A NEW ULTRASOUND METHOD FOR OSTEOPOROSIS DIAGNOSIS ON MAIN ANATOMICAL REFERENCE SITES

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OBJECTIVE: To illustrate working principles and feasibility of a new ultrasound (US) method for bone densitometry directly applicable on the main anatomical reference sites (i.e. spine and proximal femur).

MATERIALS AND METHODS: A new fully automatic algorithm was developed to calculate the same diagnostic parameters of a dual-energy X-ray absorptiometry (DXA) examination (bone mineral density (BMD), T-score, Z-score) starting from an US scan of the considered bone district. The main implemented features include: 1) processing steps combining advanced spectral and statistical analyses on both US images and corresponding "raw" radiofrequency signals; 2) diagnostic calculations always carried out on regions of interest that must satisfy specific requirements in terms of either morphologic and spectral characteristics; 3) data processing takes into account patient body mass index (BMI); 4) integration with a reference database containing model reference acquisitions for each combination of anatomical site, patient ethnic group and sex. Effectiveness of this approach was tested on 340 female patients (45-80 yr, BMI≤40 kg/m2) that underwent both a DXA examination (Hologic Discovery) and an US scan of either lumbar spine or proximal femur.

RESULTS: US diagnosis (osteoporotic, osteopenic, healthy) coincided with the corresponding DXA one for 90.0% of spines and 87.5% of femurs. Average difference between DXA-measured BMD and the corresponding values calculated from US data (mean±SD) was -0.8%±9.2% for spines and +3.1%±16.4% for femurs (analogous accuracies were obtained for T-score and Z-score).

CONCLUSIONS: The proposed method could represent a new valuable future alternative for bone densitometry, providing a diagnostic accuracy comparable to DXA without using X-rays. This innovative technique has the potential to anticipate osteoporosis diagnosis by several years through extended screenings in younger populations.

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