ORIGINAL RESEARCH

Is grand multiparity a risk factor for the development of postmenopausal osteoporosis?

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Objective: In this study, we investigated the relationship between the development of postmenopausal osteoporosis and parity.

Materials and methods: The retrospective study included 129 postmenopausal women who were divided into three groups depending on the number of parity: Group I, <5; Group II, 5–9; and Group III, ≥ 10. The mean age of the subjects was 57.71 ± 5.02 years.

Results: No significant difference was found among the three groups regarding body mass index values, duration of menopause, mean thyroid stimulating hormone values and frequency of diabetes. Among the three groups, no significant difference was found in terms of the frequency of lumbar osteoporosis ($p > 0.05$), whereas a significant difference was found regarding the frequency of femoral osteoporosis ($p = 0.012$; $p < 0.05$).

Conclusion: It was revealed that femoral bone mineral density significantly decreased as the number of parity increased.

Keywords: menopause, osteoporosis, parity

Introduction

Osteoporosis is a chronic metabolic bone disorder characterized by low bone mineral density (BMD) and increased fracture risk. With the ageing world population, osteoporosis remains a significant public health problem today and for the future.[1] The exact prevalence of osteoporosis remains unknown, but it may vary among countries and even among ethnic groups in the same country. Osteoporosis is known to be affected by numerous factors, including ethnic origin, socioeconomic status, diet, physical activity, lifestyle, alcohol and drug abuse, and insufficient exposure to sunlight.[1,2] Moreover, postmenopausal osteoporosis is associated with adolescent pregnancy, number and frequency of parity, and duration and frequency of lactation.[2] The mainstay diagnosis of osteoporosis is based on the assessment of BMD at the femoral neck and the anterior–posterior lumbar spine using dual-energy X-ray absorptiometry (DXA).[1,2] A T-score ≤ -2.5 standard deviation (SD) is considered osteoporosis.[1,2]

In this retrospective study, we aimed to investigate the relationship between the development of postmenopausal osteoporosis and parity in patients with low socio-economic status.

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Materials and methods

The retrospective study reviewed the clinical records of the postmenopausal patients admitted to Altinozu State Hospital, Hatay, Turkey, between 1 April 2011 and 1 April 2012. Deidentified patient data were used in this study. Institutional approval was obtained from Altınözü State Hospital Review Board. Patient consent to review their medical

records was not required by the review board, due to the retrospective nature of the study. The patients were admitted because of back pain, hip pain, or routine postmenopausal follow-up. The patients were divided into three groups depending on the number of parity: Group I, <5; Group II, 5–9; and Group III, ≥10.

Patients in the premenopausal period, aged over 65 years, and those with a body mass index (BMI) <20 kg/m^2 or >35 kg/m^2 and a history of smoking or alcohol abuse, were excluded from the study. Patients with a systemic or metabolic disease, such as hyperthyroidism, hypothyroidism, diabetes mellitus type I, chronic asthma, chronic arthritis, chronic inflammatory bowel disease and Cushing's syndrome, were also excluded from the study. In addition, patients using heparin, bisphosphonates, thyroxin, hormone replacement therapy, calcium, vitamin D or thiazide diuretics were excluded from the study.

Age, gravida, parity, BMI, age at the onset of menopause, duration of menopause, complaints at hospital admission, and physical signs and symptoms were recorded. Thyroid function tests were evaluated for each patient. BMD was assessed using DXA (Norland Eclipse XR; Norland Corp., Ford Atkinson, WI, USA), and the assessments were evaluated for each patient. Osteoporosis was defined as a T-score of ≤−2.5, and osteopenia was defined as a T-score between −1.0 and −2.5.

Statistical analysis

All data were analyzed using IBM SPSS Statistics 22.0 (IBM Corporation, Armonk, NY, USA). Normal distribution was tested using a Shapiro–Wilks test. Data were evaluated using descriptive statistics (mean, SD, frequency). Quantitative data with normal distribution were compared among the groups using one-way ANOVA, followed by a Tukey's HSD test. Non-normally distributed parameters were compared using a Kruskal–Wallis test, followed by a Mann–Whitney U test. Qualitative data were compared using a chi-square test. A p-value of <0.05 was considered significant.

Results

The retrospective study included 129 postmenopausal women aged 48–65 years who were admitted to Altinozu State Hospital, Hatay, Turkey between 1 April 2011 and 1 April 2012. The mean age was 57.71±5.02 years. The main complaint at admission was backache or hip pain; however, some patients were evaluated during routine postmenopausal follow-up. In Turkey BMD is assessed with DXA every 2 years in the postmenopausal period.

Table 1 Characteristics of the patients

Characteristics	Parity			p-value
	<5 (n=27)	5–9 (n=35)	≥10 (n=67)	
	Mean ± SD	Mean ± SD	Mean ± SD	
Age (years)	55.26±4.78	56.69±5.14	57.22±4.58	0.062[#]
BMI	33.47±7.9	32.35±6.4	30.3±5.2	0.055[#]
Parity (median)	3.56±1.72 (4)	7.43±1.12 (8)	11.52±1.67 (11)	0.001[##,*]
Duration of menopause (years)	7.19±6.58	7.03±4.56	8.87±5.32	0.185[#]
TSH	1.64±0.88	1.41±0.96	1.34±0.72	0.304[#]
Type II diabetes, n (%)	8 (29.6%)	6 (17.1%)	26 (38.8%)	0.079[###]

Notes: [#]One-way ANOVA test; [##]Kruskal–Wallis test; [###]chi-square test; *p<0.05.
Abbreviations: BMI, body mass index; SD, standard deviation; TSH, thyroid stimulating hormone.

The hospital is located in the Mediterranean region of southern Turkey, where Arabs constitute the most common ethnic group. All the patients studied were illiterate women with low socioeconomic status, most of whom were married and had their first delivery before the age of 18 years. Clinical records indicated that none of the women had a history of alcohol or drug abuse. The records also showed that their diet mostly consisted of meat and milk products because their primary source of income was agriculture and livestock breeding.

Table 1 presents the demographic characteristics of the women in the three groups. No significant difference was found among the three groups in terms of mean age (p=0.062). Moreover, no significant difference was found among the three groups with regards BMI values, the duration of menopause, mean thyroid stimulating hormone values and frequency of type II diabetes.

Table 2 presents the frequency of osteopenia and osteoporosis at the femoral neck and the anterior–posterior

Table 2 Bone mineral density at the femoral neck and the anterior–posterior lumbar spine

DXA findings	Parity			p-value
	<5	5–9	≥10	
	n (%)	n (%)	n (%)	
Lumbar spine				
Normal	7 (25.9%)	3 (8.6%)	15 (22.4%)	0.286
Osteopenia	10 (37%)	11 (31.4%)	20 (29.9%)	
Osteoporosis	10 (37%)	21 (60%)	32 (47.8%)	
Femoral neck				
Normal	15 (55.6%)	7 (20%)	17 (25.4%)	0.012*
Osteopenia	9 (33.3%)	18 (51.4%)	26 (38.8%)	
Osteoporosis	3 (11.1%)	10 (28.6%)	24 (35.8%)	

Note: *p<0.05.

lumbar spine in the three groups. Among the three groups, no significant difference was found in terms of the frequency of lumbar osteoporosis, whereas a significant difference was found with regards the frequency of femoral osteoporosis ($p=0.012$). Binary comparisons indicated that the frequency of osteoporosis in the women with parity <5 (11.1%), was significantly lower than in the women with parity of 5–9 (28.6%) ($p=0.012$), and ≥10 (35.8%) ($p=0.009$). However, no significant difference was found between the women with parity of 5–9 and the women with parity of ≥10 in terms of the frequency of osteoporosis ($p=0.474$).

Table 3 presents the correlation between lumbar DXA values and BMI, parity and the duration of menopause in the three groups. No significant difference was found among the three groups regarding mean BMI values, median parity, and mean duration of menopause.

Table 4 presents the correlation between femoral DXA values and BMI, parity and the duration of menopause in the three groups. In the patients with parity <5, the duration of menopause was significantly longer in the patients with osteoporosis ($p=0.002$). In the patients with parity of 5–9, the BMI values were significantly lower in the patients with osteoporosis compared to the patients with osteopenia ($p=0.035$; $p<0.05$). In the patients with parity of ≥10, no significant difference was found among the three groups in

Table 4 Comparison of BMI, median parity, and duration of menopause according to parity and the presence of osteoporosis/osteopenia at the femoral neck

Parity	Osteoporosis/ osteopenia	BMI	Parity (median)	Duration of menopause (years)
		Mean ± SD	Mean ± SD	Mean ± SD
<5	Normal	33.87±8.31	3.73±1.62 (4)	5.36±5.83
	Osteopenia	31.71±7.19	3.33±2.18 (5)	6.22±4.74
	Osteoporosis	36.8±9.43	3.33±0.58 (3)	18.67±2.31
	p-value	0.619[#]	0.628[##]	0.002[#,*]
5–9	Normal	32.49±3.01	7.57±0.98 (8)	4.57±5.19
	Osteopenia	34.55±6.21	7.5±1.25 (8)	6.78±3.66
	Osteoporosis	28.11±7.02	7.2±1.03 (7)	9.2±5.03
	p-value	0.045[#,*]	0.518[##]	0.112[#]
≥10	Normal	29.72±7.4	11.71±1.83 (11)	8.88±6.08
	Osteopenia	31.57±3.95	11.77±1.84 (11)	8.04±4.91
	Osteoporosis	29.34±4.43	11.13±1.33 (11)	9.75±5.27
	p-value	0.279[#]	0.214[##]	0.532[#]
Total	Normal	31.81±7.32	7.9±3.99 (8)	6.79±6
	Osteopenia	32.57±5.46	8.89±3.61 (9)	7.3±4.47
	Osteoporosis	29.66±5.86	9.43±2.79 (10)	10.32±5.54
	p-value	0.093[#]	0.428[##]	0.008[#,*]

Notes: [#]One-way ANOVA test; [##]Kruskal–Wallis test; *$p<0.05$.
Abbreviations: BMI, body mass index; SD, standard deviation.

terms of mean duration of menopause, median parity and mean BMI values ($p>0.05$).

Discussion

Maternal calcium turnover is increased during pregnancy and lactation. In particular, maternal–fetal calcium transfer is further increased at week 20 of gestation as a result of the peak fetal demand for calcium. Approximately 25–30 g of calcium is transported to the fetus throughout the pregnancy, which is equivalent to 2%–3% of the total calcium content of the mother.[3]

Previous studies have indicated that the loss in maternal BMD also continues during lactation. A previous study reported that the loss of maternal BMD at the femoral neck and the lumbar spine over a 6-month lactation period was 4%–7%, but this loss was partial and was restored after the lactation period.[4] Holmberg-Marttila et al also noted that the systematic loss in maternal BMD persisted during postpartum amenorrhea, but the recovery was accelerated by the resumption of menses.[5]

The association between parity and BMD remains unclear. Several studies have reported that parity has a long-term supportive effect on BMD and that the loss in BMD is lower in multiparous women compared to nulliparous women. Murphy et al reported that parity is an independent predictor for BMD and that BMD increases by 1% per

Table 3 Comparison of BMI, median parity, and duration of menopause according to parity and the presence of osteoporosis/osteopenia in the lumbar spine

Parity	Osteoporosis/ osteopenia	BMI	Parity (median)	Duration of menopause (years)
		Mean ± SD	Mean ± SD	Mean ± SD
<5	Normal	31.8±6.75	3.71±1.8 (4)	7.71±5.25
	Osteopenia	33.82±7.27	3.2±1.93 (4)	3.44±3.78
	Osteoporosis	34.3±9.69	3.8±1.55 (4)	10.2±8.05
	p-value	0.814[#]	0.504[##]	0.074[#]
5–9	Normal	35.87±4.28	7±1 (7)	3.33±1.53
	Osteopenia	33.59±7.96	7.91±1.14 (8)	5.73±4.5
	Osteoporosis	31.08±5.55	7.24±1.09 (7)	8.24±4.53
	p-value	0.368[#]	0.109[##]	0.112[##]
≥10	Normal	30.7±7.86	11.67±2.23 (11)	8.33±5.86
	Osteopenia	31.14±3.88	11.6±1.5 (11)	9.45±5.64
	Osteoporosis	29.6±4.41	11.41±1.52 (11)	8.75±4.99
	p-value	0.559[#]	0.599[##]	0.821[#]
Total	Normal	31.63±7.19	8.88±4.11 (10)	7.56±5.45
	Osteopenia	32.45±6.05	8.56±3.76 (9)	7.08±5.48
	Osteoporosis	30.83±6.02	8.81±3.2 (10)	8.81±5.38
	p-value	0.442[#]	0.902[##]	0.259[#]

Notes: [#]One-way ANOVA test; [##]Kruskal–Wallis test.
Abbreviations: BMI, body mass index; SD, standard deviation.

live birth.[6] Both Tuppurainen et al[7] and Fox et al[8] found a positive relationship between parity and BMD and reported that BMD was significantly higher in multiparous women.

However, several studies have found the opposite. Of these, Allali et al evaluated the influence of parity on mineral density and the risk of postmenopausal fracture and found that the women with parity >6 had significantly lower lumbar and femoral BMD values compared to the women in other groups. However, the authors found no significant correlation between parity and peripheral fractures.[9] In another study, Parra-Cabrera et al reported that multiparity had a deleterious effect on BMD.[10] Similarly, Demir et al,[11] Hillier et al,[12] and Allali et al[9] suggested that multiparity is a risk factor for BMD. Nevertheless, some other studies have postulated that there is no relationship between multiparity and postmenopausal osteoporosis. Of these, Turan et al[13] and Demirtaş et al[14] found no significant relationship between grand-grand multiparity (>10 deliveries) and postmenopausal osteoporosis.

Conclusion

No significant relationship was found between multiparity and the development of lumbar osteoporosis, whereas a positive correlation was found between multiparity and the development of femoral osteoporosis in grand-grand multiparous women. It also revealed that femoral BMD significantly decreased as the number of parity increased.

Despite being limited to retrospective analysis, the present study, to our knowledge, has the largest number of patient series in the literature about the relationship between grand-grand multiparity and osteoporosis. Nevertheless, further randomized, controlled prospective studies are needed to substantiate the relationship between grand-grand multiparity and postmenopausal osteoporosis.

Disclosure

The authors report no conflicts of interest in this work.

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