Quantitative multi-site ultrasound for clinical and genetic studies of osteoporosis

Dr Karen Knapp
2002

ABSTRACT

The technique of semi-reflection multi-site quantitative ultrasound measurement of speed of sound (SOS) in bone was introduced in 1998. However, to date there is only limited data on its performance. The purpose of this thesis is to evaluate the performance of multi-site SOS for skeletal assessment in a clinical setting and for studies of the genetic properties of bone.

Measurements of SOS at sites in the radius, phalanx, tibia and metatarsal were evaluated and six different definitions of the SOS variable (mean, median, maximum, minimum, 95th centile and 25th centile) were evaluated resulting in the median SOS being recommended for use at the radius, phalanx and metatarsal and the 95th centile at the tibia. The short-term precision of the SOS measurements were demonstrated to be adequate for skeletal assessment. However, the long-term precision and the inter-operator precision were too poor for precise long-term monitoring of skeletal changes. Reference data from a local UK population were collected in 485 white women and used for all data analysis. Weak to moderate correlations were found between the different SOS measurement sites and with BMD at the spine and hip. SOS measurements at the radius, phalanx and metatarsal were able to discriminate vertebral and Colles' fracture cases from controls and a combination of sites improved this fracture discrimination slightly. It was not however better than DXA. T-score thresholds equivalent to the world health organisation definition of osteoporosis for femur DXA were investigated and appropriate diagnostic thresholds for use with the SOS measurements set. A relationship was seen between some clinical risk factors and SOS, however this was less than for BMD. A significant positive influence of hormone replacement therapy on SOS were found cross-sectionally. The twin study showed that all SOS measurements were highly heritable and approximately one-third of the genetic variance was found to be shared between the different aspects of bone measured by BMD and SOS.

In conclusion semi-reflective SOS is a precise tool for assessing bone quality and

discriminating fracture cases for clinical and research purposes, but is not useful for monitoring treatment and is less useful clinically than DXA.