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Duration of breastfeeding as a risk factor for vertebral fractures

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ABSTRACT

Purpose: Among the risk factors for osteoporosis and fractures, gynecological history (fertile period, parity and breastfeeding) play an important part. Changes in calcium metabolism to enable an adequate mineral transfer to the milk have a prominent role in bone loss during breastfeeding. Data on the influence of breastfeeding in postmenopausal osteoporosis are inconsistent. The aim of the present study was to identify any association between duration of breastfeeding and vertebral fractures in postmenopausal women.
Methods: All patients underwent the following tests: bone mineral density measurements of the lumbar spine (L1–L4) and the total and femoral neck using dual-energy X-ray absorptiometry and antero-posterior and lateral radiography of the thoracic and lumbar spine to identify vertebral fractures.
Results: The study involved 752 women with a mean age of 64.5 ± 9.3; 23% of them reported vertebral osteoporotic fractures. The women with vertebral fractures had breastfed for longer periods (11.8 ± 12.9 vs. 9.3 ± 11.2 months, $p = 0.03$) and had more pregnancies (2.6 ± 2.2 vs. 2.2 ± 1.3, $p = 0.002$). Breastfeeding for more than 18 months was associated with a two-fold risk of developing vertebral fractures (OR 2.12, 95% CI 1.14–5.38, $p = 0.04$), particularly in those without current or past use of drugs positively affecting bone.
Conclusions: Our study showed an association between long periods of breastfeeding and vertebral fractures, supporting a role for lengthy lactation as a risk factor for osteoporotic fractures after menopause. Bearing in mind all the benefits of breastfeeding, this finding suggests the importance of an adequate calcium and vitamin D intake during pregnancy and breastfeeding, with the aid of dietary supplements if necessary.

Introduction

Vertebral fractures are the most common type of osteoporotic fracture and are associated with persistent pain, disability and poor quality of life [1]. Among the risk factors for osteoporosis and fractures, gynecological history (e.g. fertile period, parity and breastfeeding) plays an important part.

Breastfeeding is part of women's reproductive period and usually occurs during or shortly after they achieve their peak bone mass (PBM) [2], which is currently considered a significant predictor of osteoporotic fractures later in life [3]. During breastfeeding, the body's calcium metabolism changes to guarantee a sufficient supply of this mineral in the milk. This hormone-mediated process involves a more efficient renal conservation and intestinal calcium absorption, as well as an increased bone resorption. Without these adaptive mechanisms to conserve calcium, the transfer of large amounts of calcium to the infant (about 400 mg/day) would reduce the mother's bone mass and increase her skeletal fragility, as in the case of a low mineral intake or vitamin D deficiency [4].

There are inconsistent data on the role of breastfeeding in postmenopausal osteoporosis. Some studies have emphasized a protective role of breastfeeding on BMD [5–7] and on protection of hip fracture in old age [8,9], but others were unable to confirm such an association [10–14].

On the other hand, few studies have analyzed the relationship between duration of lactation and osteoporosis. One recent study reported a positive association between a long lactation period and the onset of osteoporosis [15], findings consistent with previous papers reporting a low BMD in long-time breastfeeding females [16,17]. Other researchers found no so such relationship [18], however, and some even reported lengthy periods of breastfeeding having a protective effect on bone strength parameters and fractures [19,20]. Given that many frailty fractures occur in patients with normal or osteopenic BMD values [21], these studies did not investigate the specific relationship between vertebral fractures and breastfeeding. Considering such premises we hypothesized that a prolonged lactation could be related to osteoporotic fractures. Therefore, the aim of the present study was to identify any

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association between duration of breastfeeding and vertebral fractures in a large group of postmenopausal women.

Subjects and methods

Study population

This retrospective study was conducted at the outpatient clinic for the diagnosis and treatment of osteoporosis at the Geriatrics Unit of Padova University, a center receiving about 600 patients each year. This study was conducted on postmenopausal women over the age of 40.

Women with a history of drug or alcohol abuse, or with evidence of any bone metabolism disorders emerging from physical examination, laboratory tests, or radiography were excluded. Other exclusion criteria were: the use of drugs known to negatively affect bone metabolism (e.g. prednisone, anticonvulsivants, thyroxine, and anticoagulants); secondary causes of osteoporosis like primary hyperparathyroidism, severe gastrointestinal or liver disease, thyroid diseases, chronic renal failure, malignancies, rheumatoid arthritis, and other inflammatory rheumatic diseases. A total of 752 were thus selected from among 1253, as shown in Fig. 1.

A trained physician administered a questionnaire to all participants on a face-to-face basis to identify any potential risk factors for osteoporosis, the use of dietary supplements or drugs, and any history of clinical fractures. Gynecological and obstetric history including history of abortions, number of pregnancies, age at menarche and at menopause, and total duration of breastfeeding were recorded.

The study was designed in accordance with the Helsinki Declaration and all participants were fully informed about the nature, purpose and procedures of the study, and gave their written informed consent.

Clinical and laboratory data

All patients underwent the following clinical and instrumental tests:

- body weight and height were measured by trained physicians and body mass index (BMI; kg/m^2) was calculated;
- bone mineral density (BMD) measurements and T-scores for the lumbar spine (L1–L4), and for the total and femoral neck were obtained using dual-energy X-ray absorptiometry (DXA) (Hologic QDR 4500W). A T-score of −2.5 or lower emerging from the results of the DXA scan obtained from one of the three body regions considered was defined as densitometric osteoporosis;
- fasting blood samples were collected for basic bone metabolism tests (calcium, phosphorus) and to measure establish serum 25-hydrovitamin D (25OHD) levels by radioimmunoassay (RIA kit; DiaSorin) at the Padova University laboratory, which belongs to the International Federation of Clinical Chemistry and Laboratory Medicine (IFCC). The intra-assay and inter-assay coefficients of variation for 25OHD were 8.1% and 10.2%, respectively. All the lab tests were available at the baseline visit and were performed within one month before.
- antero-posterior and lateral radiography of the thoracic and lumbar spine to identify vertebral fractures. Since radiological visual identification is the gold standard for detection of vertebral fracture in clinical practice, a protocol based on measurement of the anterior, middle, and posterior heights of each vertebra with the aid of a caliper was used. A prevalent fracture was defined as a reduction of at least 20% in the height according to the criteria proposed by Genant [22].

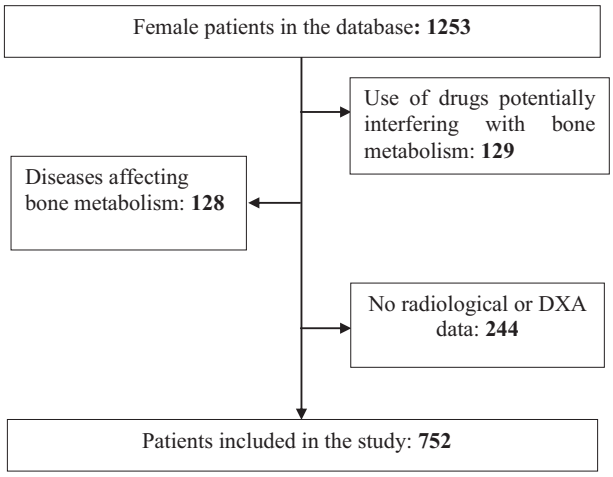

Fig. 1. Flow chart for study population selection.

Statistical analysis

Participants' characteristics were summarized using means (±standard deviations) for continuous variables, and counts and percentages for categorical variables. For the continuous variables, normal distributions were tested using the Shapiro–Wilk test. The data are presented after grouping patients according to the presence or absence of at least one vertebral fracture. Age-adjusted p values were calculated for differences between groups using a generalized linear model (GLM) for continuous variables, and logistic regression analysis for differences in categorical variables.

The variables included in the final model were chosen if any statistical difference existed in the univariate analysis (taking a $p < 0.20$ as significant) or if they have a clinical meaning (like 25OHD serum levels or estrogen use). Multivariate logistic regression models were run using months of breastfeeding in five groups: never, 0–6 months, 6–12 months, 12–18 months, and over 18 months) as independent variables, and the odds ratio (OR) and 95% confidence interval (95% CI) relating to the risk of vertebral fractures were calculated for each category, taking those with no history of breastfeeding for reference. Known factors associated with vertebral fractures were examined for inclusion in the analyses as covariates, obtaining an adjusted model. Among factors that might be important, the use or not of some drugs positively affecting bone seems to be relevant and a sensitivity analysis was performed.

Spearman's correlations were run on the combined data from both the groups and used to identify associations between breastfeeding duration and BMD at femoral and lumbar site.

All analyses were performed using the SPSS 21.0 for Windows (SPSS Inc., Chicago, Illinois). All statistical tests were two-tailed and statistical significance was assumed for a p-value <0.05.

Results

The study population consisted of 752 women with a mean age of 64.5 ± 9.4 [range: 41–91] and a mean BMI of 24.41 ± 4.02 kg/m^2 [range: 14.69–39.82]. A total of 178 women (23%) reported osteoporotic vertebral fractures. The 244 participants without radiological or DXA did not differ for age, BMI or duration of breastfeeding compared to the sample as whole (details not shown).

Table 1 shows the baseline characteristics of participants grouped by presence or absence of vertebral fractures. Women with vertebral fractures were significantly older (67.4 ± 9.6 vs. 63.5 ± 9.2, $p < 0.001$), while there were no differences in BMI or the prevalence of other risk factors for osteoporotic fractures. There were also no differences in terms of vitamin D and calcium supplementation, or use of estrogens. Women with vertebral fractures were more likely to be positive for a present or past use of biphosphonates, or the use of strontium ranelate and raloxifene (33% vs. 19.7% [$p = 0.01$], and 22.5% vs. 14.1% [$p = 0.05$], respectively). As for the bone parameters, women with vertebral fractures had lower femoral and lumbar BMD values (0.83 ± 0.09 vs.