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PREVALENCE OF OSTEOPENIA IN CHRONIC ASYMPTOMATIC TYPE 2 DIABETIC PATIENTS

PROF.DR.E.DHANDAPANI[1]*, DR. B.KALAISELVI[2], DR.S.ARUN[3]

[1]Professor, Department of Medicine, SBMCH, Chromepet, Chennai-44

2Professor & HOD of Pharmacology, ACS Medical College, Velappan Chavadi, Chennai-77

3Assistant Professor, Department of Medicine, SBMCH, Chromepet, Chennai-44

ABSTRACT

Type 2 diabetes is a pandemic and as the number of people with diabetes keeps on increasing, so does the complications of diabetes. Osteopenia and osteoporosis are uncommon complications of diabetes. The aim of the present study is to determine the bone mineral density , levels of vitamin D3, serum calcium, phosphorous and the prevalence of osteopenia / osteoporosis in asymptomatic type2 diabetic patients thereby providing a simple screening tool to detect osteopenia, correct it and improve their quality of life. The study commenced from 1st of October 2013 to june1st of 2014 in Sree Balaji Medical College Hospital, Chromepet. A total of 50 patients were selected, who met the inclusion and exclusion criteria, 25 from the Diabetology and matched controls of 25 from the General Medicine outpatient department. The selected patients were subjected to a portable real time ultrasound bone densitometer and bone mineral density levels were categorized into normal, osteopenic and osteoporotic accordingly. All the test subjects also underwent Vitamin D3 estimation. In the results we found that 17 out of the 25 in the diabetic group had osteopenia with a mean BMD of -1.428, with an SD of 0.959 as compared to the control subjects, in whom the mean BMD was-0.576 with an SD of 0.706. The comparative prevalence of osteopenia by independent samples T test revealed a p value of less than 0.001 which is statistically significant.

Keywords: *Diabetes,Osteopenia,osteoporosis,Bone mineral density, vitamin D*

PROF.DR.E.DHANDAPANI*

Professor, Department of Medicine, SBMCH, Chromepet, Chennai-44

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INTRODUCTION

The number of people with diabetes has risen from 108 million in 1980 to 422 million[1] in 2014. The global prevalence of diabetes* among adults over 18 years of age has risen from 4.7% in 1980 to 8.5% in 2014.Type 2 diabetes mellitus characterized by hyperglycemia, insulin resistance , inadequate insulin secretion, and excessive or inappropriate glucagon secretion, is associated with an array of microvascular, macrovascular, and neuropathic complications[2]. Apart from the well known complications of 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 in otherwise healthy and asymptomatic patients. Osteopenia in a term to define bone density that is not normal but not as low as osteoporosis. The WHO defines osteopenia as bone density represented by T score of -1.0 to -2.5. Although osteopenia has been associated with diabetes mellitus, the pathogenesis is unclear. In the present study of 50 patients, 25 diabetic & 25 non diabetic, we planned to evaluate the effect of diabetes on bone mineral density (BMD) , a biomarker of bone metabolism, measured by a portable real-time ultrasound densitometer.

Aim And Objectives

To determine the bone mineral density and vitamin D3 levels in asymptomatic type2 diabetic patients.

Objectives

1. To determine the prevalence of osteopenia / osteoporosis in asymptomatic chronic type 2 diabetes mellitus patients by bone mineral density, vitamin D3 levels, serum calcium, serum phosphorus.

2. To provide a simple screening tool to detect osteopenia in diabetic patients , correct it and to improve their quality of life

MATERIALS AND METHODS

Inclusion criteria

1) People with diabetes mellitus type 2 for 2 – 10 years
2) No history of bone pain or pathological fractures
3) Age group between 35-45 years
4) With poor glycemic control, Hba1c > 6.4% or FBS over 126 mg /dl
5) Serum calcium levels above 9mg/dl.
6) Serum phosphorus above 3.

Exclusion criteria

1) Newly diagnosed diabetes
2) History of pathological fractures / mal union / non union
3) Age less than 35 years or over 45 years
4) Good glycemic control.
5) Post menopausal or after hysterectomy
6) Past history of parathyroid problem
7) Serum calcium levels below 9mg/dl.
8) Patients on pioglitazone
9) History of kidney disease.

Study sample

Total : 50 patients
Subjects : 25 randomly[3] selected patients from the diabetic OPD
Control : 25 randomly selected patients from the General Medicine OPD
Study Duration : From 01.10.2013 to 01.06.2014, in Sree Balaji Medical College Hospital, Chennai 44.

Testing method

Ethical committee approval was obtained before commencing the study.(ref no: 1134)the selected people who fulfilled the inclusion criteria based on a questionnaire were subjected to a portable real time ultrasound bone densitometer[4] after obtaining written consent andased on bone mineral density levels were categorized into normal, osteopenic and osteoporotic accordingly. All the test subjects also underwent Vitamin D3 estimation.

RESULTS

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

Variables	Group	No.	Mean	Std. Devt	T-Value	P-Value
Age (years)	Cases	25	40.40	3.64	0.372	0.711
	Controls	25	40.04	3.18		
Bone mineral density	Cases	25	-1.428	0.959	3.577	0.001
	Controls	25	-0.576	0.706		
Vitamin D3	Cases	25	19.54	4.40	1.368	0.178
	Controls	25	21.14	3.82		

Table 1 shows that the

1. **Mean age among subjects with diabetes in the study was 40.40 with a standard deviation of 3.64.**
2. **Mean age among controls without diabetes was 40.04 with a standard deviation of 3.18 years.**
3. **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 a higher prevalence of osteopenia.**

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

Gender	Group					
	Cases		Controls		Total	
	No	%	No	%	No	%
Male	11	44.0	11	44.0	22	44.0
Female	14	56.0	14	56.0	28	56.0
Total	25	100.0	25	100.0	50	100.0

Chi-Square Test	Value	P-Value
Pearson Chi-Square	0.000	1.000

Out of 25 cases 11 were male and 14 female and amongst the control subjects 11 were male and 14 were female.

Table 3
Bone mineral density

Bone mineral density	Group					
	Cases		Controls		Total	
	No	%	N	%	N	%
Normal	8	32.0	20	80.0	28	56.0
Osteopenia	17	68.0	5	20.0	22	44.0
Total	25	100.0	25	100.0	50	100.0

Chi-Square Test	Value	P-Value
Pearson Chi-Square	11.688	0.001

We found that 2 patients in the cases group had osteoporosis and 1 patient from the control group. From the above table we can infer that the mean BMD amongst cases was -1.428 and that among the controls was -0.576 and the comparative p value is 0.001 which is statistically significant.

Table 4
Vitamin D3 levels among the two groups

Vitamin D3	Group					
	Cases		Controls		Total	
	No	%	No	%	No	%
Normal	13	52.0	18	72.0	31	62.0
Low	12	48.0	7	28.0	19	38.0
Total	25	100.0	25	100.0	50	100.0

Chi-Square Test	Value	P-Value
Pearson Chi-Square	2.122	0.145

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 5
Cross Tables: Chi-Square test to compare proportions between genders

Bone mineral density	Gender					
	Male		Female		Total	
	No	%	No	%	No	%
Normal	14	63.6	14	50.0	28	56.0
Osteopenia	8	36.4	14	50.0	22	44.0
Total	22	100.0	28	100.0	50	100.0

Chi-Square Test	Value	P-Value
Pearson Chi-Square	0.930	0.335

From the above table we can infer that there was no significantly higher prevalence of vitamin D3 among the genders.

Vitamin D3 levels amongst the 2 genders

Vitamin D3	Gender					
	Male		Female		Total	
	No	%	No	%	No	%
Normal	18	81.8	13	46.4	31	62.0
Low	4	18.2	15	53.6	19	38.0
Total	22	100.0	28	100.0	50	100.0

Chi-Square Test	Value	P-Value
Pearson Chi-Square	6.549	0.010

Table 6

Cross Tables: Chi-Square test to compare proportions between genders – group wise :BMD

Group	Bone mineral density	Gender					
		Male		Female		Total	
		No	%	No	%	No	%
Cases	Normal	5	45.5	3	21.4	8	32.0
	Osteopenia	6	54.5	11	78.6	17	68.0
	Total	11	100.0	14	100.0	25	100.0
Controls	Normal	9	81.8	11	78.6	20	80.0
	Osteopenia	2	18.2	3	21.4	5	20.0
	Total	11	100.0	14	100.0	25	100.0

Group	Chi-Square Test	Value	P-Value
Cases	Pearson Chi-Square	1.634	0.201

VITAMIN D3 LEVELS

Group	Vitamin D3	Gender					
		Male		Female		Total	
		No	%	No	%	No	%
Cases	Normal	7	63.6	6	42.9	13	52.0
	Low	4	36.4	8	57.1	12	48.0
	Total	11	100.0	14	100.0	25	100.0
Controls	Normal	11	100.0	7	50.0	18	72.0
	Low	0	0.0	7	50.0	7	28.0
	Total	11	100.0	14	100.0	25	100.0

Group	Chi-Square Test	Value	P-Value
Cases	Pearson Chi-Square	1.066	0.302
Controls	Fisher's Exact Test	-	0.008

DISCUSSION

Gudrun Leidig-Bruckner[4,5] and his associates in Department of Internal Medicine, Endocrinology and Metabolism, University of Heidelberg,Germany, studied 398 consecutive diabetic patients from a single outpatient clinic, received a standardized questionnaire on osteoporosis risk factors, and evaluated them for diabetes-related complications, HbA1c levels, and lumbar spine (LS) and femoral neck (FN) BMD. 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).In that study they found that for both genders, adjusted BMD was not different between the type 1 and type 2 diabetic groups[5] 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 diabetic 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.1.On the contrary in our study where we screened 25 diabetic patients for 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 from tables 1,2 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 .From the same study by Gudrun Leidig-Bruckner et al[4,5,6] they reported that there was no significant difference between the prevalence of osteopenia among men and women. Likewise in our study among 25 test subjects 11 were male and 14 female among whom 6 males and 11 females had osteopenia the comparative prevalence was not statistically significant by Pearson's correlation[7] with a p-value of 0.201 hence implying that the gender may not be an added risk factor for osteopenia atleast in menstruating women.Vitamin D levels may be altered in type 2 diabetes; previous studies like the one conducted by Christine Dalgard[8,9,10] 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 triacylglyceride concentration, serum HDL concentration, smoking status, and month of blood sampling. Furthermore, the HbA_{1c} concentration decreased at higher serum $25(OH)D_3$ concentrations independent of covariates. The possible mechanisms are unclear the; association of low serum 25-hydroxyvitamin D_3 [$25(OH)D_3$] concentrations with type 2 diabetes[11,12,13] may be mediated through effects on glucose homeostasis and, in particular, a direct effect of vitamin D on the β-cell function, and thus insulin secretion . Several studies have suggested that low vitamin D status also contributes to insulin resistance . Low vitamin D[6-7] status is associated with markers of impaired glucose metabolism, such as glycosylated hemoglobin (HbA_{1c}). However, most of these studies[14,15]

focused on heterogeneous groups of middle-aged subjects.. In our study we found that out of 25 test subjects 13 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 from table 4 and the comparative prevalence by independent samples t- test yielded a p-value of 0.178 from table 6. Even though there was an increased prevalence of vitamin D deficiency among diabetic population in the study it was not statistically significant . 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

1. There was a higher prevalence of osteopenia among asymptomatic type 2 diabetic patients with poor glycemic control which was statistically significant.
2. There was no gender difference between males and females in the prevalence of osteopenia in diabetics, implying that gender may not be a factor in determining osteopenia in diabetics atleast in menstruating women, but still further studies are necessary to prove this claim.
3. 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.

CONFLICT OF INTEREST

Conflict of interest declared none.

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