Quantitative Ultrasound Versus Dual-Energy X-Ray Absorptiometry for Diagnosis of Osteoporosis in Iraqi Women with Rheumatoid Arthritis

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ABSTRACT:

BACKGROUND:

Osteoporosis is a major co-morbidity in rheumatoid arthritis (RA). Bone mineral density (BMD) in adults can be assessed precisely by dual-energy x-ray absorptiometry (DXA). In recent years, quantitative ultrasound (QUS) technique has been used in radiation-free assessment of bone density by mean of ultrasound waves attenuated by bone.

OBJECTIVE:

The aim of study was to compare QUS to DXA in assessing BMD in patients with RA.

PATIENTS AND METHODS:

Fifty women with RA (diagnosed according to ACR criteria) of 2-12 years duration, their ages range from 30-72 years, who were seen at Osteoporosis Clinic in Baghdad Teaching Hospital were recruited. Sixty four percent were or had been receiving glucocorticoid treatment. All patients receiving disease modifying anti-rheumatic drugs (DMARDs). Lumbar spine BMD was measured by DXA, and QUS for calcaneum was performed in all patients.

RESULT:

T-scores measured by QUS were correlated significantly with lumbar spine BMD T-scores measured by DXA ($p<0.0005$). Bone mineral density T-scores were negatively correlated with age and disease duration. Patients taking glucocorticoids were associated with lower T-scores.

CONCLUSION:

The findings of this study support QUS as an alternative tool for assessing BMD in patients with RA.

KEY WORDS: quantitative ultrasound, osteoporosis, rheumatoid arthrritis

INTRODUCTION:

Osteoporosis is a major co-morbidity in rheumatoid arthritis (RA).[1] Osteoporosis associated with RA has been demonstrated in both the axial and peripheral skeleton.[2] In RA, bone loss can be periarticular, a hallmark of the disease, or more generalized form, as demonstrated in histological, computed tomographic and dual-photon absorptiometric studies.[3]

Several mechanisms contribute to bone loss in severe RA.[4] Family of inflammatory cytokines, tumour necrosis factor (TNF)-alpha & interleukin (IL)-1 have close inter-relationship in inducing simultaneous arthritis & osteoporotic changes with consequent compromised mobility & debility. Mechanism of action at molecular level has close interlink of TNF-alpha, interferon (IFN)-beta and IFN-gamma with osteoclasts have new therapeutic potential.[5] Immobility following RA is associated with rapid bone loss.[6] Nutrition deficiency in combination with frequent administration of glucocorticoids contribute additional risk factors.[7] Glucocorticoids affect bone through multiple pathways, influencing both bone formation and resorption, but the most important effects appear to be a direct inhibitory effect on bone formation. With long-term glucocorticoid use, bone turnover is actually reduced. Methotrexate inhibits osteoblast activity and may be yet another risk factor in some patients.[6]

Bone densitometry should be performed in patients with risk for osteoporosis to address the need for a bisphosphonate or a selective estrogen receptor blocker.[1] Bone mineral density (BMD) in adults can be assessed precisely by dual-energy x-ray absorptiometry (DXA)[8], which use x-rays as the source for protons. Its advantages are a reduced

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scanning time, improved resolution, precision and accuracy.[9]

In recent years, quantitative ultrasound (QUS) technique has been used in radiation-free assessment of bone density.[10] Measurement of the speed of sound and broad band ultrasound attenuation in bone tissue are the basis of QUS techniques. Both parameters are supposed to correlate to a certain extent with mechanical strength of bone. In general, the parameter "bone stiffness" is derived from both measurements, and is used for the estimation of fracture risk.[11] Ultrasound studies are usually performed at the calcaneous, although the tibia, patella, distal radius and proximal phalanges can also be measured.[12] Significant correlations were shown between QUS of the calcaneous and the future risk of hip fracture. Some authors recommend the use of all different methods of QUS only for a first screening.[11]

In this study, we compare QUS to DXA in assessing bone mineral density in patients with RA.

PATIENTS AND METHODS:

PATIENTS:

The study group consists of 50 female patients with RA who were seen at Osteoporosis Clinic in Baghdad Teaching Hospital from January through June 2006. The diagnosis of RA has been done according to the American College of Rheumatology (ACR) criteria for the classification of RA.[13] A signed consensual was taken from all patients before admission to the study.

METHODS:

Lumbar spine BMD was measured by DXA machine (Lunar DPX), and QUS (Achilles Express Lunar) for calcaneum was performed in all patients. BMD was expressed as T-score considering the diagnostic criteria for osteoporosis established by World Health Organization (WHO).[12]

Statistical Analysis

Statistical analysis was done, using correlation test and T-test when needed. A "p value" of less than 0.05 is considered to indicate significance.[14]

RESULTS:

Some clinical characteristics of patients included in the study were reported in Table 1.

Table 1: Clinical characteristics of patients with RA included in study.

Number of patients	50
Age Average +/- SD, year (range)	50 +/- 12.26 (30-72)
Duration of RA disease Average +/- SD, years (range)	6 +/- 3.16 (2-12)
Number of patients receiving glucocorticoid treatment (%)	32 (64%)
Number of patients receiving disease-modifying anti-rheumatic drugs (%)	50 (100%)

RA = rheumatoid arthritis, SD = standard deviation

In 50 women with RA included in the study, the BMD measured by DXA was reduced in 36 patients (72%); 15 patients (30%) had osteopenia and 21 patients (42%) had osteoporosis.

In these patients, the mean lumbar spine BMD T-score was -1.86 (range from -5.22 to 2.01). For the same patients, the mean peripheral BMD expressed as T-score measured by QUS was -1.37 (range from -4.21 to 2.34).

T-scores measured by QUS were correlated significantly with lumbar spine BMD T-scores measured by DXA (p value < 0.0005), as shown in Figure 1.

Bone mineral density T-scores, measured by QUS and DXA, were negatively correlated with age and disease duration, as shown in Figures 2, 3, 4 and 5.

Patients taking glucocorticoids were associated with lower T-score whether measured by QUS or by DXA, as shown in Figure 6.

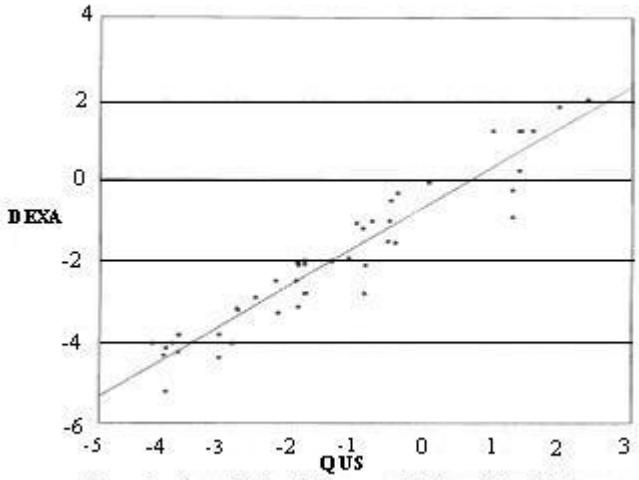

Figure1: Correlation between QUS and DEXA T-score

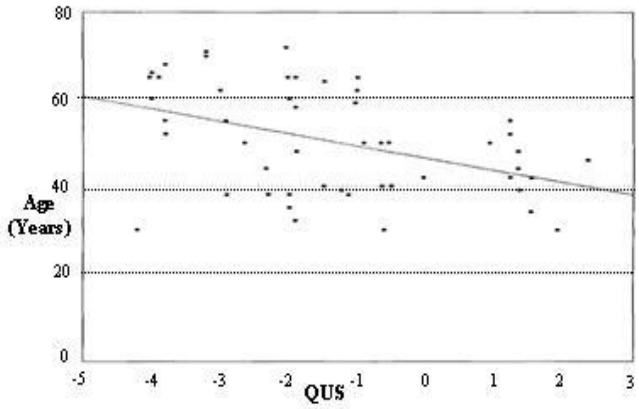

Figure2:Correlation between QUS T-score and age

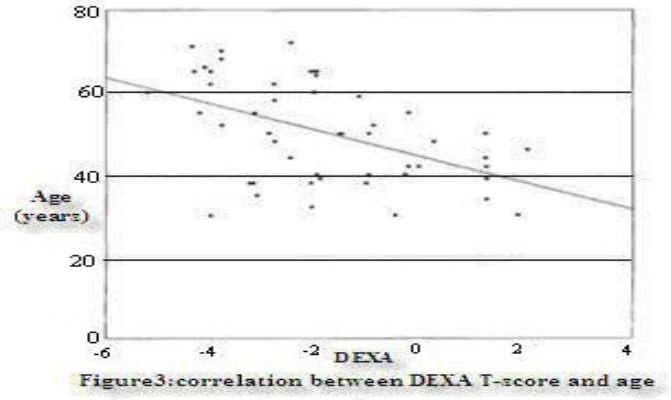

Figure3:correlation between DEXA T-score and age

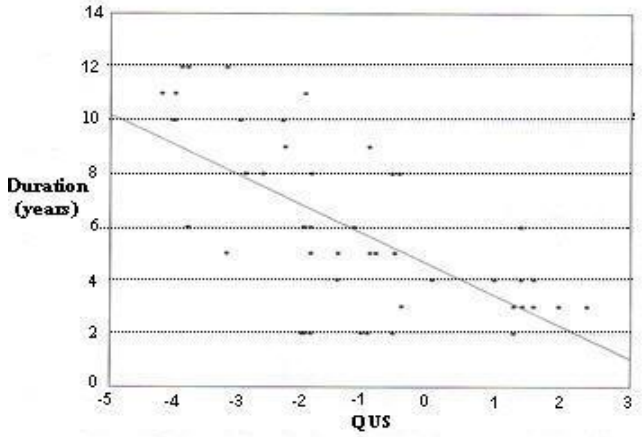

Figure4: Correlation between QUS T-score and duration

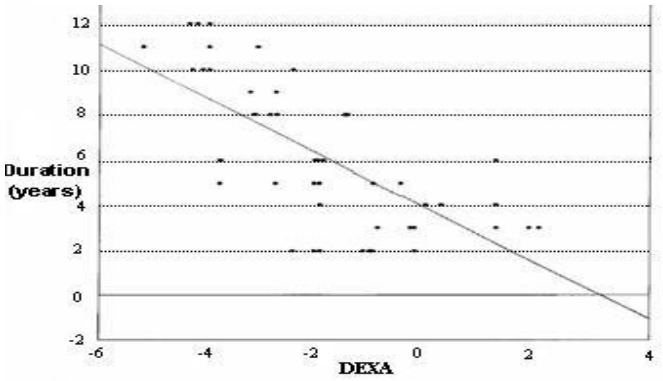

Figure5: Correlation between DEXA T-score and duration

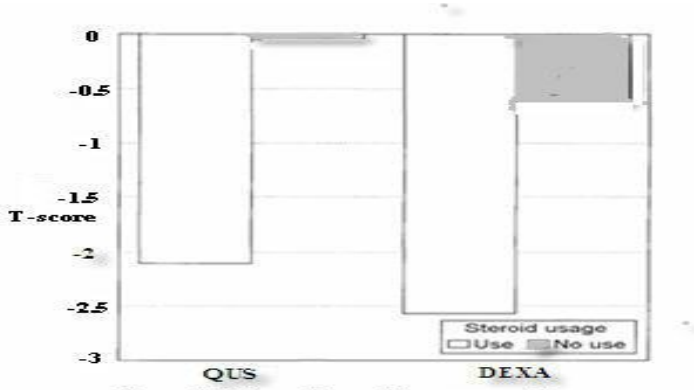

Figure6: Effect of steroid usage on T-score

DISCUSSION:

Several writers have commented on the co-existence of osteoporosis and RA.[2-5, 7] The present study confirms this finding. The bone status was compromised in a good percentage of our RA patients. The mean T-score measured by DXA and QUS was low according to the diagnostic criteria of osteoporosis established by WHO[12].

Although the DXA technique allows accurate measurement of bone density, in the last two decades, several non-invasive techniques have been developed to measure bone density at peripheral skeletal sites. Increasing interest in QUS has recently developed.[15]

Our study confirms that QUS at the heel can be considered as an alternative technique to identify subjects with high risk of bone fragility. Many authors comment on this subject. Orstavik RE, et al findings support QUS as an alternative tool for identifying patients at risk of having vertebral deformities in RA.[16] Njeh CF, et al also has demonstrated that bone status can be assessed quickly and cheaply using a portable QUS devise.[2]

In cross-sectional study done by Madsen OR, et al, bone status was assessed by QUS at different peripheral sites in 27 women with RA, and they concluded that bone status as assessed by QUS was compromised in rheumatoid arthritic patients, but whether ultrasound transmission may serve as a marker of disease progression and fracture risk in the individual patient remains to be clarified.[17]

The study done by Magaro M, et al evidenced a relationship between ultrasound and DXA in determining bone density in postmenopausal women, and as ultrasound and DXA provided comparable information on bone density, they point out that ultrasound can be used as a simple and sensitive indicator for postmenopausal osteoporosis.[18] The same results were obtained by Gambacciani M, et al.[19]

In this study, BMD T-scores measured by both QUS and DXA were negatively correlated with age and disease duration. Population-based epidemiological studies show an increased risk of fracture in patients with RA related to age, impaired ambulation and body mass.[20, 21] Verstraeten A, et al concluded that patients with long-standing destructive and disabling rheumatoid disease have low bone mass.[22]

In our study, patients taking glucocorticoids were associated with lower T-scores. Although a lower bone mineral content is found in patients on low doses of glucocorticoids, it is not clear whether this is due to disease activity or drug use.[23]

All of our patients were on disease-modifying anti-rheumatic drugs. The effect of anti-rheumatic drugs on generalized bone mineral content has not been studied extensively. The rate of generalized bone loss in patients with RA on anti-rheumatic drugs was not different from those not taking treatment in one study.[24], but others have shown that the drugs prevent bone loss or increase bone mineral content, probably by suppressing disease activity and thereby improving mobility.[25]

CONCLUSION:

The findings of this study support QUS as an alternative tool for evaluating BMD in patients with RA.

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