -57). The median duration of pain reported was 24 months (IQ range 12-48). Two hundred (82%) patients reported bilateral knee pain, while 44 (18%) had pain in either knee. Scores of ≥ 8 on VAS was reported by 124 (50.8%) patients. The characteristic of pain based on gender is shown in Table 2.

Table 2: Characteristic of pain according to gender of the study population

	Male n=63	Female n=181	P value
Duration of pain (median month)	24	33	0.167*
Time to develop pain after walking (median time in minutes)	60	45	0.047*
Pain at rest, n (%)	28 (43.8)	118(65.6)	0.474$^+$
Pain on standing > 30min, n (%)	46 (71.9)	154 (85.6)	
Pain on sitting > 2 hours, n (%)	56 (87.6)	172 (95.6)	
Visual analogue score for pain			
≤ 4, n (%)	2 (3.1)	2 (1.1)	0.085$^+$
5 -7, n (%)	35 (56.2)	81 (44.4)	
≥ 8, n (%)	26 (40.6)	98 (54.4)	

*Mann–Whitney U test, + Chi square n=number

Knee stiffness of less than 30 minutes was reported by 126 (51.6%) patients, whereas swelling of the knee and crackling were reported by 46 (18.9%) and 200 (82%) respectively. Seventy (28.7%) felt as if their knee is 'giving way' while walking and 84 (34.4%) had at least one episode of locked knee. Family history of knee OA was obtained in 118 (48.4%) patients, while 54 (29.8%) females were postmenopausal. Cigarette smoking and alcohol ingestion was reported by six (9.5%) males respectively. Diabetes mellitus was reported by 40 (16%) of patients and hypertension was present in 144 (59%). Other comorbid conditions were fibroid (6.6%), asthma (1.6%) andrenal stones (0.82%). Anthropometric variables are illustrated in Table 1. The mean BMI was 32.20±5.95kg/m^2. Thirty-five (55.6%) males and 119 (65.7%) females had BMI ≥ 30kg/m^2. Two hundred and four (83.6%) were in Steinbrocker's functional class II and III. The mean haematocrit recorded was 36.9±4.7%, and median Erythrocyte Sedimentation Rate (ESR) of 13 mm in the first hour (IQ range 5-29.5).

Table 3 shows the various signs and deformities seen when both knees were examined. Commonest sign demonstrated were crepitus (81% of both knees), joint line tenderness (55.7% of both knees), and varus deformity (23.7% bilaterally). Right knee effusion was found in 46 (18.9%) patients and left knee effusion in 29 (11.5%) patients. Bilateral knee effusion was seen in 23 (9.4%) patients. Quadriceps strength of less than or equal to 4/5 was observed in 83 (34%) patients. Seventy-two (29.5%) females and 11 (4.5%) males had reduced quadriceps strength.

Table 3: Signs of knee OA amongst the patients examined

Sign	Right knee n (%)	Left knee n (%)	Both knees n (%)
Varus deformity	82 (33.6)	69 (26.2)	58 (23.7)
Valgus deformity	68 (27.9)	20 (8.2)	53 (21.7)
Flexion contraction	58 (23.7)	16 (6.6)	54 (22.1)
Hyperextension	17 (7.0)	14 (5.7)	11 (4.5)
Knee effusion	46 (18.9)	29 (11.5)	23 (9.4)
Tenderness	153 (62.3)	46 (18.9)	136 (55.7)
Crepitus	222 (91)	220 (90.2)	198 (81)
Ligament instability	12 (4.9)	8 (3.3)	5 (2.0)
Quadriceps strength ≤4/5*	100 (41)	92 (37.9)	83(34)

*medical research council grading of power

Radiological features of knee OA: Table 4 shows the various Kellgren-Lawrence (KL) grades and the knee compartments affected. Four hundred and seventy knees (97.5%) were KL grade II and above, while 12 (2.5%) were of grade I and below (clinical OA).The most common compartment affected by OA in both knees was the combined medial and patellofemoral compartments (37.7% on the right and 38.1% on the left). Pure lateral compartment was the least, observed in eight (1.6%) patients of which Six (9.5%) were males and two (1.1%) were females.

Table 4: Radiological findings of knee OA

Characteristic	Category	Right knee n (%)	Left knee n (%)
KL grade	Grade 0	8 (3.1)	8 (3.3)
	Grade I	6 (2.4)	6 (2.5)
	Grade II	50 (19.7)	56 (22.9)
	Grade III	110 (43.3)	118 (48.4)
	Grade IV	80 (31.5)	56 (22.9)
Knee compartment	Medial (M)	78 (32.0)	84 (24.4)
	Lateral (L)	4 (1.6)	4 (1.6)
	Patellofemoral (PTF)	10 (4.1)	6 (2.5)
	Medial and lateral	2 (0.8)	2 (0.8)
	Medial and PTF	92 (37.7)	93 (38.1)
	Lateral and PTF	2 (0.8)	2 (0.8)
	M, L and PTF	44 (18.0)	40 (16.4)

There was a significant, albeit weak correlation between age and various KL grades (r =0.16, p=0.012, and r =0.21, p=0.004, for the right and left knee respectively). BMI was significantly correlated with the KL grade (r=0.244, p<0.001, and r=0.237, p<0.001, for right and left respectively). A positive correlation was seen when pain severity was compared to KL grades (r=0.128, p=0.035, and r=0.117, p=0.006, for right and left knees, respectively). Similarly, the functional status was significantly correlated to the KL grades (r = 0.278, p<0.001, and r= 0.22 p=0,001, for right and left knee, respectively).

Discussion

Osteoarthritis constitutes 54.1% of all the rheumatic diseases seen during the study period, signifying that, it is the commonest rheumatological disorder necessitating hospital visit. This study also shows that it commonly affects middle age, obese patients and is associated with marked limitation of physical activity.

Most of the patients presented late, probably because of the dissociation between joint damage and pain which is the commonest clinical symptom. These findings are consistent with what has been reported by other researchers[18,19].

The median age of 50 years at presentation in our cohorts reflects the common presentation of patients with OA of the knee in middle age as reported by other workers[5,8,20]. Age is the strongest risk factor for knee OA[21,22]. This higher age of presentation in our study reflects the increasing occurrence of knee OA with ageing.

The predominance of females (74.2%) in our study is similar to that observed in Ibadan by Ebong (66.7%)[5] and Adebajo (77.9%)[8]. Our male to female ratio of 1:2.9 is similar to, but slightly lower than the 1:4.6 reported by Adelowo *et al*[23]. Although postmenopausal women often have a higher incidence of OA due to the lack of the protective effect of oestrogen[24], only a few of our patients (29%) were postmenopausal. The higher number of premenopausal females may be attributed to other confounding factors like obesity.

The high rate of OA observed may be related to some prevailing common practices. The major ethnic groups in Maiduguri share a common culture of habitual knee bending during greetings, prayers and when carrying out domestic work. Additionally, most households use mats and carpets for relaxation with knees folded at most times. Adelowo[7] reported an association between knee OA and the habit of sitting on low stools, about a foot off the grounds with knee in extreme flexion among women traders. Similar observations were made by Adebajo[8] and among the Framingham cohort[21]. Occupations associated with repetitive movements coupled with excessive joint loading e.g. mining, farming and female housekeepers, have long been associated with OA[21].

Pain on activity is the most consistent presenting symptom in our patients, like what was reported in Ibadan[5]. The median duration of pain observed in our study is similar to that reported in Cameroon and other parts of Africa, with more than 50% of the subjects presenting with a pain score of greater than 7[5,7,20,25]. The significantly higher pain score in our female cohorts compared to the males appears intriguing. However, depression, disturbed sleep and other psychosocial factors that impact on perception of pain are more prevalent among women, and may perhaps be responsible for the discrepancy in pain score [26,27]. Few patients had sensation of their knee "giving way" or locking, but we did not identify falls due to these symptoms as reported by others[28] probably due to our exclusion of patients with crippling arthritis.

More than 75% of our patients were in Steinbrocker's functional class I and II while a third were in class III. A study from Zaria, Nigeria revealed self-reported functional disability in up to 89.3% of their patients[28]. The study also showed that self-reported disability correlates strongly and independently with self-reported pain, body mass index, comorbidity and radiographic severity. There was no comparison between genders in their study.

About half (48.4%) of our patients had family history of OA of the knee with most (64.4%) reporting their mothers having had OA. Twin studies suggest that knee OA in women has a heritability rate of 39 to 65%, with a concordance rate in monozygotic twins of 0.64[29]. In our study, genetic influences was inferred from history of knee OA within parents, brothers, or sisters identified a significant concordance rates, similar with the twin study by Spector *et al*[29].

Klussmann *et al*[30] reported that in both genders, knee OA within parents, brothers, or sisters was a significant predictor for symptomatic knee OA. The prevalence of Diabetes Mellitus (DM) among our patients was 16.4%, in contrast to 9% seen in Cameroon[25]. In a recent systematic review and meta-analysis involving 645,089 patients with OA, the prevalence of DM was 14.4±0.1%[31]. There are no local data in Nigeria regarding the prevalence of DM in knee OA patients.

Several epidemiological studies have now shown that OA is more frequent in people with hypertension[32,33]. In this study 59% had hypertension with a median duration of 60 months, in contrast to the 23.4% reported by Adebajo *et al*[9] in Ibadan. This may be explained by the difference in the definition of hypertension.

Anthropometric measures such as height, weight, waist circumference and BMI have a significant relationship with the severity of osteoarthritis of knee in non-obese subjects. Sanghi *et al*[34] showed that BMI and other anthropometric measures have a significant association with knee OA. Contrary to common belief; peripheral fat in males and central fat in females were more strongly associated with knee OA in comparison to heuristic body weight[33].

In our study, the prevalence of obesity, defined as BMI of 30 Kg/m^2 and above was 64.7%. This trend was reported by researchers in Cameroon[25]. Previous studies from Ibadan used percentage increase in body weight to assess obesity, making it difficult for comparison with our study[5,6,8]. We found a correlation between BMI and KL grading in both knees. Our subjects in the overweight and obese category had higher KL grading (III and IV), similar to what was reported in other studies[17,21,22,35]. Obesity is the strongest modifiable risk factor for OA, possibly due to the high mechanical stress imposed on the joint[36]. It is a stronger risk factor in women than in men, and is more strongly related with bilateral than unilateral knee OA[36,37]. Obesity can also cause OA through its metabolic effects. There is a close relationship between BMI and central obesity, a component of metabolic syndrome. Studies on the relationship between knee OA and metabolic syndrome have revealed conflicting results. In a meta-analysis by Wang *et al*[38] a pooled adjusted OR of 1.05 ($p<0.00001$) supports that metabolic syndrome increases the risk of knee OA. However, Niu *et al*[39] showed that after adjustment for BMI neither metabolic syndrome nor its component were associated with increased incidence of knee OA. A Nigerian study by Yerima *et al*[40] revealed that 59.8% of patients with knee OA had metabolic syndrome. Our current study was not designed to look at the metabolic effect on knee OA.

Knee deformities are either consequences or causes of knee OA. Studies have shown that valgus and varus alignment result in increased risk of tibiofemoral OA progression, after controlling for age, sex, and BMI[41]. A third (33.6%) of our patients had bilateral varus, with similar percentage having valgus deformity. Ebong *et al*[5] reported 19.8% with valgus and varus deformity at Ibadan, Nigeria.

Slemenda *et al*[42] showed that, after adjusting for body weight, quadricep weakness preceded radiographic knee OA in women. We found more females with decreased quadriceps strength than men (72 females vs 11 males) but the cross sectional nature of our study limited our ability to determine whether the weakness preceded the knee OA or it was the other way round.

Almost all (97.5%) of our patients were found to have radiographic KL grade II and above in addition to clinical symptoms of OA, thus most of the patients had symptomatic OA. The commonest compartment affected is the combined medial and patellofemoral knee OA (37.7%) supporting other studies[43]. A third (32%) had only medial compartment affected by knee OA in contrast to 25% reported from Cameroon[25] and 55% by Adebajo *et al*[8]. Tri-compartmental disease was seen in less than a quarter (18%) of our patients compared to 40% reported by Duncan *et al*[44]. Wise *et al*[45] revealed that women had a higher prevalence of lateral compartment OA than men in both African Americans and whites, although the difference did not reach significance among African Americans. This may probably explain why we had more men than women in our study with only lateral compartment OA (6 men versus 2 women). Isolated patellofemoral joint (PFJ) OA is considered to be rare in spite of the fact that patellofemoral joint (PFJ) is one of the most commonly affected compartments in combination with other compartments[46]. We found only 16 (4.1%) with isolated PTJ OA compared to 24% seen by Duncan *et al*[44]. Overall, we found that women were in higher proportion than men irrespective of the knee and the compartment involved except for lateral compartment OA.

Knee OA is often not accompanied by elevation in ESR. The ACR recommended ESR of less than 20mm in the first hour in the diagnosis of knee OA. Our finding of a median ESR of 13 is in keeping with that. The wide range noted in our study (1-80) was due to few outliers which can probably be explained by the relatively high age of the subjects and infections /infestations due to being residents in the tropics. Adelowo[6,7] and Adebajo[8] found a mean of 31 and 35.6 mm/hour, respectively in their study.

Our study has shown significant positive correlation between age and severity of radiographic knee OA. Aging being a strong risk factor in combination with late presentation of our subjects might be the reason. Most studies revealed poor association between severity of pain and radiographic features of OA with less than 50% reporting pain[18]. We also found no significant association between severity of pain based on visual analogue scale (VAS) score and KL grading in both knees. However, Avasthi *et al*[47], compared three clinical scoring system (VAS score, WOMAC score and Lequesne) and concluded that WOMAC is the best for assessing severity of disease[29].

In addition to pain we observed that there is a significant association between functional status and KL grading. Patients with higher KL grade had marked limitation of activities of daily living. Majority (84%) of our subjects were in class II to IV. High disability level (56.2%) was also reported elsewhere in Nigeria by Ebong[5], Adelowo *et al* (90%)[6], Akinpelu *et al* (90.2%)[14] and Umar (89.3%)[28]. In a community which relies heavily on physical activity for sociocultural and occupational activities, this high level of disability places a lot of burden and challenge.

Conclusion

We found that knee OA is the commonest rheumatic disorder in our clinic. The pattern is similar to that seen in

developed countries and males have higher rate of lateral knee OA. We also found a significant association between pain and higher KL grade.

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