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Original Research Article

A Hospital Based Observational Assessment of the Influence of Parity on Bone Mineral Density and Peripheral Fracture Risk in Postmenopausal Women

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Abstract

Aim: The aim of the study was to assess of the influence of parity on bone mineral density and peripheral fracture risk in postmenopausal women.

Methods: This was a hospital based cross sectional study and included 240 postmenopausal women. They had been selected randomly from a group of postmenopausal women referred to the outpatient at Department of Obstetric & Gynaecology and Department of Orthopaedics, RIMS, Ranchi, India from June 2020 to December 2020.

Results: The mean age of women was 59.4 (±7.6) years and was significantly correlated with parity level. Increasing parity was associated with higher years since menopause ($p < 0.001$), higher BMI ($p = 0.001$). In contrast, increasing parity was not significantly associated with later age of menopause ($p = 0.08$). All the patients with six and more pregnancies had spine and hip BMD values significantly lower than values in the other groups ($p < 0.001$). After adjustment for age and BMI, decreased lumbar and total hip BMD were still associated to increased parity (ANCOVA, $p = 0.014$ and 0.023, respectively), while the relation between parity and femoral neck BMD was markedly reduced and no longer statistically significant.

Conclusion: The present study suggested that the BMD of the spine and hip decreases with an increasing number of pregnancies, and this situation shows variations in different age groups. However, there was no correlation between parity level and peripheral fractures.

Keywords: Osteoporosis; Bone densitometry; Fractures; Multiparity

Introduction

Osteoporosis is a condition that is mostly associated with menopause and ageing. The rising frequency of osteoporosis is becoming a major public health concern across the world. After 50 years, it manifests clinically as fractures caused by low energy injuries. [1] Osteoporotic fracture occurs as a result of a combination of modest trauma, decreased bone mass, changes in trabecular bone microarchitecture, and cortical porosity. [2,3] At least 40% of osteoporotic women will get one or more fragility fractures over their lifetime.1 Pregnancy and nursing are times in a woman's life when she loses a significant amount of calcium, estimated at 200 to 300 mg per day. [4] This loss results in a negative calcic balance, which is stabilised by bone resorption. [5] Isolated cases of fragility fractures have been observed, particularly among primipares. Their prevalence is still underestimated, and it appears to be associated to a pre-existing fragility or severe bone resorption in the mother. [6-9] Albright and Reifenstein reported the presence of osteoporotic fractures in two pregnant women in 1948. [10]

A study from the National Health and Nutrition Examination Survey (NHANES) showed that among older US adults, the prevalence of osteoporosis and low bone mass in women was significantly higher than that in men, whether at the femoral neck or lumbar spine. [11] Bone mineral density (BMD), as an index to evaluate the mineral content in bone, is often used in the diagnosis of osteoporosis. Low BMD is strongly related to an increased risk of fracture, which increases the incidence rate and mortality for elderly women. [12]

According to Heidari et al [13], the number of pregnancies does not correlate with the prevalence of postmenopausal osteoporosis. According to Yazici et al [14], lengthy or repeated durations of breastfeeding are not associated with the incidence of postmenopausal osteoporosis. Turan et al [15] discovered that women who have had numerous pregnancies had the same BMD as nulliparous women. Sharma et al [16] and Lee et al [17], on the other hand, found that multiparity and extended breastfeeding have a deleterious influence on BMD.

The aim of the study was to assess of the influence of parity on bone mineral density and peripheral fracture risk in postmenopausal women.

Materials and Methods

This was a hospital based cross sectional study and included 240 postmenopausal women. They had been selected randomly from a group of postmenopausal women referred to the outpatient at Department of Obstetric & Gynaecology and Department of Orthopaedics, RIMS, Ranchi, India from June 2020 to December 2020.

A study inclusion criterion was: postmenopausal status (at least 1 year of menopause). Exclusion criteria consisted in having a history of: (1) taking drugs known to influence bone metabolism in the past 2 years, such as vitamin D, calcium, corticosteroids, bisphosphonates and hormone replacement therapy; (2) musclo-skeletal, thyroid, parathyroid, adrenal, hepatic, or renal disease; (3) malignancy; (4) hysterectomy. This study was approved by the Ethics committee of our hospital and all participants provided written consent.

Measurements

Information regarding age at menopause, time since menopause, personal history of smoking or alcohol intake, veiled clothing style and familial history of peripheral fractures were recorded. We also collected data related with the personal history of peripheral osteoporosis fracture, time of each event, and dynamic of the fracture to assess whether the event could be related to bone fragility or to major trauma.

Patients were separated into four groups according to the number of full-term pregnancies, group 1: nulliparae, group 2: one to three pregnancies, group 3: four to five pregnancies, and group 4: six and more pregnancies.

Additionally, patients were separated into three groups according to their ages, as <50 years, 50–59 years and ≥60 years. These age groupings were assigned in order to isolate the group of women undergoing the menopausal transition, occurring roughly in the sixth decade (ages 50–59 years). At the time of BMD measurements, weight and height were measured. Body mass index (BMI) was calculated as weight (kg) divided by height (m2).

Bone mineral density (BMD) of the hip (bilateral proximal hip, total) was measured by dual-energy Xray absorptiometry with a Lunar DPX densitometer. Both T and Z-scores were obtained. In the T-score calculations, the manufacturer's ranges for European reference population were used. The coefficient of variations (CV) 'in vivo', evaluated after two measurements in 30 postmenopausal women between 1 h and 1 week was 2.2% in lumbar spine and 1.4% in total hip.

Statistical Analysis

The continuous variables were expressed as mean±SD. We used analysis of variance (ANOVA) to compare groups according to the number of parity. For multiple group comparisons, we used post hoc Bonferroni test. Analysis of covariance (ANCOVA) was used to compare groups for the adjustment for continuous variables (age and BMI). For parity effect (in g/cm2), we used multiple linear regression for the adjustment for age and BMI.

Results

Table 1: Demographic details

	Number of children				p-Value
	Nullipare	1–3	4–5	≥6	
Age (years)	54.6±5.5	58.2±8.2	59.1±6.4	62.6±7.3	<0.001
BMI (kg/m2)	31.4±6.2	28.2±6.4	31.3±7.3	32.8±8.2	0.002
Age at menopause (years)	55.40 ± 5.28	56.29 ± 5.68	57.44 ± 5.46	54.6±5.7	0.560
Years since menopause	8.2±7.3	9.3±7.3	11.9±7.2	15.5±8.2	<0.001
Age at menarche (years)	12.8±1.5	12.6±1.2	12.6±1.2	12.8±1.6	0.620
Lactation (total months)	0	16.4±16	32±28	48.4±52	<0.001

Increasing parity was associated with higher years since menopause ($p < 0.001$), higher BMI ($p = 0.002$). In contrast, increasing parity was not significantly associated with later age of menopause ($p = 0.560$).

Table 2: Comparison of bone mineral density

	Number of children				p-Value	Age-adjusted p-value	BMI adjusted p-value
	Nullipare	1–3	4–5	≥6			
Spine BMD	0.949 ± 0.140	0.958 ± 0.162	0.968 ± 0.150	0.914 ± 0.164	<0.001	0.003	0.01
BMD trochanter	0.740 ± 0.128	0.748 ± 0.120	0.736 ± 0.118	0.680 ± 0.132	<0.001	0.005	0.001
BMD femoral neck	0.936 ± 0.150	0.904 ± 0.142	0.854 ± 0.150	0.824 ± 0.132	<0.001	0.002	0.002
Total hip BMD	0.920 ± 0.120	0.909 ± 0.136	0.880 ± 0.145	0.848 ± 0.140	<0.001	0.160	0.003

All the patients with six and more pregnancies had spine and hip BMD values significantly lower than values in the other groups ($p < 0.001$). After adjustment for age and BMI, decreased lumbar and total hip BMD were still associated to increased parity (ANCOVA, $p = 0.014$ and 0.023, respectively), while the relation between parity and femoral neck BMD was markedly reduced and no longer statistically significant.

Table 3: Comparison of age and BMI

	Site	Adjusted for age		Adjusted for age and BMI	
		Parity effect (g/cm2) (scaled to a 1-child difference in parity)	p-value	Parity effect (g/cm2) (scaled to a 1-child difference in parity)	p-value
Age <50 years	Spine	−0.07	0.003	−0.07	0.016
	Total hip	−0.05	0.18	−0.06	0.11
Age 50–60 years	Spine	-9×10^{-2}	0.25	−0.001	0.24
	Total hip	−0.015	0.068	−0.002	0.024
Age ≥60 years	Spine	−0.016	0.075	−0.002	0.054
	Total hip	-6.4×10^{-3}	0.46	−0.001	0.36

The effects of parity on BMD with two separate sets of adjustments (linear regression), one for age only and a second for age and BMI. After adjustment for age and BMI, spine BMD decreased significantly on average by 0.004 g/cm2 per child (or 0.02 per five children) ($p = 0.004$), while BMD at total hip, decreased by 0.002 g/cm2 per child but was no statistically significant.

Discussion

Osteoporosis is a hidden chronic metabolic disease that affects both developing and developed countries. It stays undiscovered unless there is a fragility fracture or an X-ray for another ailment. It is also discovered that its effects are more pronounced in postmenopausal women. Osteoporosis is a metabolic bone disease that is characterized by low bone mineral density. [18] It stays overlooked until there is a fragility fracture. It is well known that calcium mobilization and enhanced bone resorption occur after the end of pregnancy and continue to rise during the breastfeeding period. [19,20]

The current study found an unfavourable connection between parity and BMD. As the frequency of pregnancies grew, so did the BMD levels. Women with six or more pregnancies had substantially lower BMD values for both the lumbar vertebra and the hip compared to other groups in our study. After controlling for age and BMI, this link remained significant. Surprisingly, BMD declined with each delivery in all bone regions studied except the spine. Our sub-group analysis demonstrated a significant decline in BMD at the spine and total hip for the 50-year age group compared to the other groups.

Few studies have looked at the relationship between parity and BMD in postmenopausal women with high parity. The findings of the research are contentious. In line with our findings, Gur et al. [21] discovered a substantial negative association between the number of pregnancies and the spine, trochanter BMD, but no significant correlation for the hip neck BMD in Turkish women. According to Hreshchyshyn et al. [22], the BMD of the femoral neck dropped as the number of live births increased, but there was no change in the lumbar spine. The relationship between parity and BMD has also been studied among Old Order Amish women with high parity; Streeten et al. [23] discovered a positive and statistically significant link between rising parity and increasing BMD at the hip in this community. With each pregnancy, Fox et al. [24] detected a 1.4% rise in distal radius bone density. These findings contradict our findings.

Though age difference was not taken into account in earlier studies, it appears that this factor is important when assessing the correlations between the number of pregnancies and the BMD value. Women with six or more pregnancies had substantially lower BMD values for both the lumbar spine and the whole hip than those with fewer pregnancies, however only a significant decline in lumbar BMD persisted in the 50-year age group. Significant variations in total hip BMD were detected between the six-or-more pregnancies group and the other groups in the 60-80-year age range. We found no link between parity and BMD in our 60-year-old subgroup. Gur et al. [21] discovered changes in the parity-BMD relationship based on age groupings, as we did. These differences may explain some of the disparities in the parity-BMD relationship found across research. This relationship may be affected by the proportion of each study's age group.

A study of postmenopausal women in Morocco showed results that were consistent with ours. The authors found that patients with 6 or more parities had significantly lower lumbar spine BMD values than patients with other numbers of parities, but there was no significant difference in the femoral neck BMD values. [25] Gur et al [26] also found that there was a significant negative correlation between the number of pregnancies and spine BMD but no significant correlation with the femoral neck BMD. Heidari et al [27] had similar findings. They reported an independent association between parity and lumbar spine osteoporosis but not for the femoral neck and a 13% increased risk of lumbar spine osteoporosis per parity. In addition, Demir et al [28] and Seo et al. [29] observed that high parity was a risk factor for low BMD in postmenopausal women. However, other studies have shown no relationship between parity and BMD or osteoporosis [30,31], while another study suggested a protective effect of high parity on postmenopausal osteoporosis. [32]

Conclusion

This study revealed that there is a negative association between the number of children a woman has and her bone mineral density (BMD), with variations in this relation occurring according to the age groups. However, it seems that the decline in BMD after each delivery is not significant, and the negative link between BMD and parity was shown to be more significant in individuals who have had six or more pregnancies. This study also reveals that parity does not have an impact on the risk of peripheral fractures. To verify our findings in a community with the same high incidence of pregnancies, we need to do more study.

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