

Frequency of Osteoporosis in Post-Menopausal Diabetic Women attending Physical Medicine and Rehabilitation Department of a Tertiary Care Hospital

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Abstract

Introduction: Osteoporosis is a silent disaster among postmenopausal women worldwide and carries the highest contribution to morbidity and mortality, especially with concomitant Diabetes Mellitus.

Materials and methods: This was a cross-sectional observational study conducted to evaluate Osteoporosis in postmenopausal women having diabetes mellitus attending outdoor in the department of Physical Medicine & Rehabilitation, BSMMU. The study was conducted from July 2020 to June 2021. A total of 54 patients were included in the study.

Results: Osteoporosis of the lumbar spine and femoral neck were present among 72.2% and 55.6% of respondents. Osteoporosis of at least one site was present among 83.3% of respondents. Statistically, a significant relationship was found between osteoporosis and co morbidity, BMI, age of onset of menstruation, age of onset of menopause, and duration of menopause ($p=0.025, 0.01, 0.049, 0.043,$ and 0.032 respectively).

Conclusion: This study showed postmenopausal women are susceptible to Osteoporosis.



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Introduction:

Osteoporosis is a significant concern among postmenopausal women worldwide, particularly those with diabetes mellitus (DM). It's now thought to be a silent pandemic.^{1,2} Although older women are in danger of developing Osteoporosis, which increases their morbidity and mortality, the disease is widely neglected.^{3,4} The World Health Organization (WHO) ranks Osteoporosis second behind cardiovascular disease as a worldwide health problem.⁵ Osteoporosis is caused by a misalignment of bone remodelling, manifested by increased osteoclast activity and

decreased osteoblast numbers. The World Health Organization issued diagnostic criteria^{6,7} for Osteoporosis in postmenopausal women based on the T-score for bone mineral density in 1994 and 2008, respectively (BMD). According to these parameters, Osteoporosis is defined as a BMD value of 2.5 standard deviations or less than that of a young female.

Estrogen plays an essential role in bone remodelling, and estrogen levels in women's bodies drop dramatically after menopause, resulting in bone loss. Furthermore, multinucleated osteoclast cells have estrogen receptors, and when estrogen is absent, these cells become less active, increasing osteoclastic activity. For this increasing osteoclastic activity, the amount of bone resorbed is greater than the amount deposited, resulting in a net bone loss. Another cytokine, in addition to estrogen, plays a crucial role. Increased expression of cytokines including IL-1, IL-6, and TNF in osteoblasts/stromal cells, as well as increased expression of M-CSF (macrophage colony-stimulating factor) and RANKL in osteoblasts/stromal cells, increases osteoclastogenesis.^{8,9}

Furthermore, estrogen inhibits RANKL-stimulated osteoclast differentiation of human monocytes by causing the estrogen

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receptor (ER) to bind to a scaffolding protein called BCAR1. Then the ER/BCAR1 complex sequesters TNF receptor-associated factor 6 (TRAF6), resulting in decreased NF- B activation and RANKL-induced osteoclastogenesis.¹⁰ Many other risk factors are linked to the development of Osteoporosis in women and estrogen and cytokine-like chemical compounds in menopause. Age, lack of physical exercise, poor calcium and vitamin D intake, alcohol and nicotine usage, diseases, and other medicines all affect the bone mineral density and, as a result, add to the risk of Osteoporosis.⁶ Diabetes is connected to Osteoporosis by alterations in metabolic and endocrine physiology, which are primarily associated with substantial comorbidities. According to reports, Osteoporosis (OP), also known as diabetic Osteoporosis, affects more than half of type 1 diabetes patients (DO). On the other hand, several cross-sectional investigations in type 2 diabetes have reported normal³ or elevated⁴ bone mass, which is surprising given the increased fracture risk associated with the disease⁵. Compared to the postmenopausal OP, there is a more significant decline in bone formation than bone resorption in type 2 DM patients with OP, which primarily affects the rate of bone formation and may be a lower turnover ratio type.⁷

In women, the prevalence of Osteoporosis was reported to be 9% in the United Kingdom, 15% in France and Germany, 16 percent in the United States, and 38% in Japan. Still, in men, the prevalence was 1% in the United Kingdom, 4% in Japan, 3% in Canada, and 8% in France.¹¹ According to previous studies, the prevalence of Osteoporosis in Caucasian women over 50 years ranged from 7.9% to 22.6 percent.¹² Meanwhile, the Taiwanese Nutrition and Health Survey discovered that Osteoporosis in the forearm affects 25.0 percent of women and 11.6 percent of men.¹³ Because many women develop osteoporosis-related fractures during their lives, Osteoporosis requires special attention. They eventually form a spinal deformity, which is linked to chronic discomfort, incapacity, decreased mobility, increased reliance, and future complications

Methodology:

Study design:

This was a descriptive cross-sectional study carried out in the Physical Medicine & Rehabilitation Department, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, from July 2020 to June 2021.

Objectives:

General:

To assess the Frequency of Osteoporosis in Diabetic Post-Menopausal Women Attending Physical Medicine & Rehabilitation Outdoor.

Specific:

To assess the bone density based on the T-score of the femoral neck and lumbar vertebrae.

To explore the relationship between onset of menopause and duration of menopause and blood glucose level with Osteoporosis.

To assess the relationship between socio-demographic factors and Osteoporosis.

Patient selection and data collection: Our study considered all outdoor female patients attending the physical medicine department for primary enrollment. After detailed history was taken from the patients then first decided whether she had menopause or not. Women who have asthma, glucocorticoid consumption, cardiac disease, and chronic gastric problems (malabsorption, chronic diarrhoea, and Crohn’s disease) were excluded very first from the study. Patients also have non-diabetic-related renal trouble, ovariectomy, rheumatoid arthritis, or other rheumatic-inflammatory disorders and are excluded. Then she was asked for how long she had DM. If it was more than one year, then she was included in the study or not known about her diabetic status, then she was advised to go pathology department of BSMMU to assess her blood glucose level. The patient was also advised to go Nuclear medicine department to determine the BMD. A semi-structured questionnaire was used to find out the socio-demographic background of the patients.

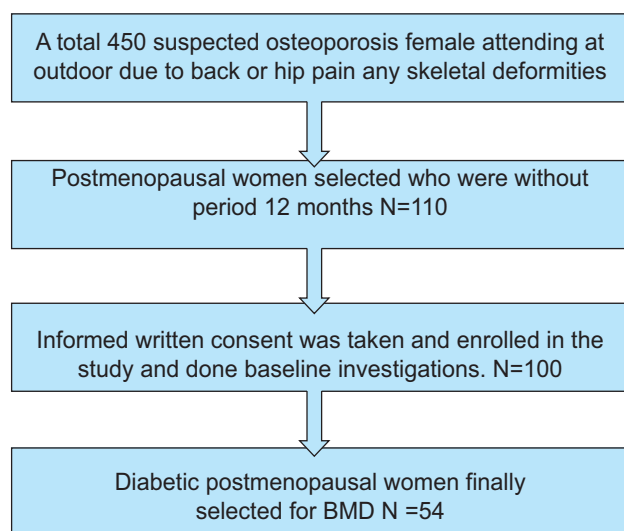


Fig.-1: Schematic diagram of participant selection

Methods of data processing and statistical analysis:

Statistical analysis was carried out by using the statistical package for social sciences version 22.0 for Windows (SPSS Inc, Chicago, Illinois, USA). A descriptive analysis was

performed for all data. Statistical analyses were done by using an appropriate statistical tool like the ‘chi-square’ test.

Ethical measures:

Proper ethical clearance was obtained from the IRB of BSMMU. We tried to avoid minimum physical, psychological, social, and legal risks while taking history, physical examination, and investigations. We took proper safety measures were taken in every step of the study. Only researchers were allowed to access the collected data. According to the Helsinki Declaration for Medical Research involving Human Subjects 1964, all the patients were informed about the study design, the underlying hypothesis, and the right of the participants to withdraw themselves from the research at any time, for any reason. Informed written consent was obtained from each subject who voluntarily gave consent to participate in this study.

Operational definition:

Osteoporosis: Based on the T score from BMD, if T-Score ≤ -2.5 : Positive for osteoporosis and T-Score > -2.5 : Negative for osteoporosis

Diabetes Mellitus: Defined as diabetes as ADA criteria

A fasting plasma glucose (FPG) level of 126 mg/dL (7.0 mmol/L) or higher, or

A 2-hour plasma glucose level of 200 mg/dL (11.1 mmol/L) or higher during a 75-g oral glucose tolerance test (OGTT), or

Random plasma glucose of 200 mg/dL (11.1 mmol/L) or higher in a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, or

A hemoglobin A1c (HbA1c) level of 6.5% (48 mmol/mol) or higher.

BMI: The body mass index (BMI)—is a formula used to calculate a person’s body fat content based on their weight and height.

Menopause and Postmenopause: Menopause is diagnosed when a woman has gone without a period for 12 consecutive months. Post menopause is the years after menopause.

Results:

Among respondents, most of the participants were below 60 years of age group, and 33.3% belonged to the 61-70 year age group. Among the respondents, 66.7% were married; 55.6% lived in rural areas; 88.9% were housewives; 38.9% were illiterate, and 88.9% were Muslims. The Majority of respondents belonged to the normal and overweight category (44.4%). Only 5.6% belonged to an underweight and obese category, and most of them also did not have any

history among family members (72.2%); the Majority (72.2%) of respondents’ age of onset of menstruation was ≤ 12 years. Rest 27.8% belonged to the >12 year age group. The Majority (61.1%) of respondents’ age of onset of menopause was 46-50 years (Table-I).

Table I. Demographic characteristics of study population

		Count	Percentage
Age group	≤ 60	27	50
	61-70	18	33.3
	>70	9	16.7
Marital status	Married	36	66.7
	Others	18	33.3
Area of residence	Rural	30	55.6
	Urban	24	44.4
Occupation	Housewife	48	88.9
	Service holder	6	11.1
Level of education	Illiterate	21	38.9
	Primary	21	38.9
	Up to SSC	6	11.1
	Above SSC	6	11.1
Religion	Islam	48	88.9
	Hindu	6	11.1
BMI	Underweight	3	5.6
	Normal	24	44.4
	Over weight	24	44.4
	Obese	3	5.6
History of osteoporosis in family	Present	15	27.8
	Absent	39	72.2
Occupation	Housewife	48	88.9
	Service holder	6	11.1
Level of education	Illiterate	21	38.9
	Primary	21	38.9
	Up to SSC	6	11.1
	Above SSC	6	11.1
Religion	Islam	48	88.9
	Hindu	6	11.1
Co morbidities	Present	24	44.4
	Absent	30	55.6
Age of onset of menstruation	≤ 12	39	72.2
	>12	15	27.8
Age of onset of menopause	≤ 45	18	33.3
	46-50	33	61.1
	>50	3	5.6

Osteoporosis of at least one site was present among 83.3% of respondents. The Majority of respondents had Osteoporosis. Osteoporosis of the lumbar spine and femoral neck were present among 72.2% and 55.6% of respondents, respectively. Table 3.

Among different variables, BMI and, total duration of menopause, presence of comorbidities were significantly associated with Osteoporosis; the p-value was 0.001 and 0.032, .025 for BMI, duration of menopause, and presence of comorbidities, respectively. All other variables like age, family history of menopause, and blood glucose level failed to show any statistically significant relationship with Osteoporosis. Table 3.

Table-3. Distribution of respondents according to presence of osteoporosis

Characteristics		Count	Percentage
Osteoporosis:	Present	39	72.2
lumbar spine	Absent	15	27.8
Osteoporosis:	Present	30	55.6
femoral neck	Absent	24	44.4
Osteoporosis: at	Present	45	83.3
least one site	Absent	9	16.7

Table 3. Relationship between different variables with osteoporosis

Variables	Total number:		Osteoporosis in number	P value
	Present	Absent		
Age:				
≤60	27	21	6	0.43 ^b
61-70	18	15	3	
>70	9	9	0	
Family history of osteoporosis				
absent	39	33	6	0.696 ^b
BMI				
Underweight	3	0	3	0.001 ^a
Normal	24	21	3	
Overweight	24	21	3	
Obese	3	3	0	
Age of menstruation				
<12years	39	30	9	0.001 ^b
>12years	15	5	8	
Onset of menopause				
<45	18	15	3	0.043 ^b
45-50	33	27	5	
>50	3	3	0	
Duration of menopause				
≤10	21	18	3	0.032 ^b
11-15	12	9	3	
>20	21	18	3	
Glucose level (mmol/l)				
≤11	15	12	3	0.696 ^b
>11	39	33	6	
Comorbidities				
Present	24	19	5	0.025 ^a
Absent	30	4	26	

a. Student t test

b. Fisher's exact test

Discussion:

Osteoporosis is a dangerous non-communicable illness that primarily affects women and has fatal consequences such as fractures. Incidence is increasing in both developed and developing countries. In our study, 83.3 percent of participants have Osteoporosis in at least one site, with Osteoporosis of the lumbar spine and femoral neck being present in 72.2 percent and 55.6 percent of participants, respectively. This result is significantly greater than those of previous international research. In the European Union, Osteoporosis affected 21% of women aged 50 to 84 years in 2010.¹⁴ In a Turkish study, Osteoporosis in the femoral neck was found to be present in 7.5 percent of males and 33.3 percent of women aged 50 and up.¹⁵ In a research done in the United States in 2010, 10.3 percent of persons aged 50 and up (numbering in the thousands)

In a 2010 research in the United States, 10.3% of persons aged 50 and more (or 10.2 million people) had Osteoporosis at the femoral neck or lumbar spine, and 43.9 percent (43.4 million) had poor bone mass at either skeletal site.¹⁶

From February 2000 to September 2002, a study was conducted at King Khalid University Hospital in Riyadh, Saudi Arabia, on 104 postmenopausal Saudi women with T2DM and 101 postmenopausal non-diabetic women (control).

The mean BMD for the diabetes group was 0.928 gm/cm² (T-score = -2.28 SD), and the mean BMD for the femoral neck was 0.817 gm/cm² (T-score = -1.21 SD), and 46.8% of the women developed osteoporosis (mean T-score = -3.3 SD).¹⁷

Another study looked at 1079 Jordanian postmenopausal women between the ages of 45 and 84. Overall, 37.5 percent and 44.6 percent of people had Osteoporosis or osteopenia, respectively. The lumbar spine had the highest Incidence of Osteoporosis (32.4 percent), followed by the left femoral neck (14.4 percent), and the left femoral neck had the highest frequency of osteopenia (56.1 percent), followed by the lumbar spine (41.3 percent).¹⁸

Because most of our ladies are oblivious of their health and less concerned about Osteoporosis, the overall prevalence of Osteoporosis in postmenopausal women in our study was surprisingly higher than in the previous studies.

According to our research, the Majority of responders (72.2 percent) had a blood glucose level of >11 mmol/l. The blood glucose level of the remaining 27.8% of respondents was less than 11 mmol/l. There was no statistically significant associations between the respondent's blood glucose level and Osteoporosis (p=0.696). Osteoporosis was more

prevalent.

Among both nations, the prevalence of Osteoporosis was higher in women who had a history of Osteoporosis or fracture in their mother or sister. One of the most important demographic indicators linked to Osteoporosis is educational attainment.

Other studies¹⁹ have found that education level has an opposite effect on Osteoporosis. The impact of education on lifestyle, diet, and economic status is most likely the reason. Another argument is that economic position has an impact on educational attainment. People from educated homes have more resources, better nutrition, and better health during childhood, all of which affect bone mass. Majority of respondents belonged to the normal and overweight category (44.4%). Only 5.6 percent of the participants were overweight or obese. The respondent's BMI and Osteoporosis had a statistically significant connection (p=0.001). Weight and BMI were found to be considerably lower in the osteoporotic group in Indian and Iranian populations in a previous study. Osteoporosis risk factors include a weight of less than 60 kg and a BMI of less than 26.²⁰ According to our findings, most respondents (72.2 percent) started menstruating when they were 12 years old. The remaining 27.8% of the population was over the age of 12. The Majority of respondents (61.1%) were between the ages of 46 and 50 when menopause began.

The Majority of those polled said they had no comorbidities (55.6 percent)

The remaining 44.4 percent of people had comorbidities. The respondent's comorbidity and Osteoporosis were shown to have a statistically significant connection (p=0.025). The vast Majority of respondents According to our findings, the vast majority of respondents had no family history (72.2 percent).

However, a prior study has shown that this severe issue is linked to family history.²¹

The Majority of the women in this study (38.9%) had been through menopause for between 10 and 15 years. The remaining 22.2 percent were between the ages of 11 and 15. The respondent's menopause duration and Osteoporosis were shown to have a statistically significant link (p=0.032). Early menopause (before 45 years old), late menarche (beyond 14 years), and postmenopausal length of more than five years have all been identified as major risk factors in numerous studies. The greater prevalence of Osteoporosis among postmenopausal diabetes women in our study could be due to a lower socioeconomic status, limited sun exposure, a poor calcium diet, or a lack of exercise. The high prevalence

of Osteoporosis among postmenopausal diabetic women in our sample could be due to a lower socioeconomic status, limited sun exposure, a poor calcium diet, a lack of hormone replacement therapy, or the use of other anti-osteoporosis drugs.

In previous studies, menstrual factors such as late menarche age, early menopause, and amenorrhea have been identified as risk factors for Osteoporosis. Many researchers have suggested that type 1 diabetes mellitus is a risk factor for Osteoporosis. However, there are still controversies in the case of patients with type 2 diabetes mellitus. A few international studies revealed that type 2 diabetes mellitus increased the risk of osteoporosis in postmenopausal women, but others were unable to confirm this link²².

Conclusion

Awareness for prevention of impending Osteoporosis in susceptible individuals as well as concerned physicians for better management of Osteoporosis. In this study, a significant difference in osteoporotic changes was observed with onset of menstruation, age of onset of menopause and duration of menopause. But we failed to show any significant relationship between blood glucose levels and Osteoporosis. As the sample size was not big enough, a further multi-center study with a large sample size was recommended.

Limitations

Although the sample size was calculated statistically, the sample size was relatively small in relation to a huge number of patients suffering from Diabetes Mellitus.

Only one center was enrolled in this study, so the result of the study may not reflect the exact picture of the country. The study was a cross-sectional study, where a causal relationship between the independent and dependent variables cannot be established. None of the patients had HbA1c determination due to financial restriction, which is the gold standard to determine the patient's "glycemic level."

Recommendations

A further multi-center clinical study with a larger sample size with an appropriate design is recommended. A comparative group of non-diabetic postmenopausal women can be included to assess the comparison between diabetic and non-diabetic group

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