

Comparison of Bone Mineral Density in Young Patients with Type One Diabetes Mellitus and Non-Diabetic Patients

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ABSTRACT: Patients with diabetes mellitus have various skeletal disorders. The aim of present study was to compare the bone mineral density among type one diabetic patients and control. This case control study was performed in endocrine clinic of Bandar Abbas in 2012. Totally 78 patients (39 case and 39 control) were enrolled in this study using convenience sampling method. Bone re-sorption markers, HbA1C, T3, T4, TSH were evaluated after 12 hours fasting. A questionnaire consisting demographic variables and BMI, cigarette smoking, and previous fracture were documented. Data was analyzed using SPSS 19 by Chi-square and T-test. The mean age of participants was 29.11 ± 7.3 years. Eighty percent of case group and 20% of control had previous pathologic fracture. Also, 4 patients of case group and none of the control patients had low BMD. Previous pathologic fracture and low BMD were significantly higher in case group in comparison with control. Osteoporosis was not significantly different between male and female. Bone mineral densitometry was lower in diabetic patients compared to non-diabetic patients. Prevention of osteoporosis by considering nutritional supplementations is recommended.

Key words: Diabetes Mellitus, Osteoporosis, Bone Density

INTRODUCTION

Type one diabetes mellitus is usually happening in early childhood and adolescence (Janghorbani, Van Dam et al., 2007). And, these patients suffered from insulin deficiency during their long life (Leidig-Bruckner and Ziegler, 2001). In addition to common complications of diabetes mellitus, skeletal disorders have reported among this population such as osteoporosis, osteopenia, diabetic foot syndrome and arthropathies (Hofbauer, Brueck et al., 2007).

The pathophysiology of osteoporosis and osteopenia is not well known but it is estimated that the insulin deficiency or resistance can effect on the bone mineral density (BMD) (Carnevale, Romagnoli et al., 2004, Hofbauer, Brueck et al., 2007). In a study demonstrated that type one diabetes mellitus is more likely to causes hip fracture than type 2 diabetes mellitus (Nicodemus and Folsom, 2001). Also, another studies indicated that femoral neck BMD is lower among patients with type1 diabetes mellitus than those without diabetes mellitus. The aim of this study was to assess the BMD in patients with type one diabetes mellitus compared to non-diabetic patients.

MATERIALS AND METHODS

This case control cross sectional study was conducted in Hormozgan University of Medical Sciences

(HUMS) in 2012. Using convenience sampling, 39 patients with type one diabetes mellitus attended to Diabetes clinic of Shahid Mohammadi Hospital of HUMS were enrolled in case group and 39 non-diabetic subjects were selected as control group. All of the participants provided informed consent and this project was approved by ethic committees of HUMS (N.89-91/128).

After 12 hr. fast, 10 cc blood was obtained from each patient for measuring biochemical markers of bone turnover such as C-telopeptide and other laboratory tests such as FBS, HbA1C and thyroid function test.

Inclusion criteria for control group were FBS and HbA1C less than 100 mg/dl and 5.5 % respectively. Exclusion criteria consisted of familial osteoporosis or osteopenia and other endocrine disorders.

Hip and spine BMD of each patient was measured using Dual energy Absorptiometry-x-ray. According to International Society for Clinical Densitometry (ISCD), hip and spine z-score less than -2 was considered as low BMD. A questionnaire containing demographic data, duration of disease, cigarette smoking, previous rheumatologic disease and pathologic fracture in patients was recorded. Also, Body mass index (BMI) of each participant was interpreted.

Data was analyzed by SPSS using descriptive statistics such as mean, standard deviation, frequency. The

differences between quantitative and qualitative data were analyzed using independent sample t-test and chi-square test respectively. P-value less than 0.05% considered statistically significant.

RESULTS

Totally 78 patients were enrolled in this study. of them, 35 (44.9%) were male and 43 (55.1%) were female. the mean age of case subjects was 29.76 ± 6.6 years old and among control subjects was 28.46 ± 0.8 . The mean BMI among case group was 23.4 ± 4.32 and in control group was 23.97 ± 4.22 . These differences were not statistically significant among both groups. The study results showed that 4 patients (5.2%) were smoker. There was no significant correlation between cigarette smoking and low BMD ($P > 0.05$). Among the participants 10 (12.8%) patients gave history of pathologic fractures, of them 8 (80%) patients were in case group and 2 (20%) patients were in control group. This was also significantly

different between both groups ($P = 0.043$, $RR = 4.7$, $CI: 0.94 - 24.15$).

In table 1, Bone mineral density in hip and spine are listed according to group studied and gender. As shown in table above, bone mineral density in hip and spine of case subjects are relatively lower than control group. But, these differences are not statistically significant among both groups.

The results showed that according to ISCD, 4 patients (5.06%) had low BMD and all of them were in case group (10.3%). This difference was statistically significant ($P = 0.04$). Also, all of the 4 patients was female (9.3%) but, there was no statistical significant between male and female ($P > 0.05$). The results showed that there was mild correlation between BMI and hip Z-score among the population studied. This correlation was statistically significant ($R = 0.41$, $P < 0.001$). But, there was no significant correlation between BMI and spine Z-score ($R = -0.011$, $P > 0.05$).

Table1: Bone mineral density regarding to group studied and gender

Variables		Case	Control	Male	Female
C-Telopeptide	Mean (SD)	318.30 (292.4)	250.06 (136.4)	329.5 (279)	247.3 (173.9)
	P-value	NS*		NS	
	CI*	-34.67, 171.14		-20.73, 185.13	
Hip z- score	Mean (SD)	-0.28 (0.87)	-0.07 (0.87)	-0.15 (0.78)	-0.19 (0.95)
	P-value	NS		NS	
	CI	-0.6, 0.18		-0.35, 0.44	
Spine Z-score	Mean (SD)	-0.6 (1.03)	-0.27 (1.11)	-0.47 (0.81)	-0.43 (1.27)
	P-value	NS		NS	
	CI	-.82, 0.14		-0.53, 0.45	

*NS: not significant; + CI: confidence interval

DISCUSSION

Osteoporosis is the most important metabolic bone disease among patients with type one diabetes mellitus (Seino and Ishida, 1995). Many studies reported that osteoporosis can be associated with diabetes mellitus related disorders. But, this mechanism retained still unknown (Miazgowski and Czekalski, 1998, Dobnig, Piswanger-Sölkner et al., 2006).

Some studies demonstrated patients with type one diabetes mellitus have higher bone turn over than general population. This association almost attributed to secondary hyperthyroidism, hypomagnesemia and decreased level of vitamin D (Pastor, Lopez-Ibarra et al., 2000, Hofbauer, Brueck et al., 2007). in addition diabetes mellitus may be associated be with some other risk factors for osteoporosis such as negative protein balance and hormonal imbalance (Hofbauer, Brueck et al., 2007). Also, common complications of diabetes mellitus including microangiopathy and neuropathy can exacerbate the

osteoporosis process (Nicodemus and Folsom, 2001). Our results showed that case subjects had lower BMD in compared to control group. This results was consisted with findings of other studies (Kayath, Tavares et al., 1998; Forsen, Meyer et al., 1999).

Many studies demonstrated that pathologic fractures among diabetic patients are more prevalent than non-diabetic populations (Munoz-Torres, Jodar et al., 1996, Vestergaard, Rejnmark et al., 2005). Forsen and colleagues reported that risk of hip fracture among postmenopausal diabetic women is 7 times more than control group (Forsen, Meyer et al., 1999). Also, Nicodemus et al., reported that hip fracture among diabetic women was 12 fold higher than control subject (Nicodemus and Folsom 2001).

These studies were consisted with our findings. Some investigations reported that diabetic microangiopathies such as peripheral neuropathy and

retinopathy that affect the physical activity of patients and thus leading to increased risk of falls and consequently pathologic fracture (Pastor, Lopez-Ibarra et al., 2000). This study indicated, cigarette smoking had no significant correlation with low BMD, but in another study performed by Lunt and colleagues reported that cigarette smoking had significant association with lower BMD (Lunt, Florkowski et al. 1998). Some studies showed that osteoporosis in female is higher than male (Cortet, Boutry et al. 2004). Our study also demonstrated that osteoporosis was more among female patients than male. While some other investigators reported inconsistent result with our finding (O'Neill, Felsenberg et al., 1996, Kemink, Hermus et al., 2000).

This study had some limitations including we studied a young population and it is possible that our results have been affected by that. In addition, we didn't clarify the cause of bone fracture among the participants. This study showed that type one diabetes mellitus is a major risk factor for developing osteoporosis and the ensuing pathologic fracture. Therefore, evaluation of bone mineral density of these patients is recommended. Also, we suggest them to accommodate suitable and sufficient supplementary diets in their daily regiment in order to prevent early osteoporosis.

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