

Multisite quantitative ultrasound: precision, age- and menopause-related changes, fracture discrimination, and T-score equivalence with dual-energy X-ray absorptiometry

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This study evaluated the clinical utility of a new multisite ultrasound device capable of measuring speed of sound (SOS) at the phalanx, radius, tibia and metatarsal. The in vitro and in vivo short- and long-term precision were evaluated, reference data were collected for 409 healthy white women (236 premenopausal and 173 postmenopausal), and age and menopause related changes were calculated using linear regression. Fracture discrimination was evaluated using 109 women with vertebral fractures and the age-adjusted odds ratios calculated for each standard deviation decrease in SOS measurement. Correlations between SOS measurements and spine and femur bone mineral density (BMD) were calculated. T-score equivalence with BMD was also investigated together with the prevalence of osteoporosis as defined by the WHO criteria. The in vivo short-term precision standardized in T-score units ranged from 0.14 to 0.33 and long-term standardized precision was 0.35-0.65. Postmenopausal age-related bone loss expressed as the annual change in T-score ranged from 0.040 to 0.089 for SOS and 0.053 to 0.066 for BMD, whilst menopause-related annual loss ranged from 0.036 to 0.094 for SOS and 0.050 to 0.074 for BMD. Correlations between the different SOS sites ranged from $r = 0.24$ to 0.55 , and between SOS and BMD from $r = 0.12$ to 0.47 . The odds ratio (and 95% confidence intervals) for fracture per 1 SD decrease in SOS were 2.0 (1.22 to 3.23) for the phalanx; 1.5 (1.01 to 2.24) for the metatarsal; 1.4 (1.03 to 1.99) for the radius and 1.2 (0.87 to 1.66) for the tibia. Odds ratios for BMD in the same population ranged from 2.6 to 4.8 (1.70 to 8.29). The prevalence of osteoporosis as defined by $T = < -2.5$ in the age range 60-69 ranged from 7.1% to 20.6% for SOS and 6.4% to 12.1% for BMD. In conclusion, this study demonstrated that multisite ultrasound has adequate precision for investigating skeletal status, is capable of differentiating between pre- and postmenopausal women and women with vertebral fractures, has a T-score equivalence similar to that of dual-energy X-ray absorptiometry (DXA), and appears to be a promising new technique for evaluating skeletal status at clinically relevant sites.

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