Assessment of bone health in pregnancy

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ABSTRACT

We performed a review of the literature on the use of radiofrequency echographic multi spectrometry (REMS) technology in pregnancy, in order to assess bone mineral density (BMD) and objectively measure its reduction during pregnancy. In a prospective case-control observational study, 78 women at 39.1 ± 1.5 weeks of gestation were submitted to a sonographic examination of the proximal femur using REMS technology to quantify BMD. The study group, when compared with a control group of non-pregnant women, was found to have significantly lower BMD values (0.769±0.094 g/cm^2 vs. 0.831±0.101 g/cm^2, p = 0.0001) with a mean reduction of 8.1%. Lower BMD values were found in older women (p<0.0001), women with a lower BMI (p=0.0004), and Caucasian women (p<0.0001). In another study, 65 pregnant women underwent femoral BMD measurement in the first and the third trimester using REMS. A significant reduction in BMD (0.723±0.069 vs. 0.709±0.069 g/cm^2; p<0.001) was noted, with a mean change of –1.9±0.6% between the first and the third trimester. On multivariable linear regression analysis, none of the population characteristics was independently associated with BMD changes. In conclusion, decreased BMD in pregnancy has been demonstrated using REMS technology. Further studies are needed to identify risk factors for decreased BMD in pregnancy.

KEYWORDS

Bone mineral density, REMS, ultrasound technology, pregnancy.

Introduction

Women's bones are subjected to considerable change throughout pregnancy due to the concurrence of several factors. While higher levels of estrogen and vitamin D promote the formation of bone tissue, fetal uptake of maternal calcium for skeletal development leads to maternal bone resorption [1]. Furthermore, some recognized hormonal factors may concur to reduce the mineralization of maternal bone during pregnancy, such as the increase in parathyroid hormone-related protein or the progressive increase in the level of oxytocin which activates the osteoclasts and stimulates calcium transport to the fetus [2]. Moreover, lifestyle may have a negative impact on bone mass during pregnancy. Levels of physical activity or sunlight exposure may be lower than usual in pregnant women, particularly in the third trimester. On this basis, the World Health Organization (WHO) recommends an extra dietary calcium intake of 200 mg/day for pregnant women compared with non-pregnant women [3]. Based on the concomitant effect of all these factors, a net reduction of women's bone mineral density (BMD) is expected to occur during pregnancy. However, this alleged demineralization of maternal bone during pregnancy has never been demonstrated or quantified due to the lack of an appropriate method of BMD assessment which can be safely employed across gestation. Currently, dual-energy X-ray absorptiometry (DEXA), which is still widely regarded as the gold standard method for quantifying BMD and determining the amount of bone loss, is limited by the potential harmful effects of radiation during pregnancy. Recently, an innovative ultrasound-based technique has been introduced into clinical practice for accurate assessment of BMD in central sites, such as the femoral neck or the lumbar spine. This method, called radiofrequency echographic multi spectrometry (REMS), has been shown to be as reliable as DEXA in the diagnosis of osteoporosis among non-pregnant women [4].

The aim of the present work was to assess femoral neck BMD by means of REMS technology, to objectively quantify BMD reduction in pregnancy.

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Methods

A review of the literature on the use of REMS technology in pregnancy was performed.

Results

In a prospective case-control observational study, a non-consecutive group of pregnant women at ≥37 weeks of

gestation and experiencing an uncomplicated pregnancy was enrolled. The study subjects underwent sonographic examination of the proximal femur, performed using REMS technology, to quantify their femoral BMD. Overall, 78 pregnant women at 39.1 ± 1.5 weeks of gestation were included in the study group. The BMD values obtained in this group were compared with those of a control group of non-pregnant women matched for age, ethnicity, and pre-pregnancy body mass index (BMI). Compared with those of the non-pregnant women, the femoral BMD values measured, using REMS, in pregnancy were significantly lower (0.769 ± 0.094 g/cm^2 vs 0.831 ± 0.101 g/cm^2, p = 0.0001), with a mean BMD reduction of 8.1%. In the study group, femoral neck BMD correlated positively with pre-pregnancy BMI (p = 0.0004) and negatively with maternal age (p < 0.0001).

In addition, a lower femoral neck BMD in Caucasian versus non-Caucasian ethnicity was noted (p < 0.0001) [5]. In another study, over a period of seven months, a total of 65 participants underwent BMD measurement at the femoral neck in the first and the third trimester of pregnancy using REMS. A significant reduction in femoral neck BMD (0.723 ± 0.069 vs. 0.709 ± 0.069 g/cm^2; p<0.001) was noted with a mean BMD change of –1.9 ± 0.6% between the first and the third trimester of pregnancy. On multivariable linear regression analysis, none of the demographic or clinical variables in the study population proved to be independently associated with maternal BMD changes at the femoral neck [6].

Conclusion

REMS technology is a safe and valid approach for monitoring bone health during and after pregnancy. In this review of the literature, lower BMD in pregnant women was objectively demonstrated thanks to REMS, a technology able to identify and quantify femoral BMD loss non-invasively during pregnancy. Furthermore, a significant reduction in BMD was noted between the first trimester and the third trimester. Further studies are needed to identify pregnant women with transient osteoporosis, for the purposes of follow up and preservation of bone health in this population, and also to identify risk factors for decreased BMD in order to improve prevention.

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