Original Article

The Relation Between Smoking and Knee Osteoarthritis in Sulaymaniyah Governorate/Iraq

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Abstract

Background Osteoarthritis (OA) is a rather common, painful chronic degenerative disease that is considered a leading cause of disability worldwide. Knee joints are the commonest joints affected by OA. Smoking, as well, is a common social habit that is related to many chronic diseases such as cancer diabetes and cardiovascular diseases. The aim of this study was to find out the relationship between smoking and knee OA in Sulaymaniyah city /Kurdistan Iraq.

Methods A cross-sectional study included 118 subjects with Knee OA who attended the Rheumatology center in Sulaymaniyah. After taking written consent, general and anthropometric data, inclusion and exclusion criteria and smoking history. We used the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) to evaluate the clinical features of OA, followed by a plain x-ray of both Knees to assess the Kellgren/Lawrence (KL) grades for each participant (only K&L grade≥2 was included). Chi-square, independent t-test and correlation were the statistical tests used to find out associated results.

Results The smoking history of OA patients was commonly never smoking (57.6%), followed by current smoking (25.4%) and ex-smoking (16.9%). The radiograph showed (50.2%) of OA patients had K&L grade 2, (33.9%) of them had grade 3 and (15.9%) of them had grade 4. Never smoking was associated with greater WOMAC scores than ever-smoking (p 0.005, p =0.006, and p= 0.008). However, mean WOMAC scores were significantly higher among the female gender and older age(p=0.026) (R=0.352). On the other hand, no association was found between different smoking histories and K&L grades in both knees (p=0.066, p=0.15).

Conclusion An inverse association was found between cigarette smoking and Knee OA regarding patients' clinical symptoms using the WOMAC scoring index. Although this inverse association was not confirmed in the radiographic analysis. The effect of residual confounding might have contributed to this result. Further investigation of this relationship between smoking and knee OA is needed to determine the specific mechanism of this inverse association.

Keywords: Osteoarthritis- WOMAC score - Kellgren &Lawrence.

INTRODUCTION

Osteoarthritis (OA) is a rather common, painful chronic degenerative disease that is considered a leading cause of disability worldwide, with the associated sequelae of deformities and functional limitation. In USA, symptomatic knee OA occurs in 10% of men and 13% of women aged 60 years or older. In addition, radiographic knee OA (according to Kellgren-Lawrence (K-L) grade >2) affects 37% of American adults. (1-2)

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Many risk factors for knee OA have been identified; non-modifiable such as age, sex, race, and genetics or modifiable as physical activity, occupation, obesity, trauma, diabetes mellitus and neuroendocrine diseases. (3-4)

Smoking, as well, is a common social habit. Studies have shown that almost 1 in 5 Americans are smokers (4). It is established that smoking is related to a variety of diseases such as cancer, diabetes, cardiovascular disease, and musculoskeletal disorders, including low back pain, rheumatoid arthritis, and degenerative disc disease. However, an inverse association was found between smoking and some other diseases such as Parkinson's disease and ulcerative colitis. (4-5). The correlation between OA and smoking is debated:

Several studies have suggested that smoking may affect the knee OA by five mechanisms: 1) stimulating cartilage degeneration and loss; 2) Correlation between cigarette smoking and genetic predisposition in OA patients; 3) An association with the production of inflammatory markers; 4) An association between smoking and both diabetes and obesity (high Body Mass Index (BMI)); and 5) a connection between smoking and high risk for metabolic syndrome. (1,5)

In contrast, a number of reports including a recent publication in Osteoarthritis and Cartilage have suggested that smokers have a lower-than-expected prevalence of osteoarthritis (OA) than nonsmokers. (6)

Since the knee joint is one of the commonest joints involved in OA, especially in the elderly, it is mandatory to better understand the factors associated with the occurrence of knee OA. We aim to study the effect of smoking on knee OA clinically and radiographically to further fuel the body of knowledge with information on the association between these two health problems. Given that the correlation between these two entities had not been studied in Kurdistan region before.

Patients And Methods

Data Collection and Sample size

A cross-sectional study that involved 118 patients with Knee OA (for at least 1 year) aged above 35 years who attended the Rheumatology and rehabilitation center in Suleimani were included in the study. The data collection time was six months. The diagnosis was made according to the American College of Rheumatology (ACR) standard criteria.

Exclusion criteria

These include obese patients (BMI>30), previous knee joint injury, lower doubtful grades of Kellgren and Lawrence radiographic classification (grade 0-1), secondary diseases that predispose to OA such as congenital anomaly of knee and hip, Metabolic, endocrine disorders, in addition to other common Rheumatic diseases (RA, SLE, Systemic Sclerosis, etc.)

General and Anthropometric covariates

After fulfilling these criteria and taking the patient's written consent, co-variables such as age, gender, residency, level of education, occupation, duration of OA, family history of Knee OA, BMI Calculation, and presence of concomitant chronic diseases were assessed.

Quantification of cigarette smoking Self-reported lifetime smoking history was utilized to quantify the amount of cigarettes smoked. we categorized smoking status to "smokers" "ex-smokers", and "never-smokers". Information about the severity and duration of smoking was also taken.

Radiographic examination of knee joints

A plain radiograph of the knees (bilateral standing Anteroposterior view and lateral 30° flexion, with feet rotated to 10 degrees) view, was conducted. The changes were then independently assessed by two musculoskeletal specialists and further reassessed by a consultant radiologist to analyze the Kellgren/Lawrence (KL) grading system for each participant, K&L grade<2 was excluded. (9)

Clinical Criteria and Physical Function Data

All participants were questioned on their osteoarthritis symptoms using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scoring system questionnaire. This scoring system was created to assess pain, stiffness, and functional limitation in hip and knee osteoarthritis. A higher score on the WOMAC indicates worse symptoms. (10)

Statistical Analysis of data was carried out using the available statistical package of SPSS-25. To estimate population parametric from study statistics 95% confidence intervals were used. Differences between groups were assessed by the Chi-square test, t-tests, and ANOVA as appropriate. Linear correlation coefficients to determine correlations between continuous variables.

Results

Of the 118 patients with Knee (OA), and a total of 189 knees examined. The mean age is (was) 59.21±9.94. The female to male ratio was 1: 1.46. The mean BMI of OA patients was 27.2±2.6 Kg/m2. The majority of participants were urban residents (89%), mainly primary school graduates (38%), occupation was commonly housewife (33.1%) and Hypertension was the commonest concomitant chronic disease in (36%).

The smoking history of OA patients was commonly never smoking (57.6%), followed by current smoking 25.4% and ex-smoking 16.9%, with mean smoking duration

(25.16±10.36) years and the severity of smoking was commonly medium (10-20 cigarette/day) 22.9%. Bilateral knee joint was commonly affected by OA (60.2%); With the mean duration of symptoms 2.7±1.9 years. The symptoms related to multi-joint OA were commonly hand (22.9%), LS spine (31.4%), and cervical spine (11.9%).

The mean total WOMAC score was (55.93±16.377) with mean WOMAC pain, stiffness, and functional limitation scores ;(12.15±3.84) (3.78±1.87), (40.0±16.377) respectively.

Regarding the radiographic features, (50.2%) of OA patients had Kellgren & Lawrence grade 2, (33.9%) of them had grade 3 and (15.9%) of them had grade 4.

Using the Chi-square test and independent t-test to assess the association between smoking and other co-variates we found no significant association between different smoking histories regarding age, residency, educational level, concomitant chronic diseases, with p=values (0.067) (0.291) (0.079) (0.065) respectively. (Table 1)

A high association was observed between never-smoking history and the female gender with P = (<0.000), and BMI (p=0.025). (Table 4&1)

The mean of WOMAC scores was higher among OA patients with never-smoking history compared with the smoker, and this difference was statistically significant except for stiffness with p-values of (p 0.005, p=0.122, p =0.006, and p= 0.008 respectively). (Table 2)

No significant association was observed between OA patients with different smoking histories regarding their Kellgren &Lawrence radiographic grades (in both right and left Knee joints) (p=0.066, p=0.15, respectively (Table 3). Regarding the effect of other covariates, we performed a correlation test which showed a moderate correlation between total WOMAC scores and patients' age R=0.352, with a significant p-value <0.001. (Figure1).

The mean total WOMAC score was significantly higher among the female gender (p=0.026).

Discussion

In this cross-sectional study, 70 out of 118 OA participants (60%) were males; unlike a systematic review of 42 studies revealed that females were most frequently getting OA (67%) than males (33%) (12). Our findings of higher male predominance might be due to a relatively smaller sample size or excluding the obese OA patients which may be more in females than males. (13)

Many studies found that OA prevalence is increasing with an increase in age. In the current study, OA is diagnosed as early as 39 years old patient; however, the mean age of the patient is around 60 years old. It is obvious that OA is an age-related chronic disease and an inevitable consequence of the aging process either directly or in association with other factors like genetics and obesity (14).

We found that educational attainment equal to or less than primary school was 64.4%; people with low educational achievement are more involved with activities that increase the risk of knee OA like lifting heavy weights, farming, and kneeling position (15). Nearly thirty percent of the study group is housewife women, their sedentary life and lack of regular exercise may be risk factors for getting OA.

More than 3/4 of the study population were having BMI above the normal range. Many other studies revealed an association between high BMI and the risk of acquiring OA, especially in weight-bearing joints like the knee joint (16,17).

Hypertension was the most prevalent chronic disease in 35.6% of the OA patients; other studies in several countries revealed comparable results regarding hypertension. (3,18)

Nearly one-third of the OA patients have a family history of knee OA, this reflects the possible genetic basis of OA. (19)

Nearly half of the OA patients in the current study were either smokers (25.4%) or ex-smokers (16.9%) The effect of smoking on the risk of developing OA or on the patients with OA is debated. On one hand, some studies reported smoking as reducing the risk of knee OA (3,4,11,20,30), similarly, the surgeons' report did not mention the OA in the list of health consequences of smoking, moreover, Felson and Zhang concluded that smoking has protected effect against the radiographic progression of OA (21).On the contrary, some researchers have connected smoking to degenerative changes in joint cartilage (22), generalized inflammation, and reducing bone density (23). Most of the patients in this study were smoking for many years before the development of clinical manifestations of OA; this finding may place tobacco smoking as a possible risk factor for OA.

It was interesting to find out that many of the knee OA patients were having one or more other joint involvement of which the hand, lumbosacral spines, cervical spines, or shoulder were the most recorded joints. Cho, H. J., et al. (4), did a survey on OA patients and found that spine OA is the most recorded followed by hands, knee, shoulder, then hip joint. These findings indicate the contribution of other risk factor/factors rather than obesity in the pathogenesis of OA.

WOMAC score is a commonly used measuring scale for clinical assessment of osteoarthritis. The mean WOMAC pain was 12.15 which is much lower than that reported by Holtz N., et al (24), who recorded 19.6, their high pain score was due to severe OA in their study group who were pre-surgical prepared for arthroplasty. Berger M. J, et al, reported a mean WOMAC pain score of 5.2 for 4796 patients with knee OA in outpatient centers which is much lower than ours (25). This clarifies the importance of pain scores for assessing the clinical indications for knee joint arthroplasty.

The mean scores of WOMAC for pain, stiffness, functional limitation, and total WOMAC scores were higher among never-smoked patients than in smokers; this inverse relationship between smoking and OA may be due to cofounder factors like higher BMI, as smoking may decrease body weight (26) which in turn improves the symptoms of

OA. Interestingly, the current smokers and ex-smokers OA patients in this study have lower BMI than the non-smokers. Moreover, the analgesic effect of nicotine on acetylcholine receptors in the brain might be associated with this inverse correlation (7,8). Comparable results were mentioned in a meta-analysis that studied the association of smoking with OA (4). There was a significant moderate correlation between the age of the patients and the total WOMAC scores; this result reflects the impairment in the quality of life because of progress in the degenerative nature of OA (3). The mean total WOMAC score was significantly increased among the female gender, this result suggests that feeling of pain and stiffness affect the physical activity of women more than men; the pain threshold may be lower in females than in males and the tolerance to this pain is lower in females (27). Comparable results were described by Kim et al and Fang, W. H, et al (28,29).

The results of this study showed no significant association between radiographic findings documented by the KL grading system and the patients' smoking conditions. Two studies were done by Zhang, et al (31), and Kim, J. W, et al (30), which showed an inverse association between cigarette smoking and radiographic knee OA in the Chinese and Korean populations respectively. However, another study by Amin S, et.al showed men with knee osteoarthritis who smoke sustain greater cartilage loss than men who do not smoke (32). A longitudinal study by Dubé CE,et.al (1) found no associations between smoking status and Joint width space(JWS). It seems that in addition to smoking, cofactors are also involved in the pathogenesis of radiological features. The absence of a significant association between smoking and radiological changes in knee joint does not mean the absence of negative health effects of smoking including the musculoskeletal system, for example, reducing blood supply to a bone, lowering bone marrow density, slowing osteoblast formation, and adverse effects on muscles, tendons, cartilage, and ligaments (33).

BMI was significantly higher among never-smokers than among currently smokers or ex-smokers; this finding suggests that smoking reduces BMI which might be due to increased energy expenditure and decreasing appetite (34).

There are several strengths and limitations to this study. The main strength is the large scale of exclusion criteria from the study sample such as obesity, previous knee joint injury, secondary diseases like RA, gout, DM, etc. which may represent major risk factors for OA, hence why excluding these factors may validate the accuracy of the results.

Several limitations to this study can be counted. First, being an observational study (cross-sectional), limited our ability to identify a causal relationship between smoking and Knee OA. Moreover, the possibility of the confounding effect of other factors (which was impossible to exclude) might affect the accuracy of the results. Second, is the subjective nature of the WOMAC scoring system which might create a patient/recall bias.

Conclusions And Future Recommendations

Number of conclusions can be elucidated; no significant association was found between cigarette smoking and radiological findings in knee OA patients although an inverse association with mean WOMAC scores was found (WOMAC score is higher among never-smoked OA patients than smokers). Moreover, a moderate correlation was found between total WOMAC scores and increasing age. Ever-smoking OA patients have lower BMI than never-smoking ones.

Furthermore, the Knee OA affects functional activity more in females than in males. Most knee OA patients have severe pain, moderate stiffness, and severe limitation in physical activity using the mean WOMAC scores as an indicator for measurement. Future longitudinal studies with larger sample size and prolonged periods of follow-up may be required to accurately identify the possibility of a causal relationship between smoking and radiographic Knee OA.

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Table 1: Association between smoking status and other sociodemographic status of OA patients (age & gender)

Variables	***Never-smoker***	***Ex-smoker***	***Current Smoker***	***P-value***
Age Mean (SD)	58.9± (9.56)	63.9± (8.69)	59.3 ± (10.69)	0.067*NS
Gender				
Male n (%)	23 (19.5)	18 (15.3)	29 (24.6)	<0.000**S
Female n (%)	45 (38.1)	2 (1.7)	1 (0.8)	
BMI Mean (SD)	27.59± (2.72)	25.80± (2.63)	27.196± (2.03)	0.025*S

Table 2: Association between smoking status and WOMAC scores of OA patients

Variables	***Never-smoker***	***Ex-smoker***	***Smoker***	***P-value***
WOMAC pain Mean (SD)	12.84± (3.9)	12.75± (4.01)	10.2± (2.92)	0.005*S
WOMAC stiffness Mean (SD)	3.74 ± (1.92)	4.5 ± (1.64)	3.4± (1.85)	0.122*NS
WOMAC functional limitation Mean (SD)	42.81± (12.35)	38.4 ± (10.68)	34.7 ± (10.18)	0.006*S
Total WOMAC Mean (SD)	59.38± (16.71)	55.65± (15)	48.3 ± (14.19)	0.008*S

Table 3: Association between smoking status and Kellgren &Lawrence radiographic findings.

Variables	***Never-smoker***	***Ex-smoker***	***Smoker***	***P-value***
Right knee (K-L) grade				
None	12	4	8	0.066**NS
Grade 2	28	4	17	
Grade 3	19	7	4	
Grade 4	9	5	1	
Left knee (K-L) grade				
None	15	5	3	0.154**NS
Grade 2	22	6	18	
Grade 3	20	6	8	
Grade 4	11	3	1	

Table 4: Distribution of total WOMAC score according to OA patients' gender.

	Total WOMAC Mean	***Standard Deviation***	***P-value***
Gender			
Male	53.17	16.209	0.026***S
Female	59.96	15.940	

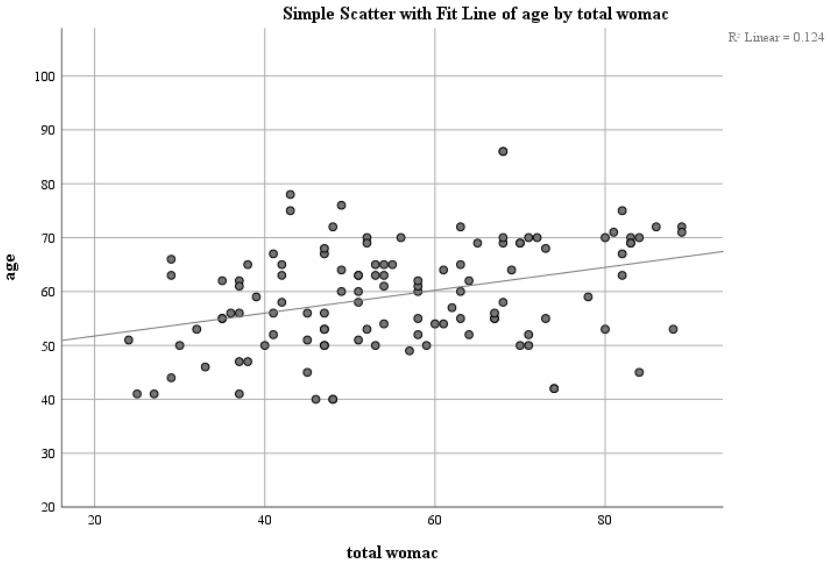

Fig.1: Distribution of total WOMAC score according to OA patients' age