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Prevalence of Osteopenia in Chronic Asymptomatic Type 2 Diabetic Patients by Means of Bone Mineral Density

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ABSTRACT

To determine the prevalence of osteoporosis in asymptomatic chronic type 2 diabetes mellitus patients by bone mineral density, vitamin D3 levels, serum calcium, serum phosphorus. To be able to provide a simple screening tool to detect osteopenia in diabetic patients to correct it and hence to improve their quality of life. The subjects were selected from the first 25 patients who present at the diabetic outpatient department and controls from the general medicine outpatient department in the age group between 35-45 years and after obtaining informed consent in writing after explaining about the study were categorized into subjects and controls, respectively. They were initially screened for poor glycemic control and normal calcium and phosphorus levels.

Key words: Osteoporosis, Diabetes, Serum calcium, Serum phosphorus.

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INTRODUCTION

Type 2 diabetes mellitus consists of an array of dysfunctions characterized by hyperglycemia and resulting from the combination of resistance to insulin action, inadequate insulin secretion, and excessive or inappropriate glucagon secretion. Poorly controlled type 2 diabetes is associated with an array of microvascular, macrovascular, and neuropathic complications. Apart from the well-known complications 51 of 1 diabetes like coronary artery disease, neuropathy, nephropathy, diabetes can also cause some uncommon and not much understood complications, one of which is the occurrence of osteopenia 6 in otherwise healthy and asymptomatic patients. Although osteopenia has been associated with human diabetes mellitus, the pathogenesis of diabetic osteopenia is unclear [1-3].

In the present study, we plan to evaluate the effect of diabetes on bone mineral density (BMD)-measured by a portable real-time ultrasound de ns attometer 32 and biomarkers of bone metabolism in 50 subjects, out of whom 25 had poorly controlled diabetes and the rest were non-diabetics of same age group and other same ethnic conditions. Type 2 diabetes mellitus consists of an array of dysfunctions 50 51 characterized by hyperglycemia and resulting from the combination of resistance to insulin action, inadequate insulin secretion, and excessive or inappropriate glucagon secretion. Poorly controlled type 2 diabetes is associated with an array of microvascular, macrovascular, and neuropathic complications. Microvascular complications 51 of diabetes include retinal, renal, and possibly neuropathic disease. Macrovascular complications 51 include coronary artery and peripheral vascular disease. Diabetic neuropathy affects autonomic and peripheral nerves. Unlike patients with type 1 diabetes mellitus, patients with type 2 are not dependent on insulin for life. This distinction was the basis for the older terms for types 1 and

2, insulin dependent and non-insulin dependent diabetes [4,5].

However, many patients with type 2 diabetes are ultimately treated with insulin. Because they retain the ability to secrete some endogenous insulin, they are considered to require insulin but not to depend on insulin. Nevertheless, given the potential for confusion due to classification based on treatment rather than etiology, the older terms have been abandoned [6]. Another older te , for type 2 diabetes mellitus was adult-onset diabetes. Currently, because of the epidemic of obesity and inactivity in children, type 2 diabetes mellitus is occurring at younger and younger ages. Although type 2 diabetes mellitus typically affects individuals older than 40 years, it has been diagnosed in children as young as 2 years of age who have a family history of diabetes. In many communities, type 2 diabetes now outnumbers type 1 among children with newly diagnosed diabetes. Diabetes mellitus is a chronic disease 51'52 that requires long-term medical attention to limit the development of its devastating complications and to manage them when they do occur. It is a disproportionately expensive disease; in the United States in 2007, the direct medical costs of diabetes were $116 billion, and the total costs were $174 billion; people with diabetes had average medical expenditures 2.3 times those of people without diabetes. The emergency department utilization rate by people with diabetes is twice that of the unaffected population [7-11].

MATERIALS AND METHODS

Inclusion criteria

- ✓ People with diabetes mellitus type 2 for > or = 2 years but less than 10 years.
- ✓ No history of bone pain or pathological fractures.
- ✓ Age group between 35-45 years.
- ✓ With poor glycemic control hbalc > 7.4% or FBS over 126 mg/dl.
- ✓ Serum calcium levels above 9.
- ✓ Serum phosphorus above 3.

Exclusion criteria

- ✓ Newly diagnosed diabetes.
- ✓ History of pathological fractures/ma! union/ nonunion.
- ✓ Age less than 35 years or over 45 years.
- ✓ Good glycemic control.
- ✓ Post-menopausal or after hysterectomy.
- ✓ History of parathyroid problem.
- ✓ Serum calcium levels below 9.
- ✓ Patients on pioglitazone.
- ✓ History of kidney disease.

Study sample

Total: 50 patients.

Subjects: 25 randomly selected patients from the diabetic office.

Control: 25 randomly selected patients from the general medicine office.

Sample selection

The subjects were selected from the first 25 patients who present at the diabetic outpatient department and controls from the general medicine outpatient department in the age group between 35-45 years and after obtaining informed consent in writing after explaining about the study were categorized into subjects and controls respectively. They were initially screened for poor glycemic control and normal calcium and phosphorus levels.

RESULTS

The Normality tests Kolmogorov-Smirnov and Shapiro Wilks tests 45 ' 46 results show that the variables follow Normal distribution. Therefore, to analyze the data parametric tests are applied. To compare mean values between groups independent samples t-test is applied. To compare proportions between groups Chi-Square tests 1s applied. SPSS version 20.0 is used to analyze the data.

Shows that the mean age among subjects with diabetes in the study was 40.40 with a standard deviation of 3.64. mean age among controls without diabetes was 40.04 with a standard deviation of 3.18 years. Mean Bone mineral density among cases was -1.428 and that among controls was -0.576 with a t value of 3.577 and the p value was 0.001 which is statistically significant and hence disproves the Null Hypothesis; hence patients with diabetes may have her prevalence of osteopenia (Table 1). Out of 25 cases 11 were male and 14 female and amongst the control subjects 11 were male and 14 were female (Table 2).

From Figure 1 we can infer that the mean BMD amongst cases was -1.428 and that among the non-diabetic population was -0.576 and the comparative p-value 1s 0.001 which 1s statistically significant.

Out of 25 cases 12 had a low Vitamin D3 level while out of 25 controls only 7 had osteopenia. This is clinically significant, but the comparative p value was 0.145 which was not statistically significant, hence further studies necessary (Table 3). Table 4 represents Chi-Square test to compare proportions between genders-overall. Table 5 Chi-square test to compare proportions between genders-group wise.

Three hundred and ninety-eight consecutive diabetic patients from a single outpatient clinic received a standardized questionnaire on osteoporosis risk factors, and were evaluated for diabetes-related complications, U A1 c levels, and lumbar spine (LS) and femoral neck (FN) EMD. Of these, 139 (71 men, 68 women) type 1 and 243 (115 men, 128 women) type 2 diabetes patients were included in the study. BMD (T-scores and values adjusted for age, BMI and duration of disease) was compared between patient groups and between patients with type 2 diabetes and population-based controls (255 men, 249 women) [12,13].

In that study they found that for both genders, adjusted BMD was not different between the type 1 and type 2 diabetes groups but was higher in the type 2 group compared with controls ($p < 0.0001$). Osteoporosis prevalence (BMD T-score < -2.5 SD) at FN and LS was equivalent in the type 1 and type 2 diabetes groups, but lower in type 2 patients compared with controls (FN: 13.0% vs 21.2%, LS: 6.1% vs 14.9% men; FN: 21.9% vs 32.1%, LS: 9.4% vs 26.9% women). Osteoporosis prevalence was higher at FN-BMD than at LS-BMD. On the contrary in our study where we screened 25 diabetic patients for

Table 1: Independent samples T-Test to compare mean values between cases and controls.

Variables	Group	N	Mean	Std. Dev	t-Value	P-Value
Age (years)	Cases	25	o.40	3.64	0.372	0.711
	Controls	25	40.04	3.18		
Bone mineral kiensity	Cases	25	-1.428	0.959	3.577	0.001
	Controls	25	-0.576	0.706		
Vitamin D3	Cases	25	19.54	0.4	1.368	0.178
	Controls	25	21.14	3.82		

Table 2: Cross Tables: Chi-Square test to compare proportions between groups.

	Group					
	Cases		Controls		Total	
Gender	N	%	N	%	N	%
Male	11	44	11	44	22	44
Female	14	56	14	56	28	56
Total	25	100	25	100	50	100
	Chi-Square Test	Value	P-Value			
	Pearson Chi-Square	0	1			

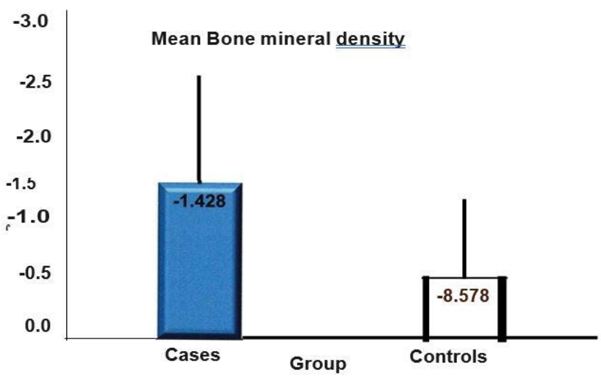

Figure 1: Bone mineral density.

Table 3: Vitamin D3 levels among the two groups.

Vitamin D3	Group					
	Cases		Controls		Total	
	N	%	N	%	N	%
Normal	13	52	18	72	31	62
Low	12	48	7	28	19	38
Total	25	100	25	100	50	100
	Chi-Square Test	Value	P-Value			
	Pearson Chi-Square	2.122	0.145			

Table 4: Cross tables: Chi-Square test to compare proportions between genders-overall.

	Gender					
	Male		Female		Total	
Bone mineral density	N	%	N	%	N	%
Normal	14	63.6	14	50	28	56
Osteopenia	8	36.4	14	50	22	44
Total	22	100 .0	28	100	50	100
	Chi-Square Test	!Value	P-Value			
	Pearson Chi-Square	0.93	0.335			

Table 5: Cross tables: Chi-square test to compare proportions between genders-group wise.

Group	Bone mineral density	Gender					
		Male		Female		Total	
		N	%	N	%	N	%
Cases	Normal	5	45.5	3	21.4	8	32
	Osteopenia	6	54.5	11	78.6	17	68
	Total	11	100	14	100	25	100 .0
Controls	Normal	9	81.8	11	78.6	20	80
	Osteopenia	2	18.2	3	21.4	5	20
	Total	11	100	14	100	25	100

Bone mineral density, we found that 17 out of the 25 screened had demonstrable osteopenia with a mean BMD of -1.428 with an SD of 0.959 as compared to the control subjects where the mean BMD was-0.576 with an SD of 0. 706 and the comparative prevalence of osteopenia by independent samples T- test revealed a p value of less than 0.001 which is statistically significant and correlates with the study we had referred to when we planned the study [14].

There was no significant difference between the prevalence of osteopenia among men and that of women. Likewise in our study among 25 test subjects 11 were male and 14 females among whom 6 males and 11 females had osteopenia the comparative prevalence was not statistically significant by Pearson's correlation with a p-value of 0.201 hence implying that the gender may not be an added risk factor for osteopenia at least 1n menstruating women [15-17]. Vitamin D levels may be altered in type 2 diabetes previous studies like the one conducted other and her associates in Denmark they had studied the possibility of altered vitamin d 3 levels in diabetes and if there was any increased risk of diabetes and insulin resistance in patients with altered D3 levels and vice versa. They concluded that having vitamin D status <50 nmol/L doubled the risk of newly diagnosed type 2 diabetes after adjustment for BMI, sex, exposure to polychlorinated biphenyls, serum triacyl glyceride concentration, serum HDL concentration, smoking status, and month of blood sampling. Furthermore, the HbA 1c concentration decreased at higher serum 25(OH) D3 concentrations independent of covariates. The possible mechanisms 16'1 7 are unclear the; association of low serum 25-hydroxyvitamin D3 [25(OH)D3] concentrations with type 2 diabetes may be mediated through effects on glucose homeostasis and a direct effect of vitamin D on the -cell function, and thus insulin sec ret ion. Several studies have suggested that low vitamin D status also contributes to insulin resistance [18-22]. Low vitamin D status 16 17 is associated with markers of impaired glucose metabolism, such as glycosylated hemoglobin (HbAl c) However, most of these studies focused on heterogeneous groups of middle aged subjects [23].

In our study we found that out of 25 test subjects had various degrees of vitamin D3 deficiency with a mean value of 19.54 as compared to 7 out of 25 control subjects with a mean value of 21.14 and the comparative prevalence by independent samples t- test yielded a p-value of 0.178. Even though there was an increased prevalence of vitamin d deficiency among diabetic population in the study it was not statistically significant unlike the study we referred to. The possible reasons may be the small sample size and the study being done in the hospital may not be representative of the general population.

CONCLUSION

There was a higher prevalence of osteopenia among asymptomatic type 2 diabetic patients with poor glycemic control which was statistically significant. There was no gender difference between males and females 1n the prevalence of osteopenia 1n diabetics hence implying that gender may not have a factor 1n determining osteopenia in diabetics at least 1n menstruating women, but still further studies are necessary to prove this claim. There was a higher prevalence of Vitamin D3 deficiency among the diabetic population, but it was still statistically significant. Hence further studies are necessary. Also, further studies are necessary to test the possible causal relationship between diabetes and vitamin d3 deficiency.

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ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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