Bone density in rheumatoid arthritis

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ABSTRACT

Objective: The aim of this study is to examine the bone mineral density (BMD) in rheumatoid arthritis (RA) patients and to study the effect of disease activity and steroid therapy on BMD.

Methods: Thirty Saudi female patients with RA and 10 Saudi healthy females matched for age as controls were the material of this work. Patients were attending the out-patient clinic of Makkah Rheumatology and Rehabilitation Center, Al-Noor Specialist Hospital, Makkah, Kingdom of Saudi Arabia between November 2002 and July 2003. All patients were subjected to clinical assessment and laboratory investigations. Bone mineral density was measured by dual-energy x-ray (DXA) in the lumbar spine at L_{2-4} and in the femoral bone (femoral neck, ward's triangle and trochanteric).

Results: The results of our study showed a significant decrease in BMD in RA patients compared with healthy controls (spine = 0.863 ± 2.29 versus 1.289 ± 0.54 g/cm^2, $p<0.05$; total femoral = 0.755 ± 0.27 versus 1.06 ± 0.49 g/cm^2, $p<0.05$; femoral neck = 0.725 ± 0.25 versus 1.008 ± 0.482 g/cm^2, $p<0.05$; ward's triangle = 0.586 ± 0.21 versus 0.909 ± 0.43 g/cm^2, $p<0.05$ and trochanteric = 0.607 ± 0.225 versus 0.898 ± 0.419 g/cm^2, $p<0.05$). The decreased BMD correlated significantly with the impairment of functional activity, increased disease activity and with the use of steroids. There was no correlation between the decreased BMD and the body weight, height, age and the duration of the disease.

Conclusion: We conclude that the impairment functional activity, increased disease activity and the use of steroids for long periods are the major determinants of BMD of both spinal and femoral bone in rheumatoid patients.

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It is recognized that rheumatoid arthritis (RA) is associated with an increased risk of generalized osteoporosis and with bone mineral density (BMD) loss early in the disease.[1] Osteoporosis in RA characterized by rapid remodeling, which results in degradation of the mechanical properties of the skeleton in juxtaarticular bone, in the diaphysis of long bones, in the pelvis, and at the base of the skull it affects both cortical and cancellous bone.[2] In the first year after diagnosis of RA, a loss of 2.5-5% of BMD of the vertebrae and proximal femur has been documented by dual energy x-ray absorptiometry.[3] It is well known that steroid therapy exacerbates bone loss in the axial skeleton, however, severe abnormality was described in patients with severe RA who have never received steroids.[4] The objective of this study is to examine BMD in rheumatoid patients and to study the effect of disease activity and steroid therapy on BMD.

Methods. This study was carried out on 30 Saudi female patients with RA attending the outpatient Clinic of Makkah Rheumatology and Rehabilitation Center, Al-Noor Specialist Hospital, Makkah, Kingdom of Saudi Arabia between November 2002 and July 2003. All the patients met the revised American College of Rheumatology

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criteria for the diagnosis of RA.[5] All patients were receiving steroid (prednisolone) and disease modifying anti-rheumatic drugs (DMARDs), non-steroidal anti-inflammatory drugs (NSAIDs) were used by many RA patients. Another 10 Saudi healthy female similar with patients in age, height and weight were chosen as a control group. All the patients were subjected to a full history taking and thorough clinical examination.

Clinical assessment. Pain was estimated by the visual analogue scale, duration of morning stiffness was calculated in minutes, determination of joint tenderness using Ritchie articular index,[6] grip strength was measured using a sphygmomanometer, functional capacity was assessed according to Steinbrocker et al,[7] erythrocyte sedimentation rate (ESR) in mm/h and hemoglobin concentration in g/dL.

Radiographic examination. Plain x-ray for both hands, feet, lumbosacral region and for both hip joints.

Bone mineral density measurements. Bone mineral density in the lumbar spine at L_{2-4} and in the femur (femoral neck, ward's Triangle, Trochanteric, and shaft) were measured with the same dual-energy x-ray absorptiometry machine (Lunar prodigy series, Madison, Wisconsin, USA).

Statistical analysis. Data were analyzed using the Statistical Package for Social Sciences/Computer Program.

Table 1 - Characteristics of rheumatoid arthritis (RA) patients and controls (mean ± SD).

Parameters	RA patients N=30	Controls N=10
Age (years)	39.6 ± 9.4	39.3 ± 9.23
Weight (kg)	71.25 ± 19.34	71.53 ± 19.55
Height (cm)	153.4 ± 53.21	153.6 ± 53.28
Disease duration (years)	8.4 ± 3.21	
Pain score	3.8 ± 1.42	
Morning stiffness (minute)	57.6 ± 25.43	
RAI (joint tenderness)	27.9 ± 8.54	
Grip strength	60.3 ± 40.52	
Functional activity grade	1.5 ± 0.16	
ESR (mm/hour)	57.1 ± 15.37	
Rheumatoid factor (%)	90%	
Prednisolone treatment		
Duration (years)	6.7 ± 2.53	
Daily dose (mg/d)	7.33 ± 3.64	

RAI - Ritchie articular index , ESR - erythrocyte sedimentation rate

Results. **Table 1** shows demographic characteristics of patients with RA and controls. It is also illustrates some parameters of disease activity and steroid therapy in RA patients. **Table 2** shows comparison of spinal BMD and femoral BMD (total femoral, femoral neck, ward's triangle and trochanteric) between RA patients and controls. Correlation matrix was carried out between lumbar BMD, total femoral BMD and other parameters in RA patients. There was significant correlation ($p<0.05$) between the decreased BMD and disease activity parameters (grip strength, Ritchie articular index [RAI], ESR and morning stiffness), impairment of functional activity and with the use of steroids. There was non-significant correlation ($p>0.05$) between decreased BMD and pain score, disease duration, age, weight and height.

Table 2 - Comparison of spinal bone mineral density (BMD) and femoral BMD (total femoral, femoral neck, ward's triangle and trochanteric) between rheumatoid arthritis (RA) patients and controls.

BMD (g/cm^2)	RA patients	Controls	*p*
Spinal BMD	0.863 ± 0.29	1.289 ± 0.54	<0.05
Femoral BMD			
Total femoral BMD	0.755 ± 0.27	1.06 ± 0.49	<0.05
Femoral neck BMD	0.725 ± 0.25	1.008 ± 0.482	<0.05
Ward's triangle BMD	0.586 ± 0.21	0.909 ± 0.43	<0.05
Trochanteric BMD	0.607 ± 0.225	0.898 ± 0.419	<0.05

Significant <0.05

Discussion. Our study showed a significant decrease in BMD in RA patients as compared to healthy controls (spine = 0.863 ± 2.29 versus 1.289 ± 0.54 g/cm^2, $p<0.05$; total femoral = 0.755 ± 0.27 versus 1.06 ± 0.49 g/cm^2, $p<0.05$; femoral neck = 0.725 ± 0.25 versus 1.008 ± 0.482 g/cm^2, $p<0.05$; ward's triangle = 0.586 ± 0.21 versus 0.909 ± 0.43

g/cm^2, $p<0.05$ and trochanteric = 0.607 ± 0.225 versus 0.898 ± 0.419 g/cm^2, $p<0.05$). This result agree with previous studies of Krogen et al[8] and Haugeberg et al[9] they have demonstrated lower BMD in patients with RA. The role of steroid in causing bone loss in RA is controversial.[10,11] In the present study, the decrease in BMD was significantly correlated ($p<0.05$) with steroid therapy (mean ± dose 7.33 ± 3.64 mg prednisolone/day). The duration was 6.7 ± 2.53 years). This result was in agreement with Haugeberg et al[9] who found a statistically significant increased frequency of reduced bone mass for those RA patients who were currently taking steroids, but, Sambrook et al,[12] found lower BMD in RA patients, who had not received steroids. In the study of Garton and Reid,[13] no BMD reduction was found in patients who were not taking steroids. Also Lean et al[14] was unable to demonstrate a significant BMD decrease in patients with RA without steroid treatment. The effect of steroids on BMD in RA patients is difficult to examine, not only due to its number of factors involved that can influence bone density, but also because steroids are more likely to be given to patient with active inflammatory disease.[9] In a recent prospective studies examining the effect of steroids on bone density in RA; it was also concluded that short term treatment (<1 year) with low dose prednisolone (<10 mg/day) leads to a limited bone loss in the femoral neck and negligible bone loss in the lumbar spine.[15] Body weight was found to be an important determinant of BMD, increased mechanical load on bones in obese persons and peripheral production of oestrone in fat tissue have been proposed as explanations. Rheumatoid arthritis patients were lighter than controls, and this may indicate that fat mass and lean body mass or both are lower in these patients.[16] We are unable to found any significant effect of body weight on BMD in patients with RA. Reduced mobility has been suggested as a cause of generalized osteoporosis in RA, a significant relationships were found between BMD and functional impairment and duration of the disease by Als et al.[10] Sambrook et al[17] found that physical activity was a significant predictor of BMD in RA patients. Our results show a significant correlation between the degree of functional impairment and a decreased BMD and no correlation ($p<0.05$) between the disease duration and BMD in RA patients. In common with the present study, most previous, studies have not been able to a show a correlation between disease duration and BMD.[18,19] As regard to the influence of disease activity on BMD findings, we found a significant relationship ($p<0.05$) between the decreased BMD and the disease activity parameters (grip strength, RAI, ESR and morning stiffness). This results was in agreement with Haugeberg et al[9] who found a strong association between high levels of systemic disease activity as an ESR >40 mm/hour and BMD loss in early RA. Also, Gough et al[19] and Shenstone et al[3] have shown an association between disease activity and bone density reduction. On other hand Haugberg et al[9] reported that association between reduce BMD and RA disease-specific conditions are weak. This findings is probably explained by the course of the disease, which is characterized by exacerbations and remissions and by the effective treatment such as with DMARDs and steroids. Thus, disease activity measures change on a short-term basis, whereas bone density is a cumulative effect of various factors over many years.

In conclusion, the results of our study shows that patients with RA have lower BMD compared with normal controls. Impaired functional activity, increased levels of disease activity and the use of steroids are the major significant determinants of BMD of both spinal and femoral bone in a RA patients. Therefore, we recommend that to keep patients with RA mobile this will counteract the adverse effects on bone and prophylaxis should be considered at the onset of steroids treatment and for its duration, particularly in patients already at risk of fracture with reduced bone density prior to treatment due to advanced age and underlying disease.

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