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A COMPARISON OF THE SENSITIVITY AND SPECIFICITY OF CALCANEAL ULTRASOUND MEASUREMENTS WITH CLINICAL CRITERIA FOR BONE DENSITOMETRY (DEXA) REFERRAL

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INTRODUCTION

Osteoporosis remains a formidable problem both in terms of cost, morbidity and mortality. It has been suggested that population screening using DEXA may not be cost effective (AGO Report, 1994), and that selective screening of those deemed to be at high risk may offer an alternative approach.

SUBJECTS, METHODS AND RESULTS

The Centre for Metabolic Bone Disease operates a contract with the Local Health Authority to provide a bone densitometry service based on agreed clinical referral criteria (Fig. 1) as part of a selective screening programme.

The subjects included 107 women who were part of a study examining the prevalence of osteoporosis at femoral neck or lumbar spine as determined by dual energy X-ray absorptiometry (DEXA, Lunar DPXL). All were aged 60-69 years (64.2±2.8) and also underwent broadband ultrasound attenuation (BUA) and velocity of sound (VOS) measurements of the calcaneum (McCue CUBA Clinical). An extensive medical and reproductive history was taken from all participants and used to identify those exhibiting at least one clinical referral criterion. DEXA was used to detect those with osteopenia and osteoporosis according to the WHO definitions. The sensitivity and specificity of the clinical criteria (discrete data) were then compared to those of BUA and VOS (continuous data). The monitoring criteria were not included in the analysis. Similarly, criterion 1 was not included in the analysis as this could apply to all the women in our cohort and therefore would not aid in selecting those with osteoporosis.

Of the 107 women, 49 (45%) exhibited at least one of the referral criteria. These criteria resulted in a specificity of 66% with a sensitivity of 50% for both osteopenia and osteoporosis at femoral neck or lumbar spine. Selecting the lowest 49 (45%) ultrasound values resulted in a threshold of 65 dB/MHz for BUA and 1600 m/s for VOS. The specificity at these thresholds were 76% for BUA and 52% for VOS. The sensitivity for osteopenia at femoral neck or lumbar spine was 44% for BUA and 33% for VOS. Similarly, the sensitivity for osteoporosis was 77% for BUA and 69% for VOS.

COMMENTS

Our data contribute to the debate on the role of ultrasound in the management of osteoporosis. The correlation of BUA at the calcaneus with axial BMD is only moderate at r=0.35 and r=0.40 for femoral neck and spine respectively in perimenopausal women (Young,

Fig. 1

Screening criteria

1. Any oestrogen deficient woman who would want to be treated or would want to continue treatment if found to be osteopenic or osteoporotic.
2. Patients suspected to be osteoporotic from radiological and clinical findings.
3. Patients who have a medical condition predisposing to be osteoporosis if effective treatment is available, eg metabolic bone disease, liver disease, anorexia nervosa, malabsorption syndromes and other rarer causes of osteoporosis.
4. Patients receiving corticosteroids at a dose $\geq$ 5 mg Prednisolone or equivalent.
5. Women who experience primary amenorrhoea or secondary amenorrhoea (including hysterectomy) below the age of 45 years.
6. Patients with a positive family history of osteoporosis in at least one first degree relative.

Monitoring criteria

7. Patients prior to starting management with oral corticosteroids of a prolonged duration of 6 months or greater.
8. To monitor response to treatment in patients with established osteopenia or osteoporosis.

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1993). The relative risk for fracture for each standard deviation (SD) decrease in measurement by BUA is 2.2 (1.8 - 2.7) for hip and 1.8 (1.5 - 2.2) for vertebrae, but an improved assessment of this risk of fracture can be determined by measuring the site concerned. For each SD decline in measurements by X-ray methods, the relative risk for fracture of hip is 2.6 (2.0 - 3.5) and for vertebrae 2.3 (1.9 - 2.8) (Marshall, 1996). Massie (1993) similarly revealed that only 73% of the lowest DEXA L2-L4 quartile were below the mean BUA value. Martin and Reid (1996) suggest that calcaneal ultrasound cannot be used to pre-select women for DEXA at femoral neck and lumbar spine because the poor correlation with DEXA would necessitate DEXA scanning almost the entire population to successfully select all individuals with osteopenia of hip or spine. We offer an alternative viewpoint. Population screening with DEXA has been deemed not to be cost-effective. Selective screening using clinical referral criteria to determine those who should have densitometry has a very low sensitivity and specificity. This data suggests that we would be better served by a programme of population pre-screening with calcaneal ultrasound; those below a certain threshold of BUA deserving a more "precise" assessment of bone density and fracture risk by DEXA. Follow-up and determination of response to treatment would also be performed by DEXA. BUA is quick, cheap and portable. The setting of the ultrasound threshold, however, needs to be determined by a cost benefit analysis.

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