

ORIGINAL RESEARCH

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Does osteoporosis with type 2 diabetes mellitus (Diabetoporosis) increase the risk of fracture?

Raikan Buyukavci, Semra Akturk, Yuksel Ersoy

Inonu University Turgut Ozal Medicine Center Department of Physical Therapy and Rehabilitation, Malatya, Turkey

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Abstract

Our aim was to investigate whether the association of diabetes and osteoporosis caused an increased risk of fracture or not. The study included 120 patients with osteoporosis aged between 40-90 years. Age, gender, body mass index (BMI), history of fracture and presence of Type 2 diabetes mellitus (T2DM) were recorded. 10-year major fracture and hip fracture risks were calculated with FRAX-WHO Fracture Risks Assessment Tool. Bone mineral density (BMD) measurements were made from femur neck and lumbar 1-4 vertebrae. All of the 120 patients included in the study, 21 were male and 99 were female. Twenty patients had T2DM diagnosis. The patient group with T2DM was older than the non-T2DM group in terms of mean age ($p < 0.05$). There was no differences in terms of BMI, BMD measurements, and FRAX 10-year major fracture and hip fracture risks of patients with T2DM and patients without T2DM ($p > 0.05$). The number of patients with previous history of fracture was 24, and two of them were suffering from T2DM. In this study, Our results showed that osteoporosis with Type 2 Diabetes Mellitus may not significantly affect the fracture risk. The relationship between diabetes and bone metabolism should be screened in larger quantities, and T2DM should be positioned among the algorithms that assess the risk of fracture.

Keywords: Osteoporosis, type 2 diabetes mellitus, fracture risk

Introduction

Osteoporosis is a systemic skeletal disorder characterized by low bone mass and deterioration of the bone microstructure, resulting in increased bone fragility and increased susceptibility to fracture [1]. Osteoporosis is the most common disease of the elderly population. As it can result in fractures, it becomes an important social health problem [2].

Diabetes Mellitus (DM) is a chronic metabolic disease that affects many systems with various clinical and biochemical findings. Type 2 DM (T2DM) accounts for more than 90% of all diabetes cases and is the most common form of diabetes [3]. The prevalence of diabetes was 16.5 % (new 7.5 %), translating to 6.5 million adults with diabetes in Turkey [4]. Along with the increased frequency of diabetes mellitus, diabetic complications are also increasing. The adverse effects of diabetes on bone tissue have been the subject of work in recent years. The association of diabetes and osteoporosis is termed 'diabetoporosis' and this term was first used by the International Osteoporosis Foundation (IOF). The complex relationship in glucose, fat and bone metabolism results in an increased risk of fracture.

In this light, our purpose is to determine whether the association between diabetes and osteoporosis causes an increase in fracture risk.

Material and Method

Study included 120 patients between the ages of 40-90 who were referred to the Physical Medicine and Rehabilitation outpatient clinic due to osteoporosis. Evidence-based medicine application study group in our faculty contributed to the collection of data of this study. Demographic data including age, gender, body mass indexes of patients were recorded. T2DM disease story and previous history of fracture were questioned. Bone mineral density measurements (BMD) were performed with dual energy X-ray absorptiometry (DXA) technique from lumbar (1-4) and femur (neck) regions. 10-years of major fracture and hip fracture risk were calculated with FRAX for Turkey Fracture Assessment Tool. In the algorithm model defined as FRAX; age, sex, body weight, previous history of fragility fracture, parental history of hip fracture, current smoking, glucocorticoid use (longer than 3 months, more than 5 mg / day), rheumatoid arthritis, other causes of secondary osteoporosis and excessive alcohol consumption were identified as factors used to determine absolute fracture risk of individuals [5].

*Corresponding Author: Raikan Buyukavci, Inonu University Turgut Ozal Medicine Center Department of Physical Therapy and Rehabilitation, Malatya, Turkey

E-mail: rsoydemir@yahoo.com

Statistical Analysis

Statistical analysis was made with the statistical package for social sciences (SPSS) version 16.0). Data related with continuous variables were defined as mean $\pm$ standard deviation (SD) and the number was used to identify the ones related to the categorical variables. Independent sample t test and Mann-Whitney U test were used for analyses. p values of <0.05 were accepted as statistically significant.

Results

Of the 120 patients included in the study, 21 were male and 99 were female. Twenty patients had T2DM diagnosis. Average age and demographic data were given in Table 1. The patient group with T2DM was older than the non-T2DM group in terms of age averages ($p<0.05$).

There were no significant differences in terms of BMI, BMD measurements and FRAX 10-year major fracture and hip fracture between the two groups ($p>0.05$) Table 2.

The number of patients with previous history of fracture was 24 and two of them were suffering from T2DM.

Table 1. Demographic data of patients

	With T2DM	Without T2DM	P value
Age (year)	65.2 $\pm$ 8.04	59.95 $\pm$ 10.51	<0.05
Gender (n: female/male)	11/9	88/12	
BMI (kg/m ²)	29.67 $\pm$ 5.13	29.16 $\pm$ 4.85	>0.05

T2DM: Tip 2 Diabetes mellitus, BMI: Body mass index

Table 2. Assessment of BMD and FRAX fracture risk factors between type 2 DM and non-DM group

	With T2DM	Without T2DM	P value
Lumbar L1-4 BMD (gr/cm ²)	0.86 $\pm$ 0.15	0.83 $\pm$ 0.15	>0.05
Lumbar t-score	-1.64 $\pm$ 1.24	-1.93 $\pm$ 1.33	>0.05
Femoral neck BMD (gr/cm ²)	0.79 $\pm$ 0.19	0.77 $\pm$ 0.14	>0.05
Femoral neck t-score	-1.07 $\pm$ 1.15	-0.93 $\pm$ 1.01	>0.05
FRAX Major osteoporotic fracture risk (%)	6.81 $\pm$ 5.35	7.44 $\pm$ 4.95	>0.05
FRAX Hip fracture risk (%)	1.92 $\pm$ 2.50	1.70 $\pm$ 3.01	>0.05

T2DM: Tip 2 Diabetes mellitus, BMD: Bone mineral density

Discussion

As a main result of this study, we determined that osteoporosis with Type 2 Diabetes Mellitus (diabetoporosis) did not significantly affect the fracture risk.

In osteoporosis; amount of bone tissue reduces and this conditions is accepted as a major health problem for the elderly people, especially for postmenopausal females. As it is a silent illness, it is generally diagnosed after the occurrence of a bone fracture. Osteoporosis-related fractures have a severe impact on patient's quality of life and cause high healthcare costs [6,7]. DXA has been regarded as the gold standard analysis to diagnose osteoporosis [8].

It is known that metabolic diseases such as diabetes affect bone turnover. Although the relationship between type 2 diabetes and osteoporosis has been broadly studied, some details remain controversial [9]. Type 2 diabetes could influence bone metabolism through many mechanisms [10]. Studies regarding the association between Type 2 diabetes and bone quality showed different results: some studies reported that diabetes increased BMD [11], while others reported that it either decreased [12] or did not affect the BMD in patients with osteoporosis [13]. In our study, BMD measurements of both lumbar and femur bone mineral density values in patients with T2DM were higher than those of non-diabetic patient group, but this result was not statistically significant. Perhaps it may be affected because of the low number of patients in the T2DM patient group.

Diabetes mellitus is characterized by a significant increase in

fracture risk that is only partially reflected by the BMD reductions seen in T1DM and is underestimated in T2DM where BMD is increased. While BMD from DXA still stratifies fracture risk in those with diabetes, additional measures that can be obtained from DXA help to identify patients at increased risk of fracture. Incorporating this information into risk prediction models may help to avoid systematically underestimating the risk of osteoporosis-related fractures in subjects with diabetes [14]. The number of patients with previous history of fracture was 24 and two of them were suffering from T2DM. With this limited number of results, it is not possible to assess the effect of the presence of T2DM on fracture when combined with osteoporosis. At the same time, there was no additional screening to assess the presence of vertebral fractures in patients in this study.

FRAX calculates the possibility of fracture by using clinical risk factors such as age, sex, body mass index, prolonged use of glucocorticoids, current smoking, alcohol intake of three or more units per day, a parental history of hip fracture, secondary osteoporosis, rheumatoid arthritis, prior fragility fracture, and (optionally) femoral neck BMD or T-score. Possibility of major osteoporotic fracture and hip fracture after 10 years were generated and have been shown to improve fracture prediction over T-score alone. Diabetes is not a primary variable in FRAX recently [15]. However, in our study, the risk of 10-year hip fracture in the patient group with T2DM was higher than in the non-diabetic group, although it was not statistically significant.

All these results will allow T2DM to be included in the algorithms

for evaluating the risk of fracture such as FRAX, if diabetoporosis screening is performed in a wider patient population and risk is detected.

Limitations

Although there was a close relationship between blood glucose level and duration of diabetes mellitus in this study, we did not obtain any information on the duration of diagnosis and diabetic control of T2DM patients. At the same time, most of our patients treated for osteoporosis did not have BMD values which were at the osteoporotic border.

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