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Original Research Article

Incidence density and relative rate assessment of knee osteoarthritis with respect to BMI, age and gender conducted in a tertiary care hospital in Hyderabad, India

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ABSTRACT

Background: Osteoarthritis is the most common form of arthritis associated with limitation in mobility. Weight bearing joints of axial and peripheral skeleton are primarily affected. Prevalence of symptomatic knee osteoarthritis among men and women is 10% and 13%. Ageing and obesity epidemic are the leading causes for development of osteoarthritis in a given population.
Methods: The study was conducted at a tertiary care hospital in Hyderabad, India. Data was gathered from orthopedic department on a daily basis during the study duration. Patients with any grade of Kellgren-Lawrence scale of knee osteoarthritis were included in the study and incidence density, relative rate, p-value were assessed.
Results: During the study course, a total of 100 patients were enrolled. Overweight, obese and healthy patients contributed to 51%, 33% and 16% of incidence density with relative rate as 1.04, 0.49 and 0.19 respectively (p-value=0.042). Incidence density of patients ≥45 years and <45 years was 83% and 17% with relative rate as 4.9 and 0.2 (p value<0.0001). Incidence density in males and females was 34% and 66% with relative rate as 1.94 and 0.51 (p-value<0.0001). The data analyzed is statistically significant.
Conclusions: A direct proportionality between people exceeding normal BMI range and progression of knee osteoarthritis is observed due to strain manifested on diarthrodial joint by overweight patients. Increase in age is associated with onset of knee osteoarthritis because of age related-changes seen in cartilage and loss of chondrocytes. Women are more affected with knee osteoarthritis when compared to men due to irregularities in hormones post-menopause.

Keywords: Knee osteoarthritis, Incidence density, Relative rate, Epidemiology, Diarthrodial joint

INTRODUCTION

Osteoarthritis is the most common form of arthritis which is associated with a limitation in mobility.[1] Weight bearing joints of axial and peripheral skeleton are primarily affected by osteoarthritis.[2] Mechanical factors play a central role in the development of osteoarthritis which is a multi-factorial process further characterized by changes in the structure and function of the whole joint.[3] Osteoarthritis is mainly manifested in the diarthrodial joint which is the weight bearing joint that performs physical activity and exhibits joint-specific range of movement. Articular cartilage, subchondral bone, meniscus and synovial tissue are affected entirely during the progression of osteoarthritis.[4] The tissues in the joint break down overtime and the progression of this condition is

characterized as osteoarthritis. The most common manifestation in the patients with osteoarthritis is joint pain and stiffness felt in the joint after rest. The most commonly affected joints are as follows; Hands (ends of the fingers and at the base and ends of the thumbs), Knees, Hips, Spine.[5]

Classification of osteoarthritis

Primary (Idiopathic) Osteoarthritis: As the name suggests the cause of the condition is idiopathic and there is no direct history of joint disease or injury. It is speculated to be associated with genetic predisposition and family history of the patient affected with osteoarthritis. Postmenopausal women are more likely associated with primary generalized osteoarthritis due to the presence Heberden's Nodes. Secondary Osteoarthritis: More prevalent in men when compared to women. It is associated with trauma, previous inflammatory activity, bone dysplasia, sports activity, congenital factors (Perthes Disease of the hip), Paget's Disease, obesity, systemic disorders, acromegaly, neuropathic disease such as charcot joint.[6] According to statistics, osteoarthritis is considered to be the most common joint disorder in the United States. The prevalence of symptomatic knee osteoarthritis among adults is 13% in women and 10% in men. Ageing and the obesity epidemic are the leading causes for the development of osteoarthritis in a given population.[7] Radiographic evidence of osteoarthritis is seen in majority of adults who are > 55 years of age but methodological problems arise when definitive prevalence and incidence rates of knee and hip osteoarthritis are determined. Age, gender, behavioral influences, genetics and ethnicity are some of the factors that play a role in the prevalence of osteoarthritis.[8] Prevalence of osteoarthritis increases with age and it is uncommon in people aged less than 45 years with a prevalence of less than 2%. Among the general population affected with osteoarthritis, about 30% patients are asymptomatic.[9]

Aim and objectives

The principle aim of current study is to understand correlation of BMI, age and gender with knee osteoarthritis by calculating the incidence**.** To obtain Body Mass Index of patients affected with knee osteoarthritis using the formula BMI = kg/m². To assess the incidence density of knee osteoarthritis with that of the age of the patient. To assess the risk of knee osteoarthritis in patients who exceed the normal BMI count. To compare the incidence density of knee osteoarthritis in both men and women. To calculate the relative rate and p value of the collected data to assess whether it is statistically significant.

METHODS

Study design, location and duration

The study was Observational Study conducted at Shadan Hospital and Research Center, Peerancheru, Hyderabad. Data was gathered from the orthopedic outpatient and inpatient department of the hospital regarding the correlation of osteoarthritis with BMI, age and gender on a daily basis during the duration of the study. The study duration was 6 months i.e., from the first week of January 2022 to the first week of June 2022.

Sample size and sampling technique

A sample size of 100 were admitted in the study based on the technique of random sampling method whereby an inclusion and exclusion criterion were set and patients in alignment with that criteria were chosen at random.

Inclusion criteria

Inclusion criteria for current study were; patients affected with knee osteoarthritis that are willing to participate in the study, patients with any grade of Kellgren and Lawrence Scale of osteoarthritis are taken into consideration, patients who are obese or exceeding "healthy" weight status on the BMI scale are admitted into study, patients of all ages are considered for the determination of incidence density of knee osteoarthritis with respect to age and patients of both the gender are evaluated in the study.

Exclusion criteria

Exclusion criteria for current study were; Patients who are not willing to participate in the study and patients with hip, spine, finger or big toe osteoarthritis are excluded from the study.

Study procedure

The patients in alignment with the inclusion criteria are asked for consent to be included in the study conducted in the hospital. The data collected from the patients affected with knee osteoarthritis are recorded in patient profile forms. The data is then tabulated and classified according to BMI, age and gender. Tabulated data is analyzed and the percentage incidence or incidence density is calculated. Furthermore, relative rate along with the p value is calibrated to determine the statistical significance of the data. P value is calculated using student t test on Statistical Package for the Social Sciences (SPSS) Software, p value <0.05 is considered to be statistically significant. The results are analyzed and presented on a data spread.

RESULTS

Calibration of p value for the given data correlating BMI with knee osteoarthritis by using one sample t test

The one-tailed test which is done by the one sample t test method calibrated the significance or the p value as 0.042 which is <0.05 depicting that the data analyzed in table 1 is statistically significant. The test value of 0.5 that is used in the determination of p value is calculated by using z test for one sample proportion on the SPSS Software.

Calibration of p value for the given data correlating age with knee osteoarthritis by using paired sample correlation t-test

The paired sample correlation t test calibrated the significance or the p value as <0.0001 which is <0.05 depicting that the data analyzed is statistically significant. The obtained data given in Table 2 is correlated against the data published by Cui et al in the Lancet as standard to obtain the significance or the p value.[10]

Table 1: Incidence density and relative rate of knee osteoarthritis with respect to BMI.

BMI category	BMI range	Incidence density	Relative rate
Obese	≥30	33%	0.49
Overweight	25-29.9	51%	1.04
Healthy	18.5-24.9	16%	0.19
Underweight	<18.5	0	0

Table 2: Incidence density and relative rate of knee osteoarthritis with respect to age.

Age (years)	Incidence density	Relative rate
≥45	83%	4.9
<45	17%	0.2

Table 3: Incidence density and relative rate of knee osteoarthritis with respect to gender.

Gender	Incidence density	Relative rate
Male	34%	0.51
Female	66%	1.94

Calibration of p value for the given data correlating gender with knee osteoarthritis by using paired sample correlation t-test

The paired sample correlation t-test calibrated the significance or the p value as <0.0001 which is <0.05 depicting that the data analyzed is statistically significant. The obtained data given in Table 3 is correlated against the data published by Zhang et al in Clinics in Geriatric Medicine as standard to obtain the significance or the p value.[7]

DISCUSSION

Among 100 patients that were included in the study, overweight patients followed by obese patients were found to be more affected with knee osteoarthritis and thus showcasing a higher incidence density. Healthy and underweight patients had significantly lower incidence density of knee osteoarthritis. Overweight patients (BMI = 25-29.9 kg/m^2) contributed to 51% of incidence density followed by obese patients (BMI ≥30 kg/m^2) with 33% of incidence density and healthy patients (BMI=18.5-24.9 kg/m^2) with 16% of incidence density. Relative rate also followed the same order as that of incidence density indicating a directly proportionality between incidence density and relative rate. Overweight patients (BMI=25-29.9 kg/m^2) showed relative rate of knee osteoarthritis as 1.04 followed by obese patients (BMI ≥30 kg/m^2) who showed relative rate of 0.49 and healthy patients (BMI = 18.5-24.9 kg/m^2) who showed relative rate of 0.19. The p value was found to be 0.042 depicting that the data analyzed is statistically significant. This is similar/ comparable to a study by Samma et al.[11] Age is considered to be one of the major factors for the onset of knee osteoarthritis. Incidence density of knee osteoarthritis in patients of and above 45 years of age was significantly higher when compared to patients who were younger than 45 years of age. 83% of knee osteoarthritis patients in the study were of and above 45 years of age whereas 17% of knee osteoarthritis patients were less than 45 years of age. Relative rate of knee osteoarthritis was also found to be distinctly elevated in patients of and above 45 years of age with relative rate as 4.9 when compared to those below 45 years of age who showed relative rate of 0.2. The p value was found to be <0.0001 depicting that the data analyzed is statistically significant. This is similar/ comparable to a study by Peters et al.[12] A comparison between incidence density of knee osteoarthritis between male and female portrayed that female were notably more affected with knee osteoarthritis when compared to the male population. Incidence density of knee osteoarthritis in females was calculated to be 66% and for males the incidence density was 34%. Relative rate of knee osteoarthritis when calculated was evidently higher in female patients with a relative rate of 1.94 than in male patients with a relative rate of 0.51. The p value was found to be <0.0001 depicting that the data analyzed is statistically significant. This is similar/comparable to a study by Tschon et al.[12]

Limitations

The limitation to the study conducted is the incorporation of person-time rate in the calculation of incidence density or incidence rate. By this it is assumed that the probability of disease during the period of the study remains constant as in the case of most chronic conditions including knee osteoarthritis.

CONCLUSION

A direct proportionality between people exceeding normal BMI range and progression of knee osteoarthritis is observed due to the strain manifested on diarthrodial joint by overweight patients. Obesity is a risk factor for development of many disease conditions including knee osteoarthritis and the study that is conducted confirms a high incidence rate and relative risk of knee osteoarthritis in overweight and obese patients when compared with that of healthy patients. Increase in age is associated with the onset of knee osteoarthritis because of age related-changes seen in cartilage and the loss of chondrocytes. Patients who were of 45 years and above have shown higher incidence rate and relative risk of knee osteoarthritis. Women are

notably more affected with knee osteoarthritis when compared to men due to irregularities in hormones in post-menopausal women which is portrayed in the percentage incidence calculated in the study. The data collected further understands and confirms the correlation of BMI, age and gender with knee osteoarthritis.

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