

Evaluation of bone mineral density in premenopausal women with type-2 diabetes mellitus in Zahedan, southeast Iran

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Abstract

Objective: To determine the BMD in premenopausal women with type-2 diabetes mellitus.

Methods: This case-control study was performed on 60 premenopausal women with type-2 diabetes mellitus and 60 normal premenopausal subjects. The groups were not completely matched regarding BMI; but they were in the range of obesity. Bone mineral density was determined using dual energy X-ray absorptiometry (DXA) to define bone mineral density (BMD) in second to fourth lumbar vertebrae and the neck of the femur (g/cm²).

Results: The results showed that BMD, T- and Z-score of femoral neck, total femur, L2, and Ward's were not significantly different between type 2 diabetic and normal premenopausal women ($p > 0.5$). A significant increase of L3 BMD and L2-L4 Z-score was observed in diabetic group ($p < 0.05$). In addition BMD, T- and Z-score of L4 were significantly higher in type 2 diabetic women than normal premenopausal women ($P < 0.05$).

Conclusion: Higher BMD was noted over the spine in diabetic group which may be due to higher BMI in this group.

Keywords: Bone mineral density, Diabetes mellitus (JPMA 61:443; 2011).

Introduction

Diabetes mellitus is a group of disorders in which blood glucose levels are increased due to deficiency of insulin secretion or abnormal insulin action. The increased blood glucose causes diabetes complications.¹ Besides having a role in glucose and lipid metabolism, it is thought that insulin also has an anabolic effect on bone.²

There are conflicting results on bone involvement in patients with diabetes mellitus due to the pathogenesis complexity of the condition. Alterations in mineral and bone metabolism are associated with diabetes mellitus and bone loss is one of the chronic complications of diabetic patients. Decreased bone mineral density (BMD) is known as a major determinant of fracture. While low bone mineral density (BMD) is consistently observed in type 1 diabetes, the relationship is less clear in type 2 diabetes. The effects of type 2 diabetes on bone metabolism are unclear and the association between diabetes mellitus and osteoporosis still controversial. There are some studies showing lower,³⁻⁵ similar,⁶⁻⁹ or higher BMD values¹⁰⁻¹⁴ in type 2 diabetes than in normal subjects.

The aim of the present study was to determine the bone mineral density in premenopausal women with type 2 diabetes mellitus in Zahedan, southeast Iran.

Subjects and Methods

In this study 60 premenopausal women with type 2

diabetes and 60 matched healthy women were also studied as controls. Exclusion criteria were heavy smoking (>10 cigarettes/ day), alcohol intake, renal and hepatic disease, endocrine disease, malignancy, rheumatic disease, any drug treatment which can influence bone metabolism such as thyroid hormones, steroids, products containing vitamin D or its derivatives, calcium and magnesium. The project was approved by the ethical committee of Zahedan University of medical sciences and informed consent was obtained from patients and normal subjects.

Bone mineral density (BMD) of the femoral neck, lumbar spine (L2-L4) was measured by dual-energy X-ray absorptiometry (DXA) using a Lunar DPX-MD+ densitometer (Lunar Radiation Corporation, Madison, WI, USA).

Statistical analyses were performed using SPSS for Windows (version 17). The results were expressed as the mean \pm S.D. Student t-test, was used for statistical analysis. A P-value less than 0.05 were considered statistically significant.

Results

In this project, 60 premenopausal women with type 2 diabetes mellitus (age; 35-50, mean age 44.63 ± 3.75 years) and 60 normal premenopausal subjects (age; 35-52, mean age 42.58 ± 4.81 years) were studied. Table shows BMI, Bone mineral density (BMD), T- and Z-score of the case and control groups. BMI of premenopausal women with type 2 diabetes was significantly higher than normal premenopausal

Table: Comparison of Body mass index (BMI), Bone mineral density (BMD) and T-score of premenopausal type 2 diabetes mellitus with normal premenopausal women.

| Characteristic | Case (n=60) | Control (n=60) | P value |
|---------------------------------------|-----------------|----------------|---------|
| BMI (kg/m ²) | 31.26 ± 4.49 | 29.13 ± 5.06 | 0.016** |
| Femoral neck BMD (g/cm ²) | 1.029 ± 0.162 | 1.009 ± 0.142 | 0.475 |
| Femoral neck T-score | 0.396 ± 1.351 | 0.253 ± 1.195 | 0.539 |
| Femoral neck Z-score | 0.665 ± 1.364 | 0.426 ± 1.216 | 0.315 |
| Total femur BMD (g/cm ²) | 1.105 ± 0.192 | 1.065 ± 0.139 | 0.222 |
| Total femur T-score | 0.832 ± 1.455 | 0.527 ± 1.169 | 0.238 |
| Total femur Z-score | 0.955 ± 1.505 | 0.604 ± 1.175 | 0.184 |
| L2 BMD (g/cm ²) | 1.187 ± 0.206 | 1.125 ± 0.145 | 0.059 |
| L2 T-score | -0.343 ± 1.336 | -0.618 ± 1.217 | 0.241 |
| L2 Z-score | -0.2817 ± 1.318 | -0.673 ± 1.147 | 0.85 |
| L3 BMD (g/cm ²) | 1.227 ± 0.193 | 1.164 ± 0.138 | 0.045** |
| L3 T-score | 0.100 ± 1.384 | -0.280 ± 1.180 | 0.104 |
| L3 Z-score | 0.116 ± 1.360 | -0.310 ± 1.150 | 0.062 |
| L4 BMD (g/cm ²) | 1.211 ± 0.182 | 1.143 ± 0.143 | 0.026** |
| L4 T-score | 0.041 ± 1.468 | -0.451 ± 1.206 | 0.047** |
| L4 Z-score | 0.105 ± 1.432 | -0.491 ± 1.199 | 0.015** |
| L2-L4 BMD (g/cm ²) | 1.190 ± 0.160 | 1.147 ± 0.135 | 0.113 |
| L2-L4 T-score | -0.068 ± 1.323 | -0.466 ± 1.101 | 0.076 |
| L2-L4 Z-score | -0.050 ± 1.321 | -0.498 ± 1.077 | 0.044** |
| Ward's BMD (g/cm ²) | 0.886 ± 0.200 | 0.864 ± 0.150 | 0.515 |
| Ward's T-score | -0.120 ± 1.554 | -0.349 ± 1.162 | 0.373 |
| Ward's Z-score | 0.284 ± 1.581 | -0.017 ± 1.183 | 0.306 |
| Fracture risk of hip | 1.833 ± 0.375 | 1.850 ± 0.360 | 0.805 |

women (p=0.016).

BMD, T- and Z-score of femoral neck were not significantly different between diabetic and normal premenopausal women (p>0.05). In addition there was no significant differences regarding BMD, T- and Z-score of femoral neck, total femur and L2 between two groups (p>0.05).

Although BMD of L3 was significantly higher in cases than controls group (P=0.045), but there were no significant differences between the groups regarding T- and Z-score of L3 (P>0.05).

The results showed that BMD, T- and Z-score of L4 were significantly higher in diabetic than normal premenopausal women (p<0.05).

While Z-score of L2-L4 was significantly higher in women with diabetes (p=0.044), there was no significant difference concerning BMD and T- score of L2-L4 different between case and control groups (p>0.05).

BMD, T- and Z-score of Ward's were not significantly different between diabetic and normal premenopausal women (p>0.05). Fracture risk also did not show a significant difference between case and control group (P>0.05).

Discussion

In this study we determined BMDs of the femoral neck, lumbar spine (L2-L4) and Ward's of premenopausal

women with type 2 diabetes mellitus and premenopausal healthy women.

BMD, T- and Z-score of femoral neck, total femur, L2, and Ward's were not significantly different among type-2 diabetes and normal premenopausal women.

The results of the present study showed that the BMI of diabetic group was significantly higher than the control group. A meta-analysis showed that BMI is a major predictor of BMD in both the spine and hip in diabetes. Hip fracture risk is increased in both type 1 and type 2 diabetes, whereas BMD is increased in type 2 and decreased in type 1.¹⁵ The findings regarding the influence of type 2 diabetes on bone mass density does not appear consistent.^{6, 8, 16-18}

Anaforoglu et al investigated BMD in postmenopausal women with type 2 diabetes and compared it with postmenopausal nondiabetic women. They found that the groups did not differ on BMDs and T scores at the hip, lumbar spine, and radius.⁸ Hamilton et al found that BMD, T- and Z-scores at the hip, femoral neck and spine were lower compared with control subjects in males with type 1 diabetes, while female type 1 patients and control subjects had similar BMDs and T- and Z-scores at all sites.¹⁹

Women with type 2 diabetes mellitus have an increased risk of hip fractures despite having normal to high BMD.²⁰ In agreement with our results Gupta et al²¹ reported that premenopausal Arab women with type 2 diabetes have a higher BMD at the spine than women without diabetes. They matched control and diabetic groups concerning the BMI.

Although we did not completely match our case and control groups regarding BMI, they were in the range of obesity according to BMI. The higher BMD noted over spine in diabetic group might be due to the higher BMI in this group.

A study performed in mainland China showed that postmenopausal women with type 2 diabetes had higher BMD and lower osteoporosis risk in the lumbar spine.²² Kao et al found that Mexican-American women with type 2 diabetes have a higher BMD compared to women without diabetes and increased BMD correlates with serum insulin levels.¹³ Our BMD results of subjects with type 2 diabetes is supported by other studies.^{14,23,24}

One of the weaknesses of our study is that we did not determine the insulin levels. An association between insulin level, BMD and fractures may exist.¹² Insulin has an anabolic effect on bone formation by binding with the IGF-1 receptor, which is present on osteoblasts in bone, resulting in higher bone mass.² Type 2 diabetes is preceded by a period of insulin resistance. Hyperinsulinaemia may confer a protective effect on BMD, either directly through elevated fasting insulin¹² or indirectly through BMI.²⁵

Conclusion

The present study found that premenopausal women with type 2 diabetes have higher BMI as well as BMD than normal premenopausal women which may be due to hyperinsulinaemia.

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