IMPACT OF PREGNANCY-RELATED BONE MINERAL DENSITY CHANGES ON PERSISTENT BACK PAIN: A TWO-YEAR POSTPARTUM FOLLOW-UP STUDY

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Abstract

Background: Pregnancy is associated with a reduction in bone mineral density (BMD), which has been linked to pregnancy-related back pain. This study aimed to assess the changes in BMD post-pregnancy by conducting ultrasound assessments of the os calcis two years after delivery. **Methods**: A follow-up study was conducted with 60 women who experienced back pain during pregnancy. These women were assessed 24 to 28 months after delivery to evaluate persistent symptoms. Quantitative ultrasound measurements of os calcis BMD were compared with BMD values during pregnancy. **Results**: Out of the 60 participants, 24 (40%) continued to experience back pain. Women with persistent back pain showed greater BMD loss during pregnancy compared to those without ongoing symptoms. Furthermore, women without persistent pain were able to recover their BMD loss from pregnancy, while those with persistent pain had lower BMD levels post-pregnancy compared to their early pregnancy levels. **Conclusion**: These findings suggest that the loss of BMD during pregnancy may contribute to persistent back pain after pregnancy.

Keywords: Pregnancy-related back pain, Bone mineral density (BMD), Ultrasound assessment, Os calcis, Persistent symptoms

Introduction

Multiple factors may contribute to back pain during pregnancy, but bone loss has been found to be positively associated with both back pain and pelvic pain in pregnant women. Specifically, femoral bone density has been linked to hip pain, while os calcis bone mineral density (BMD) is correlated with back pain symptoms [1-5]. Over 60% of women who experience back pain during pregnancy continue to have symptoms postpartum [6], with the prevalence reaching up to 82% in women who had back pain during a previous pregnancy at 18 months. At two years postpartum, the incidence of persistent back pain is 21% [3]. The role of osteoporosis and postpartum BMD loss [4] in the persistence of pain, including back pain, remains controversial [5], as do other contributing factors [6]. This study will observe women with significant back pain during pregnancy to determine if changes in postpartum BMD correlate with continued back pain. It is crucial to assess whether recovering the BMD lost during pregnancy can help minimize persistent back pain symptoms.

Methods

Pregnancy Cohort

The study recruited consecutive patients attending a general obstetric clinic over a twelve-month period. Routine antenatal care was provided, and data on weight and height during early pregnancy were collected with written consent. Between 36 and 38 weeks of pregnancy, quantitative ultrasound measurements of bone density were made bilaterally at the os calcis using the Sahara Clinical Bone Sonometer system. The system made direct contact with the heel through elastomer pads and ultrasound coupling gel. A stable, wheelless chair was recommended by the manufacturer for the patient during measurement. To ensure focus between ultrasound probes at the os calcis, a foot guard was used. Patients were given 30 minutes to allow the skin to reach ambient temperature before measurements were taken on both sides. The system generates simulated bone mineral density (BMD) by measuring Broadband Ultrasound Attenuation (BUA) and Speed of Sound (SOS). Computers then calculate BMD. The manufacturer estimates the system's coefficient of variation to be 2-3%, which aligns with the investigators' data. Body fat percentage was measured using the Tanita 500 bio-impedance system. Individuals with medical conditions or long-term medications that affect bone density, such as steroids or thyroid drugs, were excluded, as were those with spinal deformities, prior back surgeries, or chronic back pain. Patients experiencing back pain in the early postpartum period were surveyed before discharge from the hospital. Women who had back pain during pregnancy filled out a pain distribution chart. Back pain severity was classified using a visual analog scale (VAS) into mild, moderate, and severe categories. Moderate back pain was defined as lasting for more than three consecutive days or requiring additional medical attention, while mild and transient pain was considered negative. The relationship between pregnancy-related back pain and BMD changes during pregnancy was evaluated [7].

Study Cohort of Two Years

Following the early postnatal survey, a mailed questionnaire was used to assess back pain symptoms 24 to 28 months postpartum. Back pain that required medical attention, sick leave, or treatment within six months of completing the questionnaire was considered positive, while negative symptoms did not require medical intervention. Women who had subsequent pregnancies during the study period were excluded. BMD measurements were repeated for those who responded to the 24-28 month follow-up survey. Information about menstrual status, last menstrual period, and breastfeeding status was collected. Any long-term medications or medical conditions were also noted. If pregnancy was confirmed during the follow-up, these participants were excluded from the study. Quantitative ultrasound and anthropometric measurements were performed following the same protocol as the initial pregnancy assessment. The study participants experienced back pain during pregnancy and completed a two-year postpartum survey. The correlation between body weight, body fat percentage, and os calcis BMD with persistent back pain and previous pregnancy-related changes was analyzed using a regression model. A p-value greater than 0.05 was considered significant. Data analysis was conducted using SPSS version 13.0

Results

460 of 926 patients recruited during pregnancy had experienced significant back pain. The 24-28 months questionnaire follow-up survey was completed by 286 women without further

pregnancies, and 66 reported persistent back pain symptoms. 62% completed the 2-year survey, including 48 with persistent back pain and 72 without. Currently, 120 women are being analyzed from this final cohort. According to this cohort, the mean BMD loss from early to late gestation was 0.473 g/cm2, or around 5%. Two years after delivery, measurements showed marginally decreased BMD. In contrast, weight, body fat percentage, and BMI significantly increased during pregnancy, but fell again after delivery. All these parameters showed positive gains two years after delivery (Table 1). A 24-28-month assessment divided the cohort into groups with and without significant persistent back pain. The PBP group had a higher BMD in early pregnancy than the NBP group, but this was countered by a higher BMD loss during pregnancy compared to the NBP group. Comparing 24-28 month values to early pregnancy values, the PBK group also gained more weight, and lost more BMD. In the index pregnancy, there was no difference in lactation duration. In the NBP group, BMD levels were almost identical to those in early pregnancy two years after delivery, almost recovering their BMD loss in pregnancy. There was a significant relationship between early and late pregnancy BMD values, as well as between late pregnancy BMD values and BMD values 24 to 28 months after delivery. All possible confounding continuous variables were controlled against persistent back pain at 24-28 months. The two-year weight gain and BMD changes remain significant, whereas pre-pregnancy BMD values and pregnancy BMD loss disappear. Persistent back pain is associated with more weight gain after delivery, whereas a positive balance in BMD is protective.

Discussion

In this study, quantitative ultrasound measurements demonstrated a progressive decline in BMD at the os calcis from early to late pregnancy. Studies have used various methods for measuring BMD loss during pregnancy [8, 9], including quantitative ultrasound measurements [10,11]. The current study found that around 50% of participants had back pain symptoms, which is in line with previous studies. Around 20% of patients complained of persistent back pain. The losses of BMD after pregnancy, during pregnancy, and during pregnancy were also associated with BMD loss. Previous studies have investigated back pain history, weight and older age , maternal smoking , pregnancy pain pattern, and psychosocial factors , but postpartum BMD changes have not been examined in detail for back pain persistence. Direct tests such as DXA and quantitative ultrasound could clearly demonstrate a marked bone turnover during pregnancy [12-15]. Long-term BMD loss is largely reversible [16,17]. Back pain symptoms associated with BMD changes have been studied, but the long-term effects remain unclear. Pregnant women with documented back pain symptoms are more likely to experience subsequent symptoms [18]. In pregnancy, persistent back pain is associated with a greater loss of bone mineral density (BMD) and an inability to fully recover this loss after 2 years. The risk of developing clinical osteoporosis might be higher among women who suffer from severe back pain symptoms in later life.

Table 1: Anthropometric changes during pregnancy and 24 to 28 months after delivery

	Early Pregnancy (< 20 weeks) (SD)	Late Third Trimester (36-38 weeks) (SD)	Two years post-delivery (SD)	P-value by ANOVA
Weight	57	66.5	60.3	< 0.001

Body Mass Index	23.7	27.6	25.1	< 0.001
Body Fat Composition (%)	30.4	38.3	33	< 0.001
Mean os calcis BMD (g/cm2)	0.738	0.701	0.716	< 0.001

Vertebral fractures and radiological abnormalities were rarely associated with severe persistent back pain. Many attribute low back pain to biomechanical factors, and immobility or reduced exercise could theoretically cause BMD loss. Back, pelvic, and hip pain symptoms are also associated with quantitative BMD loss. Back and pelvic pain symptoms are associated with lower BMD values during pregnancy. In pregnancy and afterward, osteoporosis, hip pain, and decreased femur bone density are associated. Therefore, pregnancy osteoporosis may go undetected. Additionally, we have not studied calcium intake or vitamin D status during or after pregnancy. Research on the recovery of BMD after pregnancy and delivery would be beneficial.

Table 2: At 24-28 months, Comparison of anthropometric and BMD measurements

	PBP group (n = 48)	NBP group (n = 72)	p-value; MD (95% CI)
Age	34.3	33.2	0.23
Height	158	157	0.68
Weight during early pregnancy	55.5	58	0.22
BMI during early pregnancy	23	24.2	0.12
Body fat percentage during early pregnancy	29.7	30.8	0.67
BMD in early pregnancy	0.786	0.705	0.031
Weight gain during pregnancy	10.55	10.43	0.98
Accumulation of pregnancy body fat	8.75	9.05	0.76
Loss of BMD during pregnancy	0.0572	0.0406	0.044
Duration of lactation during index pregnancy	9.8	9.1	0.60
2 years post-delivery weight change	4.68	3.86	0.041

Chronic back pain women had high bone mineral density early in pregnancy, but then lost more bone mineral density during pregnancy. Pregnant women with higher BMD loss have higher BMD to begin with, whereas those with borderline low BMD appear to preserve their BMD better. During pregnancy, they lose less BMD. BMD loss during pregnancy was higher among women with persistent back pain after childbirth, which may have resulted in significant higher BMD loss during pregnancy.

Table 3 : Logistic regression with persistence of significant back pain after delivery

Variable	B	S.E.	Wald	Significance	Odds ratio	95% CI
Variables that are significant Gaining weight 2 years after delivery	-0.753	0.403	5.62	0.04	2.92	2.05 to 4.48
2 years post-delivery BMD change	-22.9	11.26	5.55	0.04	0.12	0.02 to 0.106
Variables excluded Age	0.0629	0.213	0.303	0.75	2.05	0.94 to2.32
BMI during early pregnancy	-0.506	0.338	3.90	0.09	0.76	0.51 to 2.06
Fat percentage during early pregnancy	0.231	0.225	2.09	0.39	2.14	0.99 to 2.45
BMD in early pregnancy	0.308	4.944	0.003	0.105	2.23	0.04 to 6.7
Pregnancy weight gain	-0.041	0.229	0.068	0.90	0.106	0.85 to 2.24
Pregnancy fat gain	-0.353	0.311	2.434	0.33	0.87	0.61 to 2.17
Loss of BMD during pregnancy	26.26	17.97	3.21	0.23	0.47	0.07 to 9.91
Two years after delivery, fat changes	-0.506	0.367	3.32	0.23	0.77	0.49 to 2.13
Confidence interval = CI.						

This study had some limitations. However, of our original cohort (60/230) reporting back pain during pregnancy, only 26% (60/230) had BMD findings. While 55% had persistent back pain symptoms, 26% had BMD findings. The number of those who were available for follow-up assessments of their BMD was 33% for those without further pain; 73% for those who had further pain. Secondary analyses revealed no significant differences between those who completed the follow-up study versus those who defaulted on it in terms of epidemiological characteristics, BMD loss during pregnancy, and back pain. This group should thus represent the entire cohort, based on the data presented here. Also, despite a tiny sample size in the final cohort, body fat differences were not demonstrated after two years. However, the current cohort

already showed significant and consistent differences in primary outcomes like BMD loss during pregnancy.

Generally, quantitative ultrasound measurements of BMD predict clinical osteoporosis and fractures as well as DXA measurements. The coefficient of variation of these quantitative ultrasound systems can affect serial longitudinal comparisons, especially when the absolute difference is smaller than the coefficient. As a result, we believe that these measurements are valid, as measurable BMD loss during pregnancy was significantly greater (5-7%) than expected. Several studies and our own data indicate that quantitative ultrasound systems produce consistent and reproducible results. The correlation coefficients between pregnancy BMD and 2-year follow-up values were extremely high. Such BMD measurements should be reproducible over time. DXA or peripheral quantitative computer tomography could also be used to measure the axial skeleton more precisely after pregnancy, which should result in lower coefficients of variation. It is, however, not possible to directly correlate BMD changes during pregnancy with these methods because of the theoretical risks of radiological exposure. The same measurement method was used after pregnancy, despite its limitations. BMD recovery back to pre- or early pregnancy levels can be monitored with quantitative ultrasound.

Conclusions

Overall, this study supported a correlation between BMD loss, as measured by quantitative ultrasound, and persistent back pain symptoms during pregnancy. Future large-scale studies should use BMD measurements at different skeletal sites to correlate persistent back pain symptoms. The risk of osteoporosis and menopausal bone health needs to be considered if BMD can be recovered during pregnancy.

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