Ultrasonographic attenuation predicted fractures in older women


Objective
To compare broadband ultrasonographic attenuation (BUA) with bone mineral density (BMD) for the prediction of hip and other fractures in postmenopausal women.

Design
Blinded comparison of BUA with BMD for prediction of hip and other fractures (Study of Osteoporotic Fractures).

Setting
4 clinical centers in the United States.

Participants
6189 postmenopausal women who were > 65 years of age at baseline. Mean follow-up was 2 years.

Description of tests and diagnostic standard
During one visit, BUA was done in duplicate on the right heel (UBA 575, Walker-Sonix Inc., Worcester, MA), calcaneal BMD was done on the same foot using single radiographic absorptiometry (Osteoanalyzer, Dov Medical, Newbury Park, CA), and hip (femoral neck) BMD was done using dual-energy radiographic absorptiometry (QDR 1000, Hologic, Waltham, MA). The diagnostic standard was self-reported, radiography-confirmed hip and nonspine fractures.

Main outcome measures
Age-adjusted Cox proportional hazard models were used to determine the relative risk (RR) for hip and nonspine fractures per standard deviation (SD) reduction of the mean value of BUA or BMD. Women were separated into 4 categories of fracture risk (from lowest to highest) using BUA, BMD, or both. Data were adjusted for age and clinic.

Main results
The correlation between BUA and femoral neck BMD was \( r = 0.42 \) and between BUA and calcaneal BMD was \( r = 0.7 \). The observed hip fracture frequency in the highest risk category was between 1.5 and 1.7 per 100 patient-years of follow-up. Each SD reduction in BUA was associated with an increased risk for nonspine fractures (RR 1.3, 95% CI 1.2 to 1.5) and hip fractures (RR 2.0, CI 1.5 to 2.7). Similar results were shown for calcaneal BMD (RR for nonspine fractures 1.4, CI 1.2 to 1.6 and RR for hip fractures 2.2, CI 1.9 to 3.0) and for femoral neck BMD (RR for nonspine fractures 1.3, CI 1.1 to 1.5; RR for hip fractures 2.6, CI 1.9 to 3.8). After adjustment for BMD at the femoral neck, each SD decrease in BUA was still associated with an increased risk for nonspine fractures (RR 1.2, CI 1.1 to 1.4) and hip fractures (RR 1.5, CI 1.0 to 2.1). After adjustment for calcaneal BMD, decreased BUA was no longer associated with an increased risk for any fracture.

Conclusions
A strong correlation existed between BUA and BMD. BUA predicted the risk for fractures during a 2-year period in postmenopausal women. However, the combination of BMD plus BUA was no better at predicting any fracture than calcaneal or femoral neck BMD alone.

Source of funding: Public Health Service.

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Commentary
Measurement of BMD using bone densitometry techniques is now established as a useful test for prediction of fractures in older persons (1). The study by Bauer and colleagues suggests that quantitative ultrasonography, especially measurement of BUA, may be as good as bone densitometry. This confirms the findings of a recent high-quality French study with a similar design and large sample size (2).

The data from these 2 prospective studies suggest that quantitative ultrasonography of bone is a reasonable alternative to bone densitometry. Development of techniques for assessing ultrasonography parameters at bone sites that are more clinically relevant than the calcaneus, and improving its precision, may make ultrasonography the test of choice in the future. The relatively low cost of ultrasonography is also a factor in its favor.

Should patients receive both bone densitometry and ultrasonography? The study by Bauer and colleagues concluded that it was enough to do just 1 of these tests. Although the French study of ultrasonography originally reported that BMD plus BUA was better than either test alone, reanalysis of the data led to the conclusion that combining the tests was unlikely to be useful (3). The reason that the use of both tests is not helpful may be that they are essentially measuring the same thing: bone strength.

The other big risk factor for fractures is falling. Combining a test of neuromuscular function, such as muscle strength or balance, with either BUA or BMD is likely to be the most effective way of identifying persons at high risk for fractures.

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References