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Smoking is Associated with Increased Risk of Osteoporosis in Diabetes Mellitus Patients

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Abstract

Background: Diabetes mellitus, in particular Type 2 Diabetes Mellitus (T2DM), is a common metabolic disease with increasing prevalence throughout the world. Musculoskeletal (MSK) complications of DM are the most common endocrine arthropathies.

Osteoporosis is considered a global public health problem currently affecting over than 200 million people. Osteoporosis is the most common systemic skeleton illness that characterized by reduce of bone mass and disruption of bone architecture resulting an increased risk of fragility fractures which represent the main clinical consequence of the disease.

Smoking is associated with multiple complications of diabetes; the risk of complications associated with tobacco use and diabetes in combination has been stated to be approximately 14 times higher than the risk of either smoking or diabetes alone.

Objective: To assess the association of smoking with osteoporosis in diabetes mellitus patients.

Patients and Methods: A cross sectional study was conducted on 150 patients with diabetes mellitus mainly type 2. All patients were seen in the Department of Rheumatology in Hilla Teaching Hospital. Patient's data were obtained via face-to-face interview performed by a rheumatologist. DM related data, such as duration, Smoking history, drug use (oral hypoglycaemic drugs, insulin), Body Mass Index (BMI), patient send for DEXA (Dual Energy X-ray Absorptiometry) to confirm diagnosis of osteoporosis, also after exclusion of other causes of osteoporosis by exclusion criteria which done by many hormonal and other laboratory investigations.

Results: Among 150 patients with DM, 60.70% were females and 39.30% were males, as the females predominant in the study. There is an association between osteoporosis and age <50 years ($p<0.004$) due to most patients were female at premenopausal age.

There is significant association between smoking and osteoporosis in DM patients ($p<0.002$), Also, BMI show no significant association with osteoporosis in DM patients as most of patients were obese or overweight with increase bone mineral density.

Conclusion: There is significant association between smoking and osteoporosis in DM patients.

Keywords: Diabetes mellitus; Arthropathies; Osteoporosis, Rheumatology, Bone mineral density, Musculoskeletal

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Introduction

Diabetes mellitus

Diabetes mellitus, in particular Type 2 Diabetes Mellitus (T2DM), is a common metabolic disease with increasing prevalence throughout the world [1]. Musculoskeletal (MSK) complications of DM are the most common endocrine arthropathies. These have been generally under- recognized and poorly treated compared with other complications, such as neuropathy, retinopathy, and nephropathy. These manifestations, which are some of the causes of chronic disability, involve not only the joints, but also the bones and the soft tissues [2].

Chronic complications adversely affect multiple organ systems, including bones, and cause an enormous medical and economic burden [3]. Typical skeletal complications of poorly controlled diabetes mellitus include diabetic foot syndrome and Charcot neuro-arthropathy, which account for a high percentage of surgical procedures and even amputations.

Fragility fractures owing to low bone strength have become increasingly recognized, as skeletal complications [4].

Osteoporosis

Osteoporosis is considered a global public health problem currently affecting over than 200 million people [5]. In particular, 1 in 3 women over 50 years old will experience osteoporotic fractures in contrast with 1 in 5 men [6]. Evidently, the overall prevalence of osteoporosis is higher in females approaching 80% [7].

Osteoporosis is the most common systemic skeleton illness that characterized by reduce of bone mass and disruption of bone architecture resulting an increased risk of fragility fractures which represent the main clinical consequence of the disease. It is often called the silent disease because the loss of bone occurs silently and progressively and there are no symptoms until the first fracture appear [8].

The World Health Organization (WHO) recommended that females are much more likely to develop osteoporosis that gradually increased with age [9].

Furthermore, low dietary calcium and lifestyle (smoking and alcohol consumption) have also been associated for an increased risk for osteoporosis, especially tobacco use as recently reported for the Greek citizens with 40% proportion [10].

Smoking

Smokers were defined as tobacco users of >30 packs per year (20 cigarettes/pack) following the WHO recommendations [11].

Smoking is associated with multiple complications of diabetes; the risk of complications associated with tobacco use and diabetes in combination has been stated to be approximately 14 times higher than the risk of either smoking or diabetes alone [12].

Smoking is thought to cause low bone density through various pathways

1. Smoking has been linked to changes in hormone household, leading to a decrease in parathyroid hormone (thus reducing calcium absorption) and estrogen levels as well as to an increase in the level of cortisol and adrenal androgens, changes that have been linked to an increased risk of osteoporosis [13].
2. Smoking reduces body mass, which is postulated to provide an estrogenic stimulus and is linked to higher BMD [14].
3. Smoking reduces the level of vitamin D in the body, which is required for good bone health [15].
4. Smoking increases free radicals and oxidative stress which affects bone desorption [16].
5. Smokers are more likely to suffer from peripheral vascular disease, reducing blood supply to the bones [17].
6. Finally, there may also exist direct toxic effects of many of the constituents in tobacco smoke on bone cells [18].

Patients and Methods

Study population

A cross sectional study was conducted on 150 patients with diabetes mellitus mainly type 2. All patients were seen in the Department of Rheumatology in Hilla Teaching Hospital, a tertiary referral centre in Iraq between June 2014 and June 2015.

The study was granted full ethical approval from the local ethics committee and all patients gave their informed written consent prior to commencement of the study.

Diabetes mellitus characteristics

Patient's data were obtained via face-to-face interview performed by a rheumatologist. DM related data, such as duration, Smoking history, drug use (oral hypoglycaemic drugs, insulin), Body Mass Index (BMI), patient send for DEXA (Dual Energy X-ray Absorptiometry) to confirm diagnosis of osteoporosis, also after exclusion of other causes of osteoporosis by exclusion criteria which done by many hormonal and other laboratory investigations.

Exclusion criteria

1) Menopause
2) Corticosteroid therapy
3) Low body weight (BMI <I8)
4) Alcohol
5) Connective tissue diseases e.g., RA, SLE, AS, etc
6) Thyroid problems
7) Parathyroid problems
8) Hypo-gonadism

9) Celiac disease

10) Drugs: Thyroxin, Corticosteroids, Cyclosporine, Heparin, Anticonvulsants, Gonadotropin-releasing hormones, Aromatase inhibitors and Cyto-toxic drugs

11) Family history

Statistical analysis

Statistical Package for Social Sciences version 18 (SPSS v.18) was used for data input and analysis. Discrete variables presented as numbers and percentages.

Continuous variables presented as mean and Standard Deviation (SD). χ^2 Test for goodness of fit used to test the significance of observed distributions. χ^2 Test for independence used to test the significance of association between two discrete variables. To test the significance of difference in mean for more than one sample; ANOVA test used for normally distributed variables and Kruskal-Willis test used when the distribution was in question. p Value used for all tests was asymptotic and two sided. Findings with p value less than 0.05 considered significant.

Results

The overall mean age of DM patients was (55.46 ± 8.58) years, and (77.3%) of patients were 50 years and older, and (22.7%) less than 50 years **(Figure 1)**.

This figure shows that majority of DM patients were females (60.7%), and (39.3%) were males **(Figure 2)**.

Table 1 shows the distribution of DM patients by BMI and smoking habit. (58.7%) and (58.0%) of DM patients were with normal weight and non-smokers, respectively.

This table shows that (52.7%) of DM patients had the disease less than 5 years and (98.7%) were on OHA **(Table 2)**.

Figure 3 shows that (74.7%) of DM patients did not have Osteoporosis and (25.6%) had osteoporosis.

There was significant between presence of osteoporosis and age groups, p value ≤ 0.004 is significant **(Table 3)**.

There was significant between presence of osteoporosis and Smoking Habit, p value ≤ 0.002 is significant **(Table 4)**.

Discussion

According to the results of this study, there is significant association between osteoporosis and age <50 years, the explanation of that is the majority of patients were females and premenopausal age.

In this study, there is significant association between smoking habits (current smoker) and osteoporosis in diabetes mellitus patients with (p<0.002), this in agreement with other studies done by Kao WHL, et al. Barrette-Connor, et al. and Schwartz AV, et al. [19,20,21], that the T2DM tend to be higher BMI or over weight, increased insulin level, less physical activity and smoke more.

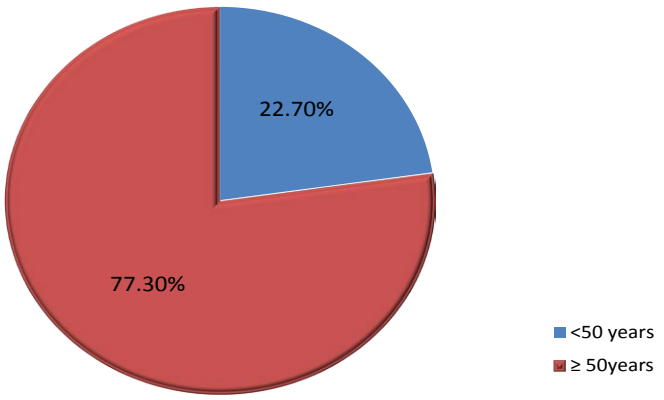

Figure 1 Age of diabetes mellitus patients. The overall mean age of DM patients was (55.46 ± 8.58) years, and (77.3 %) of patients were 50 years and older.

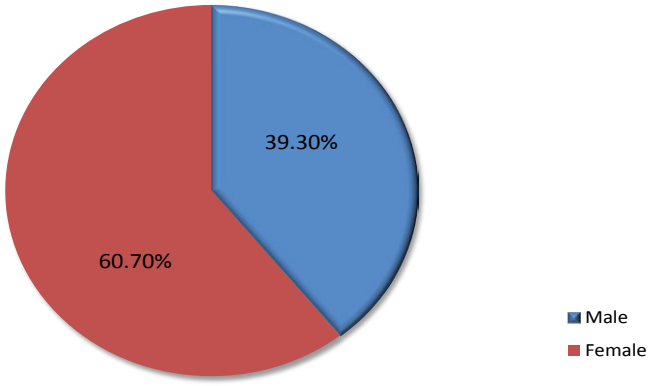

Figure 2 Shows the distribution of DM patients by sex.

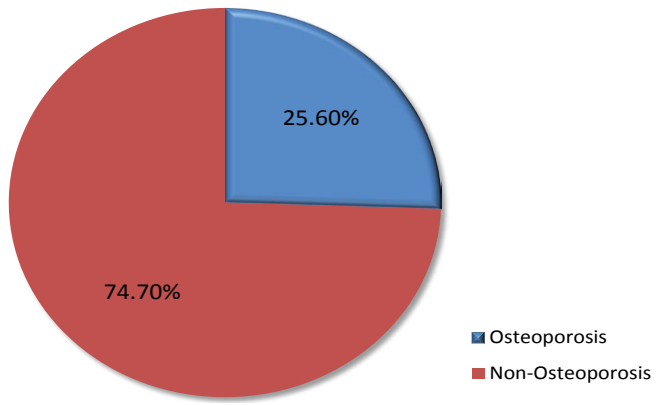

Figure 3 Shows the distribution of DM patients by presence of osteoporosis (74.7%) of DM patients did not have osteoporosis.

BMI shows no significant association with osteoporosis and this in agreement with other studies done by Wang, et al. and Barrera, et al. [22,23] that show no relation of BMI to osteoporosis, the possible explanation of that most T2DM were obese or overweight with increased bone mineral density.

The main limitation of our sturdy was the small size of studied samples and being cross-sectional sturdy, has limited the correlation regarding the cause and effect relationship between smoking and osteoporosis in DM patients.

Conclusion

There is significant association between smoking and osteoporosis in diabetes mellitus patients.

Recommendations

1) Proper attention to the diabetes mellitus patients who were smokers, to decrease risk of osteoporosis in those patients.
2) Musculoskeletal complication especially osteoporosis in DM were underestimated which considered as part of chronic disability.
3) The finding in this study will need to be confirmed using large prospective study.

Table 1 Shows the distribution of DM patients by BMI and smoking habit. (58.7%) and (58.0%) of DM patients were with normal weight and non-smokers, respectively.

Variable	Frequency (%)
BMI	
Normal weight	88 (58.7)
Obese	62 (41.3)
Smoking habit	
Smokers	63 (42.0)
Non-Smokers	87 (58.0)

Table 2 Shows the distribution of DM patients by duration of disease and type of treatment. (52.7%) and (98.7%) of DM patients had the disease less than 5 years and were on OHA, respectively.

Variable	Frequency (%)
Duration of disease	
<5years	79 (52.7)
≥ 5years	71 (47.3)
Type of treatment	
Insulin	2 (1.3)
OHA	148 (98.7)

Table 3 Shows the Association of Osteoporosis with DM patients Socio-Demographic Characteristics. There was significant between presence of osteoporosis and age groups, p value ≤ are significant.

	Osteoporosis		χ^2	p
Variable	**Absent (%)**	**Present (%)**		**Values**
Age groups				
<50 years	19 (17.0)	15 (39.5)	8.201	0.004*
≥ 50years	93 (83.0)	23 (60.5)		
Sex				
Male	49 (43.8)	10 (26.3)	3.614	0.057
Female	63 (56.2)	28 (73.7)		
Residence				
Urban area	50 (44.6)	17 (44.7)	0.000	0.992
Rural area	62 (55.4)	21 (55.3)		

Table 4 Shows the Association of osteoporosis with DM patients BMI and smoking Habit. There was significant between presence of osteoporosis and smoking Habit, p value ≤ is significant.

	Osteoporosis		χ^2	p
Variable	**Absent (%)**	**Present (%)**		**Values**
BMI				
Normal weight	66 (58.9)	22 (57.9)	0.013	0.911
Obese	46 (41.1)	16 (42.1)		
Smoking habit				
Smokers	39 (34.8)	24 (63.2)	9.352	0.002*
Non-Smokers	73 (65.2)	14 (36.8)		

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