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Original Research Article

Assessment of Bone Mineral Density in Post-Menopausal Women with Rheumatoid Arthritis

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Abstract

Introduction: postmenopausal individuals with rheumatoid arthritis (RA) had their levels of bone mineral density (BMD) and inflammatory markers compared to their body mass.

Material and Methods: The study included 60 postmenopausal women with active RA who were lean, overweight, or obese. These patients femoral BMD, high sensitivity C-reactive protein, interleukin-6, and tumour necrosis factor (TNF)-a serum levels were assessed.

Results: In comparison to the lean subjects, obese women were found to have significantly higher total femoral BMD and total T-score (p B 0.01). BMD measurements and CTX levels were shown to significantly correlate with body mass parameters (p B 0.01 and p 0.05, respectively). TNF-a concentrations were negatively correlated with neck BMD values that had been corrected for BMI (p 0.05). No correlations between BMD and other inflammatory indices were discovered. OPN levels were found to have inverse relationships with body mass (p 0.05), waist circumference (p 0.05), and the length of the postmenopausal period (p B 0.01).

Conclusion: The bone metabolism in postmenopausal women with active RA is significantly influenced by body mass and inflammatory markers, particularly hs CRP and TNF-a.

Introduction

Complications of rheumatoid arthritis (RA) include osteoporosis and an increased risk of fractures. In order to account for clinical risk factors in this rheumatoid arthritis, the FRAX algorithm (World Health Organisation Fracture Risk Assessment), a recently developed tool for fracture risk assessment that includes femoral neck bone mineral density (BMD), T-score, age, gender, and body mass index (BMI), helps patients qualify for pharmacological treatment of osteoporosis [1]. In RA patients, measuring biochemical bone turnover markers (BTMs) may be a helpful independent tool for fracture prediction and therapy vigilance.

Additionally, despite conflicting literature evidence, the components of MetS may be linked to OP. For instance, some papers have highlighted a decline in bone mineral density (BMD) as a result of metabolic impairments (central obesity in the first place), whereas other evidence reports a positive effect of MetS on BMD [2,3]. Systemic bone loss in RA patients may be caused by a number of pathogenetic pathways, but lifestyle choices and anti-rheumatic medication may also be responsible [4,5]. Inflammatory cells contribute to the onset and progression of osteoporosis in RA by directly or indirectly promoting bone resorption through proinflammatory cytokines, with TNF-a and IL-6 serving as important bone loss mediators [6-9]. Resistin dramatically raises IL-6 and TNF-a levels, which cause inflammation [10]. This adipocyte-derived protein is also present in the peripheral blood mononuclear cells and swollen joints of RA patients, suggesting that it may play a part in inflammatory processes [11–12]. It promotes development of osteoblasts and osteoclasts in bone metabolism, possibly through the nuclear factor kappa B (NF-jB) pathwayIn this study, we looked at the relationship between bone turnover markers or bone mineral density and inflammation and obesity in postmenopausal women with active RA.

Material and Method

We evaluated 60 postmenopausal female RA patients (mean age, 56.5 4.5 years; range, 53-62 years). Body mass index (BMI) was utilised to classify the subjects into two groups: group I, defined as overweight (n = 30), and group II, defined as obese (n = 30). Patients receiving hormone replacement medication and those suffering from conditions such diabetes, hyperthyroidism, and hyperparathyroidism, which are known to affect bone metabolism, were excluded from the study. They had not altered how often they took glucocorticoids or disease-modifying anti-rheumatic medications (DMARDs) in the three months prior. Biological therapy was not given to anyone.

Body mass and height were measured using standard equipment. The body mass index (BMI) was calculated as body mass in kilograms divided by the square of height in meters.

Laboratory Tests:

Basal blood tests (kidney/liver function) were performed with systemic inflammatory biomarkers such as erythrocyte sedimentation rate (ESR) and Creactive protein (CRP) concentrations. In addition, serum concentrations of calcium (Ca), phosphorus (Ph), 25-hydroxyvitamin D [25(OH)D], parathormone (PTH), and the bone isoenzyme of alkaline phosphatase were measured.

Bone mineral density (BMD):

Dual X-ray absorptiometry (DXA) at the hip (total and neck) was used to evaluate bone mineral density. BMD (g/cm2) and T-score (comparison with normal patients of the same sex with peak bone mass) were calculated using DXA results.

Results

Age, menopausal age, disease duration, DAS28 and other biochemical indicators of inflammation, as well as markers of bone turnover, did not significantly differ across groups. Obese women with RA exhibited significantly greater total femoral BMD and total T-score compared to lean females. However, no significant variations between groups were found after adjusting for body mass. There were no appreciable variations between the groups in the femoral neck BMD measures. Significant correlations between femoral BMD (total or neck), bone turnover markers, inflammatory indices, and disease duration were discovered. But after adjusting for BMI, linear regression analysis revealed that rising TNF-a

concentrations were linked to reduced neck BMD.

There were no statistically significant differences in the median values of BMD at the lumbar spine and femur levels at any of the locations (total, neck, and trochanter) between RA MetS+ patients and RA MetS patients (p = 0.88, p = 0.118, p = 0.22, p = 0.07, respectively). Even the TBS values did not differ significantly between the two groups (p = 0.18).

Table 1: Characteristics of women with rheumatoid arthritis (in groups: lean, overweight and obese)

	Overweight (*n* = 30)	Obese (*n* = 30)	*p* level
Age (years)	55.7 (4.7); 57.0 (54–60)	57.5 (4.29); 57 (55–62)	0.3884
Body height (cm)	168.3 (6.2); 161 (156–165)	156.1 (4.0); 158 (158–162)	0.2664
Body mass (kg)	74.3 (5.2); 70.5 (68.0–73.0)[a]	82.6 (8.2); 87.0 (77.0–86.1)	0
BMI (kg/m^2)	28.4 (1.6); 26.6 (25.6–28.8)[a]	33.6 (2.8); 32.2 (30.8–33.9)	0
Waist circumference (cm)	96.7 (5.9); 94.5 (86.0–96.0)[a]	106.7 (8.1); 102.0	0
Menopause (years)	45.5 (2.8); 52.0 (49.0–50.0)	47.4 (3.0); 56.0 (48.0–52.0)	0.7107
Duration of postmenopausal period (years)	9.3 (11.22); 7.5 (4.37–15.52)	10.6(12.63); 8.2(4.60–16.77)	0.5225
Disease duration (years)	14.5 (8.1); 9.5 (7.0–13.0)	12.3 (7.1); 11.0 (4.0–17.0)	0.8687
hsCRP (mg/l)	23.56 (15.73);	19.16 (13.81); 13.0 (9.0–22.0)	0.7638
TNF-a (pg/ml)	15.63 (14.12); 7.62	12.89 (14.61); 8.15	0.6934
IL-6 (pg/ml)	13.30 (4.87); 7.75	11.55 (8.85); 9.33	0.7698
L1–L4 T-score (mean ± SD)	−1.1 ± 1.5	−1.1 ± 1.3	NS
Total femur BMD (mean ± SD)	0.80 ± 0.13	0.84 ± 0.12	NS
L1–L4 BMD (mean ± SD, g/cm2)	1 ± 0.17	1.03 ± 0.15	NS
Rheumatoid Factor positive, *n* (%)	17 (88.9)	15(84.2)	0.768
ESR (mm/h)	32.22 (15.97); 36.0	27.74 (18.45); 15.0	0.637

Results are expressed as mean (SD); median (interquartile range) BMD bone mineral density

Table 2: Femoral bone mineral density (BMD) in women with rheumatoid arthritis and comparative analysis

	Overweight (n=30)	Obese(n=30)	Statistical power (a=0.05)
BMD Total (g/cm^2)	0.95 (0.10); 0.88 (0.80 to 0.94)	0.91 (0.12); 0.97 (0.86 to 0.97)	0.08
Neck (g/cm^2)	0.79 (0.12); 0.86 (0.78 to 0.94)	0.99 (0.10); 0.86 (0.85 to 0.96)	0.30
T-Score total	-2.06 (0.85); -1.05	-1.61 (1.01); -0.17	0.06
Neck	-0.37 (1.03); -1.05	-0.45 (0.79); -0.50	0.28

Discussion

In this study, we found significant relationships between BTMs and BMD, body mass indices, and a wide range of inflammatory markers. The levels of bone turnover indicators and femoral BMD (total or neck) did not, however, correlate. We think it's because there are so many different bone indicators, and because of how they relate to the current bone metabolic status. High BTM levels have been suggested to predict fracture risk in postmenopausal women irrespective of bone mineral density [13], and the connection between baseline BTM levels and bone loss rate is more reliable when bone loss is assessed at sites other than the hip [14].

The relationships between somatic factors and femoral BMD or bone resorption marker (CTX) may show that body mass has a significant impact on bone tissue. Our results are in line with recent research in people without [15] and with RA that showed body mass has a favourable impact on BMD. The beneficial effect of body mass on bone in postmenopausal women may result from hormonal factors associated with obesity [17–18] or mechanical loading by body weight on bone tissue [16].

It is well known that inflammation significantly affects bone metabolism and raises the rate of resorption [19]. Other RA research has linked some disease activity indicators to a reduction in bone mass [20]. Intriguingly, no associations between hsCRP, IL-6, or TNF-a serum levels and indicators of bone mass or bone turnover were discovered in the current investigation; the lone connection between TNF-a levels and neck BMD after BMI adjustment may support the idea that an inflammatory state has a detrimental effect on bone tissue. Both common osteoporosis and RA are caused by TNF-a [21]. According to Fuller et al. [22–23], TNF-a causes the production of RANKL in osteoblastic cells, directly boosts osteoclastic differentiation and activation, and synergizes with RANKL. An increase in BMD at the hip of up to 13.1% was found by Barnabe and Hanley [24] after reviewing the most recent data on the impact of anti-TNF-a therapy, while changes in markers of bone formation and bone resorption were inconsistent. Verge'ly et al. [25] claim that steroid therapy also lowers OC expression. In an animal model, steroids increased the production of resistin in adipocytes.

Thommesen et al. [26] demonstrated that resistin is involved in bone remodelling, while Forsblad d'Elia et al. [27] discovered modest relationships between resistin and a telopeptide of type I collagen (ICTP) indicative of increased osteoclast activity. According to Seriolo et al. [28], patients with active RA have significantly lower levels of serum OC than matched controls and patients with inactive RA, and markers of bone resorption (cross-linked N-telopeptidases of type 1 collagen and deoxypyridinoline) are significantly higher. As a result, it is possible to conclude that RA causes an increase in bone resorption and a decrease in bone production. Obesity is related with low-grade systemic inflammation [29], which is manifested by changes in plasma levels of substances such as high sensitivity C-reactive protein (hsCRP), IL-6, TNF-a [30], and resistin [31] in people who do not have RA. Furthermore, it has been demonstrated that plasma OPN levels are elevated in overweight and obese subjects and are also related to body fat [32].

Additionally, there was a marginally significant correlation between FG serum concentrations and L1-L4 BMD. Serum glucose levels and better bone health have been linked in other studies, however the results are still controversial (33). Advanced glycation end-products (AGEs) have been shown to reduce osteoid thickness in diabetic patients as a result of their impact on osteoblast apoptosis. If glucose is an important source of energy

for osteoblasts and is necessary to produce collagen fibres and promote osteoblast differentiation, excessively high concentrations in association with insulin resistance have been shown to do so (34). Our data reveal a negative connection between blood FG and insulin concentrations and bone quality (as determined by TBS), despite a slight increase in BMD. According to van der Helm et al. [35], oestrogens associated with obesity may be to responsible for this impact due to their anti-inflammatory properties. The aromatization of androgens to oestrogens in adipose tissue is one of the most major sources of sex steroids in the circulation and for peripheral tissues, including bone, following menopause [36]. Our study's limitation is that oestrogen levels weren't taken into account.

Conclusion

The current study came to the conclusion that body mass and many inflammatory markers, including ESR, CRP, and TNF, play crucial roles in bone metabolism in postmenopausal women with RA. This study shows that generalised bone loss, which is seen in active RA and is marked by symptoms of bone resorption, occurs and is linked to high levels of inflammation. We argue that more aggressive RA treatment in the future will not only stop joint degradation and inflammation but also potentially reduce the incidence of osteoporosis and its adverse repercussions.

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