Original Article

Demographic Correlates and Risk Factors of Primary Osteoarthritis Among Rural Dwellers

Nwokike OC[1], Enoma E[1], Ogbue AI[1], NwokikeEC[2], Onuminya JE[1]

[1]Department of Orthopaedics and Traumatology, Faculty of Clinical Sciences, College of Medicine, Ambrose Ali University, Ekpoma and Irrua Specialist Teaching Hospital Irrua, Edo state, Nigeria. [2] University of Belgrade, Faculty of Medicine DR Subotica 8, Belgrade, Republic of Serbia.

ABSTRACT

Primary osteoarthritis is a complex destructive and slowly progressive disorders of diarthrodial joints. The pathological end result is loss of articular cartilage characterized by joint pains, stiffness, deformity and loss of functions with grave impact on socioeconomic status and quality of life. We carried out a cross-sectional study of 82 attendees of a tertiary hospital in a rural district of Nigeria diagnosed of primary osteoarthritis. Successive attendees who met the inclusion criteria were recruited based on clinical and radiological diagnosis of primary osteoarthritis. We administered structured questionnaire to collect data on patient's demographics, biometrics, Kellgren and Lawrence grade of the radiograph and body mass index. Data were analyzed using SPSS software. We found a preponderance of females with a male to female ration of 1:2 and 68% knee joint affectation. Fifty-nine respondents (72%) had only primary or informal level of education, this reflects the type of work they do. We found no statistically significant correlation between obesity and Kellgren-Lawrence OA radiographic grade nor between the affected joint and body mass index. Domestic activities requiring kneeling, bending and crawling commonly engaged by the rural women in addition to the anatomical variation in Q angle of the female knee predisposes them to primary osteoarthritis. Currently, there is no approved disease modifying drugs for osteoarthritis, efforts at prevention of osteoarthritis in rural women must be geared at mechanizing domestic activities to reduce the incidence of OA among rural women.

Keyword: Primary Osteoarthritis, Rural-Dwellers, Women, Manual Jobs, Osteochondral, Cartilage, Joints

Introduction

Osteoarthritis is a chronic, progressively deteriorating joint disease that affects diarthrodial joints [1]. It is characterized by loss of articular cartilage, with architectural and functional changes throughout the joint and adjoining structures. It manifests clinically as pain, stiffness, deformity, and loss of function at the affected joint [2]. A diarthrodial Joint is formed by cartilage-capped articulating bones enclosed in a cavity lined by the synovial membrane called the joint capsule [1]. Osteoarthritis has long been considered a disease of articular cartilage. In recent times, the osteochondral Unit has become a focus in the study of the pathogenesis and search for osteoarthritis disease-modifying drugs [2,3]. The osteochondral unit consists of a layer of avascular and aneural cartilage, a layer of calcified cartilage, and a layer of highly trabeculated, vascularized, and innervated subchondral bone [2]. Overloading may lead to remodeling of the subchondral bone and disrupt the integrity and function of the osteochondral unit [4]. The pathomorphological changes of osteoarthritis eventually affect all the structures of the joint and surrounding tissue, such as the synovial membrane, the joint capsules, the ligaments, and muscles [5,6].

The synovial or diarthrodial Joint is a major component of the locomotive system of the human body. It permits a wide range of movement. On this basis, it is classified as a hinge, plane, saddle, condyloid, pivot, or ball-and-socket joint. The articular cartilage consists mainly of type II collagen as the

Correspondence:

Dr.Nwokike Osita Chizoba , Department of Orthopedics and Traumatology, Faculty of clinical sciences, College of Medicine, Ambrose Ali university,Ekpoma .

structural framework, with sulfated and non-sulfated chondroitin and hyaluronic acid as the ground substance. Chondrocytes are embedded in the ground substance. The cartilage is avascular, anural, sits on the subchondral bone, and depends on it for nourishment and oxygen. The chondrocyte synthesizes and maintains the integrity of the cartilage. The cartilage and synovial fluid function to provide painless, frictionless movement across the joint. Except for the articular cartilage, other structures in the knee are well supplied with sensory and proprioceptive innervations, including Pacinian corpuscles, Ruffini endings, and free nerve endings. This is the basis of the symptom of pain in osteoarthritis. The Hiltons and Gardner laws explain much of the sensory and autonomic innervations of the joints [7,8].

Osteoarthritis is considered primary when it is idiopathic or secondary when it follows trauma and other pre-existing joint pathology [9]. Sub classification of primary osteoarthritis into 3 different classes: Type 1, genetically determined; Type II, estrogen hormone dependent; and Type III, age-related. These sub-classifications are interrelated and are based on their etiopathogenesis [9].

The trigger that sets off osteoarthritis is largely unknown and has been a focus of much research in an effort to discover a cure or disease-modifying drug, which has remained elusive to humanity. Genetics, age, obesity, and metabolic syndrome are the key predisposing risk factors for primary osteoarthritis.

Genetic predisposition to osteoarthritis has been investigated through Epidemiological studies, Twin studies, family clustering, family History, and the exploration of rare genetic disorders [10]. It has been determined to be a polygenic disorder with a heritability of Hip osteoarthritis of 39- 65%, hand and Knee osteoarthritis of 60%, hip and spine 60-70% [10,11].

Taken together, this study puts the heritability of OA at 50%. The candidate genes or susceptible genes are located on the q arm of chromosomes 2, 9, 11, and 15, respectively, [12, 13]. These genes are associated with cartilage matrix proteins, cartilage link protein, and collagens II, IX, and XI. It has been noted that sex and different body sites of osteoarthritis may involve different genes at play [14].

The prevalence of osteoarthritis increases with age [15]. In people over 60 years of age, 30-50% are symptomatic and about 80% are radiologically diagnosed with osteoarthritis [15, 16], while aging itself doesn't cause osteoarthritis; it accentuates other risk factors such as biomechanics, obesity, and genetics (15). Radiological survey of adults over 60years of age reveals osteoarthritic changes in over 80%, symptoms of osteoarthritis, however, can be detected in only half of this population [16].

Metabolic syndrome, characterized by a series of factors such as Obesity, diabetes, hypertension, and dyslipidaemia, has been associated with osteoarthritis [17]. Although controversial, it is considered a risk factor for osteoarthritis through unclear mechanisms, largely related to the formation of systemic low-grade inflammatory products. It can therefore predispose to osteoarthritis of the weight-bearing and non-weight-bearing joints.

Obesity, defined as a body mass index (BMI) greater than 30 (kg/m2), is the most implicated of the metabolic syndromes [18]. There is a consensus that it is a major risk factor for the initiation and progression of symptomatic and radiological osteoarthritis. The mechanisms include joint overloading, biomechanical and systemic effects of low-grade inflammatory by-products of adipokines [17,18].

Activities that involve prolonged kneeling, crawling and squatting have been associated with a high risk of knee osteoarthritis [19]. These activities are common among the rural women of Nigeria both in their occupation and domestic activities. The major occupation here is the use of hoes and cutlasses in subsistence farming. Recreational activities have an uncertain risk effect on osteoarthritis, unlike high-impact elite sporting activities, which have a proven association with osteoarthritis [19,20].

The GlobalEconomy.com reported that 45.72% of Nigerians lived in rural areas in 2003. This indicates a quite significant population. Many of these rural dwellers are into subsistence farming and are exposed to the risk of Osteoarthritis. Osteoarthritis is subject to environmental modulation of its risk factors. It is known that environmental modulation differs between urban and rural environments, but how much this can influence risk factors and predictability for osteoarthritis remains unknown.

We aim to analyze the demographic characteristics and risk factors associated with osteoarthritis patients in a Nigerian suburban district tertiary hospital. This knowledge will aid in preventive measures for this near epidemic condition, for which the discovery of a disease-modifying drug has remained elusive.

Materials and Methods

This is a hospital based cross- sectional descriptive study of consecutive orthopedic clinic attendees at a rural Nigerian tertiary hospital. Patients clinically diagnosed with osteoarthritis of the hip, knee, shoulder, or Elbow joints who met the inclusion criteria of monoarthritis with no previous known joint pathology or trauma were enrolled in the study. Respondents were recruited based on radiological confirmation and basic

clinical diagnostic criteria of pain, stiffness, and loss of joint function, with or without deformity. We set out to evaluate symptomatic primary osteoarthritis. We collected demographic data on patients, risk factors for osteoarthritis, and correlations with primary osteoarthritis using a structured questionnaire.

The Body Mass Index (BMI) was calculated as $W/H^2 = Kg/m^2$.Where H is the height in meters (m), and W is the weight in kilograms (Kg). Plain radiographs of the affected joints in standard views were evaluated for osteoarthritis and graded using the Kellgren-Lawrence classification. Patients with a history of trauma and pre-existing joint pathology were excluded from the study. We obtained informed consent, and respondents were recruited consecutively as they presented to the clinic and provided informed consent. Results were analyzed using SPSS20 and presented in tables and graphs.

Results

A total of 82 respondent met the study criteria with a mean age of 52.5years, and a preponderance of females with a male to female ratio of 1:2.1 (Fig.1). No respondent was less than 40 years. Sixty-eight of the

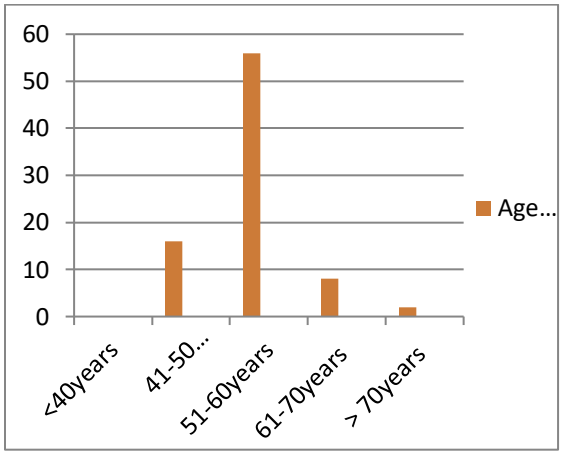

Fig.1: Age Distributions

respondents were 51 -60 years of age (Fig. 2). Seventy-two percent of the respondents had primary or informal education (Fig. 3). While those who had secondary or tertiary education make up 28% of the respondents. Kellgren and Lawrence moderate grade disease was found in 24% of the respondents while severe disease was seen in 36% of the respondents (Fig. 4).

The most affected joint is the Knee joint seen in 77% of the respondents (Fig. 5). Obesity (BMI greater than $30kg/m^{2)}$ was seen in 0.06% of the respondents on the other hand majority of the respondents 68% were overweight (BMI of 26-29.9kg/m^2) Table 1. There is no statistically significant correlation between the body mass index and Joint involved. Kellgren and Lawrence grading of severity and Body mass index ($p>0.05$).

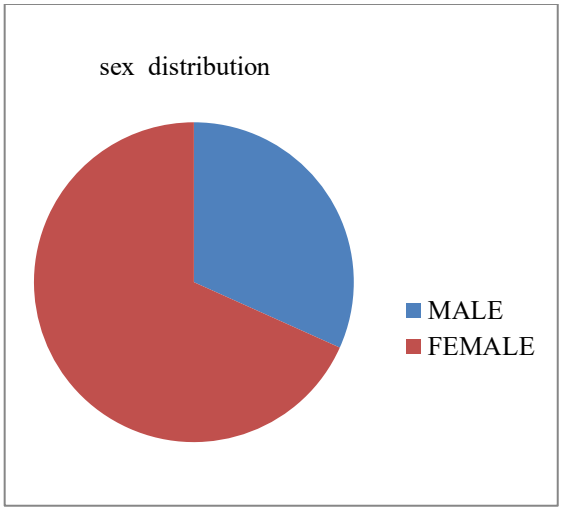

Fig.2: Sex distributions

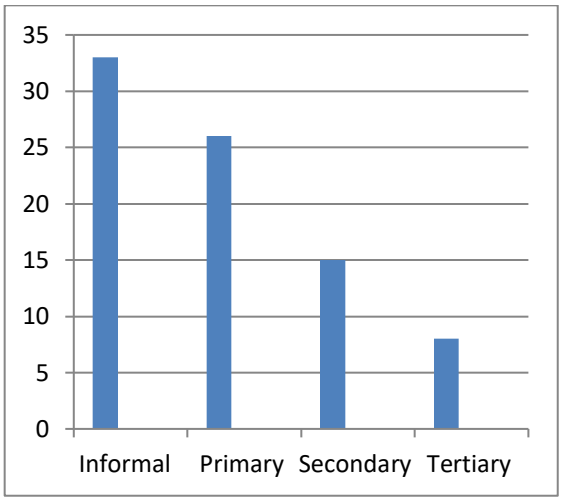

Fig. 3: Educational status

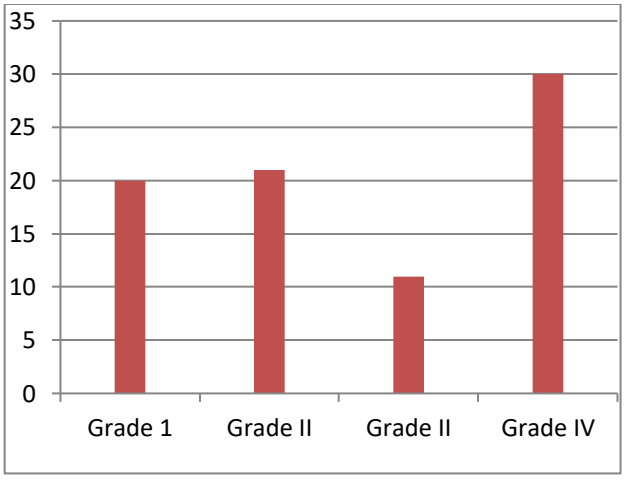

Fig. 4: Kellgren and Lawrence grading of osteoarthritis

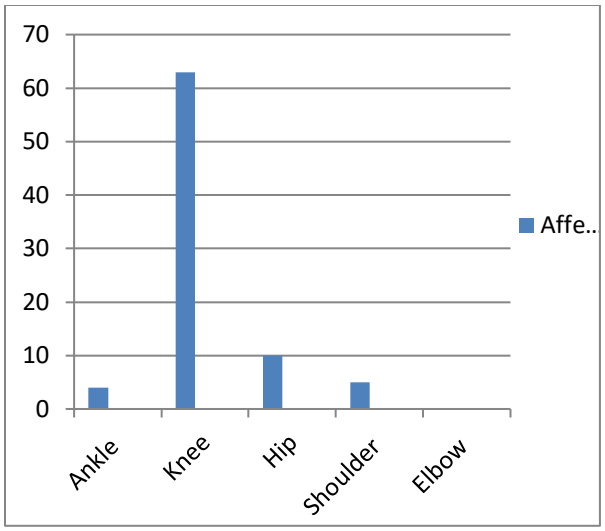

Fig. 5: Distribution of joint involvement

Table I: Classification of BMI

BMI	<18.5 Kg/m2	18.5-24.9 Kg/m2	25-29.9 Kg/m2	30-34.9 Kg/m2	35-39.9 Kg/m2	>40 Kg/m2	<18.5 Kg/m2
class	Under weight	Normal	Over weight	Obesity class 1	Obesity class II	Obesity class III	Under weight
No of respondent	Nil	21	56	5	Nil	nil	Nil

Discussion

Osteoarthritis is a progressively deteriorating disease of the diarthrodial joints. It has a significant impact on productivity and quality of life and, to date, has no disease-modifying drug [21]. We found that 58% of our respondents were female. This aligns with a meta-analysis documenting the preponderance of females with hip and knee osteoarthritis [22,23]. Anatomical variations, including the thickness of cartilage layers, the size of the female knee condyles, and hormonal interplay, have explained the preponderance of females [23]. Females have a higher patellar pull Q angle and thinner articular cartilage, which predisposes them to osteoarthritis. Estrogen maintains cartilage health; a decline in estrogen levels as menopause sets in leads to rapid cartilage degradation and osteoarthritis [23].

Additionally, in our rural setting, the nature of female physical engagement and activities may have also contributed to our findings. In rural settings, women are more involved in domestic chores, subsistence farming, and trading. During these activities, they encounter excessive repetitive movements involving kneeling, crawling and squatting as well as excessive joint loading [24].

Sixty-eight percent of our respondents with symptomatic osteoarthritis are aged 51 – 60 years (Fig. 1). This is the pre-retirement and post-menopausal age group. They are often still very active in domestic and economic activities. If unchecked, osteoarthritis will lead to early forced retirements, resulting in a decline in the workforce and productivity. Age is a major risk factor for osteoarthritis; however, it is not a cause or an inevitable consequence of aging [25]. Ageing contributes to osteoarthritis in several ways, including cell senescence and changes in matrix proteins involving advanced glycation end products that affect the mechanical properties of cartilage, subchondral bone, joint capsules, and surrounding soft tissue [26,27]. These changes in the musculoskeletal system with age increase the propensity for osteoarthritis, but the Joint affected, and its severity depend on other osteoarthritis risk factors [25].

The knee joint was the most affected site in our findings, accounting for 63% of respondents. This aligns with the global burden of disease 2019 results, which indicated that the predominant site of primary osteoarthritis is the knee [28]. One can expand the reasons further to include greater involvement of females in manual domestic chores and anatomical variations of the female knee that predispose it to osteoarthritis [23]. The nature of the rural manual jobs and subsistence farming with hoes, cutlasses, and diggers, largely performed by women, may also be contributory. This is because occupational exposure to osteoarthritis has been largely associated with jobs that require repetitive or vibratory motions. Jobs requiring stair climbing, kneeling, bending, and crawling are associated with the development of knee osteoarthritis [25].

Obesity is generally considered a significant risk factor for osteoarthritis, especially in weight-bearing joints. BMI has been found to have a positive correlation with developing osteoarthritis in association with other risk factors [29]. The mechanism by which obesity predisposes to osteoarthritis is largely systemic than joint overload [31]. Chemical signals from adipokine-driven inflammatory mediators promote cartilage destruction, osteophyte formation, and synovial inflammation [30]. Excess adipose tissue in the obese produces humoral factors and cytokines that alter cartilage metabolism [31]. Obesity and overweight are prevalent in Nigeria, but much less so in the rural Nigerians [31, 32]. Our findings are in line with this, here; we found only 6% of our respondents were obese (Table 1). This study is based in a rural area of Nigeria with a reported low obesity incidence. Obesity and being overweight are seen in Nigeria, but it's more of an urban problem [33].

The Kellgren and Lawrence grading system is of great utility and has been widely used in the

radiographic classification of osteoarthritis [34]. This study recorded patients presenting at various grades as classified by Kellgren and Lawrence (Fig. 4). The implication is that the radiographic grade does not often mirror the symptomatology or clinical manifestations of osteoarthritis [35]. The utility of this grading system as a screening tool is doubtful, as clinical symptoms can occur even before plain radiographic evidence, and the severity of symptoms does not often tally with the grade of disease. It is, however, useful for planning, diagnosis, and surgical intervention for arthroplasty.

We found no statistically significant correlation (P> .005) between the Body mass Index and affected joint and there is also no statistically significant correlation between body mass index and Kellgren and Lawrence grading of the arthritic joint. This is similar to literature reports from similar environment [36].

Conclusion

Osteoarthritis is a major musculoskeletal disorder with a widespread socioeconomic impact. It is a progressively deteriorating condition with no known disease-modifying drugs. It, however, has some modifiable risk factors that can redirect the progression of the disease. Obesity and overweight are less prominent risk factors in our rural setting. We ascribe these differences to the prominence of non-mechanical occupational strain and deleterious manual activities of squatting, kneeling, and crawling that characterize rural workers engagements. The introduction of mechanical and motorized devices for domestic chores and improvements in health care delivery may reduce the incidence of osteoarthritis in women. While the search for disease modifying drugs goes on.

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