ORIGINAL RESEARCH

Prevalence of Osteoporosis in Postmenopausal Diabetic Women; A cross-sectional study

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ABSTRACT

Introduction: Osteoporosis is a significant public health concern, particularly among postmenopausal women with type 2 diabetes mellitus (T2DM). This study aimed to evaluate the prevalence of osteoporosis and osteopenia in diabetic women compared to non-diabetic controls and identify related risk factors. **Materials and Methods:** A cross-sectional study was conducted, including 272 postmenopausal women diagnosed with T2DM and 255 age-matched non-diabetic controls. Clinical, demographic, and laboratory data were collected. Bone mineral density (BMD) at the femoral neck and lumbar spine was measured using dual-energy X-ray absorptiometry (DXA). The correlation between osteoporosis and diabetes-related parameters, including HbA1c, insulin therapy, retinopathy, and microalbuminuria, was analyzed. **Results:** The prevalence of femoral neck osteoporosis was significantly higher in diabetic women (28.3%) compared to controls (16.4%, p=0.001). Lumbar spine osteoporosis was observed in 8.4% of diabetics compared to 7.0% of controls (p=0.05). No significant correlations were found between osteoporosis and HbA1c, microalbuminuria, retinopathy, hypertension, ischemic heart disease, or insulin therapy. **Conclusion:** Postmenopausal women with diabetes have a higher prevalence of osteoporosis at the femoral neck compared to non-diabetic controls. These findings highlight the need for proactive osteoporosis screening and preventive measures in diabetic women to mitigate fracture risk.

Keywords: Osteoporosis, Type 2 Diabetes Mellitus, Postmenopausal Women, Bone Mineral Density, Osteopenia

INTRODUCTION

Osteoporosis is a metabolic bone disease characterized by decreased bone mineral density (BMD) and an increased risk of fractures, particularly in postmenopausal women due to estrogen deficiency [1]. It is a major global health concern, with significant morbidity, mortality, and economic burden [2]. Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder associated with numerous complications, including cardiovascular diseases, nephropathy, neuropathy, and retinopathy. However, its impact on bone health remains a topic of debate [3].

Several studies have reported an increased risk of osteoporosis and fractures among postmenopausal women with T2DM, despite their often higher BMD compared to non-diabetic counterparts [4]. The pathophysiology linking T2DM and osteoporosis is multifaceted, involving insulin resistance, chronic hyperglycemia, and the accumulation of advanced glycation end products (AGEs), which may impair bone quality and strength [5]. Additionally, diabetic complications such as nephropathy and retinopathy have been suggested to contribute to poor bone health by affecting calcium and vitamin D metabolism [6].

The prevalence of osteoporosis in diabetic postmenopausal women varies across populations, and the factors influencing its development remain unclear. This study aims to assess the prevalence of osteoporosis and osteopenia among postmenopausal women with T2DM compared to non-diabetic controls and to identify possible correlations between osteoporosis and diabetes-related complications.

MATERIALS AND METHODS

A cross-sectional study was conducted at a tertiary care center, enrolling 272 postmenopausal women diagnosed with T2DM and 255 age-matched non-

diabetic controls. The study was approved by the institutional ethics committee, and informed consent was obtained from all participants.

Participant Selection

Participants were selected based on predefined inclusion and exclusion criteria. Inclusion criteria included postmenopausal women aged 45 years and older with a confirmed diagnosis of T2DM for at least one year. Exclusion criteria encompassed secondary osteoporosis, chronic kidney disease, long-term corticosteroid use, or other metabolic bone diseases.

Data Collection

Comprehensive demographic, clinical, and laboratory data were collected through structured interviews, medical record reviews, and laboratory assessments. Variables recorded included age, body mass index (BMI), smoking status, hypertension, diabetes duration, presence of complications (retinopathy, nephropathy), and glycemic control (HbA1c levels).

Bone Mineral Density (BMD) Measurement

BMD was assessed at the femoral neck and lumbar spine (L2-L4) using dual-energy X-ray absorptiometry (DXA) scans, following standardized protocols. T-scores were used to classify participants into normal, osteopenic, or osteoporotic categories based on WHO criteria (osteoporosis: T-score ≤ -2.5, osteopenia: T-score between -1.0 and -2.5).

Statistical Analysis

All data were analyzed using SPSS version 25.0. Continuous variables were expressed as mean ± standard deviation (SD) and compared using Student's t-test, while categorical variables were analyzed using the chi-square test. Pearson's correlation coefficient was used to determine relationships between osteoporosis and clinical variables. A p-value <0.05 was considered statistically significant.

RESULTS

We analyzed the data of 272 patients with diabetes mellitus and 255 subjects as control group. Table 1 shows clinical and laboratory characteristics of diabetic patients. In Table 2 diabetic patients were compared with control group.

Table 1: Demographic, clinical and laboratory characteristics of diabetic women (n=272)

Diabetes Variable	Distribution
Age at diagnosis (years ± S.D)	44.1 ± 8.7
Symptom of hyperglycemia at diagnosis	44 (16.1%)
Duration of diabetes (years ± S.D)	6.8 ± 4.6
HbA1c %	9.2 ± 2.8
Insulin therapy	44 (16.1%)
Hypertension	141 (51.8%)
Retinopathy	42 (15.4%)
Microalbuminuria	37 (13.6)
Ischemic heart disease	23 (8.4%)

Table 2: Comparison of type 2 diabetic women with control subjects

Characteristics	Diabetics (N=272)	Control (N=255)	P Value
Age (years ± S.D)	54.5 ± 11.58	55.0 ± 9.0	0.58
Age at menopause (years ± S.D)	46.7 ± 5.8	48.1 ± 6.3	0.30
BMI (kg/m2, mean ± S.D)	29.5 ± 7.2	28.4 ± 6.6	0.46
Current smoker	23	16	0.32
Alcohol drinker	0	0	-

Prevalence of femoral neck osteoporosis in diabetic women was 28.3 percent (77 cases) and osteopenia was 49.2 percent (121 cases). Osteoporosis prevalence in spine was 8.8 percent (23 cases) and ostropenia was 47.2 percent (116 cases). Osteoporosis in both femoral neck and spine were significantly higher in cases than in controls (Table 3). Correlation between HbA1c and femoral neck (p=0.12, correlation coefficient=0.04) and also spine (p=0.11, correlation coefficient= -0.13) T score was not significant. No significant correlation was found between osteoporosis with presence of microalbuminuria (P=0.92), retinopathy (P=0.34), hypertension (P=0.71), ischemic heart disease (P=0.58) and insulin therapy (P=0.09).

Table 3: Comparison of T score and BMD between tow groups

	Diabetics	Control	
	(N=272)	(N=255)	P Value
Femoral neck T score	-2.81 ± 2.17	-2.47 ± 2.11	0.002
Total spine T score (L2–L4)	-2.02 ± 1.07	-2.11 ± 0.87	0.22

Femoral neck osteoporosis*	77 (28.3%)	42 (16.4%)	0.001
Lumbar osteoporosis*	23 (8.4%)	18 (7.0%)	OR=3.05 (2.29 - 4.27) 0.05
Femoral neck osteoporosis and osteopenia*	194 (71.3%)	166 (65.0%)	OR=3.14 (0.95 - 5.98) 0.11
Lumbar osteoporosis and osteopenia*	135 (49.6%)	18 (7.0%)	0.08

DISCUSSION

We analyzed the data of 272 patients with diabetes mellitus and 255 subjects as control group. Table 1 shows clinical and laboratory characteristics of diabetic patients. In Table 2 diabetic patients were compared with control group.

Our study highlights the significant association between T2DM and osteoporosis, particularly at the femoral neck. The increased prevalence of osteoporosis in diabetic women suggests a potential influence of metabolic dysregulation on bone health. Chronic hyperglycemia may contribute to impaired bone remodeling by affecting osteoblast function and increasing bone resorption [7]. Additionally, advanced glycation end products (AGEs) have been implicated in reducing bone quality by disrupting collagen cross-linking and increasing bone fragility [8].

Moreover, the observed lack of correlation between osteoporosis and HbA1c levels suggests that factors beyond glycemic control, such as insulin resistance, inflammatory cytokines, and oxidative stress, may contribute to bone deterioration [9]. Previous studies have shown conflicting results regarding the relationship between diabetes complications and bone loss, with some indicating a link between nephropathy and reduced BMD, while others report no significant association [10-14].

These findings underscore the need for routine BMD assessment in postmenopausal diabetic women to facilitate early intervention and fracture prevention strategies. Future longitudinal studies should explore the molecular mechanisms driving osteoporosis in diabetes and evaluate the effectiveness of pharmacological and lifestyle interventions in mitigating bone loss.

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