ORIGINAL ARTICLE

Bone mineral density level by dual energy X-ray absorptiometry in rheumatoid arthritis

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Abstract

Objective: To observe the level of bone mineral density by Dual Energy X-ray Absorptiometry in rheumatoid arthritis patients.

Methods: The observational study was conducted at Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan, from January 2011 to December 2014. Bone mineral density was measured from the femoral neck, ward's triangle and lumbar spine, in patients 25-55 years of age, who were diagnosed with rheumatoid arthritis. All the cases were assessed for bone mineral density from appendicular as well as axial skeleton. Data was collected through a designed proforma and analysis was performed using SPSS 21.

Results: Of the 229 rheumatoid arthritis patients, 33(14.4%) were males. Five (15.1%) males had normal bone density, 14(42.4%) had osteopenia and 14(42.4%) had osteoporosis. Of the 196(85.5%) females, 45(29.9%) had normal bone density, 72 (37.7%) had osteopenia and 79(40.30%) had osteoporosis. Of the 123(53.7%) patients aged 30-50 years, 38(30.9%) had normal bone density, 59(48.0%) had osteopenia, and 26(21.1%) had osteoporosis. Of the 106(46.3%) patients over 50 years, 12(11.3%) had normal bone density, 27 (25.5%) had osteopenia and 67(63.2%) had osteoporosis.

Conclusion: Osteoporosis and osteopenia were most common among rheumatoid arthritis patients. Assessment of bone mineral density by Dual Energy X-ray Absorptiometry can lead to quick relief in the clinical symptoms with timely therapy.

Keywords: Bone mass density, Rheumatoid arthritis, DEXA. (JPMA 67: 15; 2017)

Introduction

Rheumatoid arthritis (RA) is a connective tissue disease producing persistent systemic inflammation with joint inflammation and also leads to function loss and joint destruction.[1]

RA produces local or juxta-articular and generalised bone loss. Many cross-sectional studies conducted on RA patients found decreased bone mineral density (BMD) of the lumbar spine and hips compared to healthy individuals.[2]

In general, rheumatic patients are more prone to developing osteoporosis because of effective systemic inflammation, immobility and the use of steroids.[3] It is a well-known factor that generalised osteoporosis is a feature of RA but it is not clear that either this is due to a consequence of treatment, immobility, or the activity of the disease.[4] Another factor is peri-articular osteoporosis in RA, and that is also considered controversial because the aetiology of decreased bone mass is perhaps multifactorial, involving their lifestyle risk factors and disease-related elements.[5]

Low bone mass results in bone loss of the skeleton and is regularly termed osteopenia or osteoporosis. Further fractures around the hip can increase the significant economic burden, morbidity and mortality.[6] The pathophysiology of osteoporosis is multifactorial and complex, but most of the studies proved that bone mass was the most important factor of bone strength for 80% of its variation.[7,8] Diminished bone mass is consequently a valuable predictor of increased chance for fractures.[9] Several studies verified that a reduction in bone density at the hip and spine of one Standard Deviation (SD) increases the fracture risk by a factor of 2-3.[10-13] and activity of the disease also suggested a potential risk factor for osteopenia for RA patients.[14,15]

American College of Rheumatology (ACR) classification for RA osteopenia of the hands detected on the radiographs is one of the requirements,[16] but the radiological evaluation is incapable of detecting bone loss once it is less than 30%. Dual Energy X-ray

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Absorptiometry (DEXA) seems to be an added reliable method for discovering early bone loss in patients with RA compared to radiographs. The association between BMD, disease duration and bone destruction also indicates that the DEXA method can be beneficial for the estimation of activity of disease and its progress.[17,18]

In early RA BMD measurement of hand by DEXA is possible and decreased hand bone mass also occur in early before the lumbar and hip BMD loss, and also can be the possible outcome measure in early disease.[19] DEXA technology is necessary for the diagnosis, as the World Health Organisation (WHO) defined currently that osteoporosis is a T score of > -2.5 SD.[20]

The current study was planned to observe the axial as well as appendicular skeleton of BMD by DEXA method in RA patients.

Subjects and Methods

The observational study was at Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan, from January 2011 to December 2014.

Patients aged 25-55 years, who were already diagnosed with RA were included. Patients with other arthritic problems were excluded.

The patients were registered, prepared and evaluated on an outpatient basis and they were advised at the time of appointment that on the day of DEXA assessment, they should eat normally, stop taking any calcium supplements at least 24 hours prior to DEXA test, to come in loose and comfortable dress, and to avoid garments having zippers, belts or buttons made of metal. Patients who had recently been examined by barium or were injected any contrast material for a computed tomography (CT) or isotope scans were advised to wait at least two weeks for a DEXA test. All women were asked about pregnancy status because of the radiation prevention.

During DEXA test for spine, patient's hips were flexed and stayed on a padded box to flatten the pelvis and lumbar spine. To assess the hip, the patient's foot was internally rotated and placed in a fixed block that rotated the hip inward. After confirmation of the positions the DEXA sensors started and passed gradually and over the required area for scan-generated images on a computer screen which were analysed.

The collected data was examined using SPSS 21. In the first stage, descriptive statistics were computed to know the background information about patients like age, gender, areas scanned (i.e., femoral neck, trochanteric area, lumbar spine) and type of rheumatoid arthritis (i.e., osteopenia, osteoporosis, and normal). In the second stage, inferential statistics were computed using Chi-Square test to examine the relationship between age and various types of RA.

BMD was measured from the appendicular skeleton like femoral neck, and also in Ward's triangle, and for axial skeleton from L1 - 5 lumbar spines.

Results

Out of 229 patients, 33(14.4%) were male and 196(85.5%) were female. Five (15.15%) males were normal; 14 (42.42%) had osteopenia and osteoporosis was detected in 14 (42.42%). Females were 45 (29.95%) normal, 72 (37.73%) osteopenia and 79 (40.30%) osteoporosis (Figure).

The overall mean age was 46.46±11.96 years (range: 25-55 years). Significant statistical association with age and areas scanned through DEXA were noted (Table-1).

Overall, 123(53.7%) were aged 30-50 years. Of them, 38 (30.9%) were normal, 59 (48.0%) were osteopenic and 26 (21.1%) had osteoporosis. The remaining 106(46.3%) were over 51 years of age. Of them, 12 (11.3%) were normal, 27 (25.5%) were osteopenic and 67 (63.2%) had osteoporosis.

Table-1: Significant statistical association by age in years and hip and lumbar scanned areas by DEXA.

		Age in Years	Neck of Femur T-score	Trochanteric Area T-score	Lumbar Spine T-score
N	Valid	229	225	225	225
	Missing	0	4	4	4
Mean		46.46	-1.572	-1.039	-1.714
Median		50.00	-1.800	-1.003	-1.700
Mode		55	-1.9	-2.3a	-2.1a
Std. Deviation		11.964	1.4386	1.3853	1.8316
Minimum		25	-4.9	-5.6	-5.4
Maximum		55	4.4	4.1	9.4

DEXA: Dual Energy X-ray Absorptiometry.

Table-2: Distribution of disease according to age.

Age * Disease Cross tabulation							
Variables			Disease			Total	P-value
			Osteoporosis	Osteopenia	Normal		
Age	30-50 years	Count (%)	26 (21.1%)	59 (48.0%)	38 (30.9%)	123 (100.0%)	0.000
	51 and above	Count (%)	67 (63.2%)	27 (25.5%)	12 (11.3%)	106 (100.0%)	
Total		Count (%)	93 (40.6%)	86 (37.6%)	50 (21.8%)	229 (100.0%)	

Table-3: Association between Bone Minerals.

Statistics						
		Age	Calcium	Phosphorus	Alkaline Phosphorus	Vitamin-D
N	Valid	229	227	227	229	228
	Missing	0	2	2	0	1
Mean		46.46	8.726	3.958	156.43	16.671
Median		50.00	8.900	3.800	129.00	14.270
Mode		60	8.9	3.4	115	8.6
Std. Deviation		11.964	1.1013	1.0318	110.830	11.5850
Minimum		25	1.4	2.4	4	3.4
Maximum		55	10.8	8.5	1016	94.8

Table-4: Significant association between categorical variables according to disease.

Variables	Frequency	Percentage
Osteoporosis	93	40.6
Osteopenia	86	37.6
Normal	50	21.8
Total	229	100.0

There was a significant association between age and disease ($p<0.05$) (Table-2).

Bone minerals like serum calcium, phosphorus and alkaline phosphatase were also assessed (Table-3).

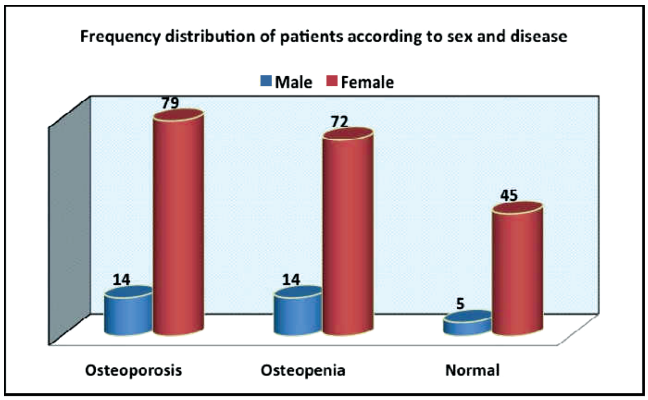

Figure: Dual Energy X-ray Absorptiometry (DEXA) analysis according to the gender (n= 229).

Of the total 229 patients, 50 (21.83%) were normal, 93 (40.61%) had osteoporosis and 86 (37.55%) had osteopenia (Table-4).

Discussion

Quite a few techniques have been used previously to assess the level of BMD in RA patients and DEXA is a relatively recent advanced procedure. In this study patients were assessed for BMD by DEXA of 229 diagnosed RA patients. RA patients had lower BMD with osteopenia and osteoporosis regardless of age, and there were fewer normal subjects.

BMD in RA patients proved the relationship among the high radiological RA destruction and low BMD at the hip, suggesting the connection between the severity of RA and the risk of generalised bone loss.[21]

There are three altered disease-dependent mechanisms, which may be dependable for the increased prevalence of low bone mass in RA. These include disease activity, reduced physical activity and the use of glucocorticoids. Further, potential risk factors for bone loss in RA can include the treatment with methotrexate or cyclosporin A.[22]

Studies[23-25] are available about the evaluation of bone mass density in the hand with forearm of RA patients. We examined the lumbar spine and hip region with neck of femur and trochanteric areas and found that the mean T-score of lumbar was less than the mean T-score of hip areas.

RA is itself also associated with osteoporosis.[26] Peri-articular osteoporosis is also one of the earliest radiological signs in RA,[27] and the release of inflammatory mediators, like cytokines, from the different inflammatory cells is the most likely cause.[28]

A continuing reduction in bone mass within the first five years causes rheumatoid-determined mechanisms. The relationship of variance of lumbar BMD explained by the deterioration equation is low.[29] Data of this study also showed that lumbar spine score was low compared to that of hip.

Shenstone et al.[30] studied the relationship between BMD and Health Assessment Questionnaire (HAQ) score, and also presented correlation between lumbar BMD and baseline Stoke Index, and the loss of bone mass density was found to be higher in the neck of femur during early stages of RA irrespective of the activity of disease and working loss. Low bone density was also found in this study, but data did not comprise Stoke Index.

Another study measured BMD in the lumbar spine, hip and the neck of the femur in 97 patients between 27 and 80 years of age who had been recently diagnosed with RA. The average BMD of the patients was lower than normal at all three skeletal sites, especially in the femur region.[31]

The occurrences of osteopenia (45.6% vs 36.4%, p= 0.170) and osteoporosis (33.6% vs 5.45%, p= 0.000) were greater in RA patients compared to the age- and gender-matched healthy individuals.[32]

In the current study, 50 (21.83%) RA patients were found with normal BMD which has not been reported previously in literature.

Conclusion

Osteoporosis and osteopenia were most common among RA patients. The assessment of BMD by DEXA could lead to early relief in clinical symptoms through combine therapy.

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