The following study was awarded first prize in the 2005 MMJ Student Research Competition

Skin thickness as a Predictor of Bone Mineral Density

Melanie Burg, Claire Cordina, Kristelle Vassallo

Abstract

Background: Low bone mineral density (BMD) has been correlated with increased risk of fracture, which in turn causes significant morbidity, mortality, and health and social care costs. Currently, bone mineral density (BMD) is measured by dual energy X-ray absorptiometry (DXA) scanning, an expensive and time consuming technique that is not universally available. An alternative method of predicting BMD is therefore required, that can be used for wider screening purposes. As the connective tissue of both skin and bone contain > 70% collagen type I, skin thickness (ST) has previously been proposed to correlate with BMD.

Objective: To assess the correlation between BMD and ST; and develop a model for the prediction of BMD that includes other factors, such as age, weight, height and menopausal status, which may influence this relationship.

Methods: We analysed data collected from 1406 women (mean age of 55.2 years) at the Bone Density Clinic at St. Luke's Hospital. Their BMD was measured by DXA scanning at six sites: L2, L3, and L4 vertebrae; Ward's triangle, femoral neck and trochanter at the hip. Skin thickness (ST) was measured at the T1 dermatome using ultrasonography. Medical history (including drug and bone history) was also elicited. Statistical tests, in particular multivariate analysis of variance (MANOVA), were used to select significant predictors of bone mineral density.

Results: Age, weight, and skin thickness were all shown to have a significant relationship with BMD in postmenopausal women (MANOVA $p= 0.001$ for weight, age and $p< 0.05$ for skin thickness).

We show a significant relationship between height and BMD at the lumbar spine (MANOVA $p< 0.03$) but not at the hip. Age and weight variables are of particular importance in predicting BMD in this model, while ST is more important than height. Used in conjunction, weight, age, height and skin thickness result in the model having an R^2 value of 0.3 at the femoral neck, and 0.25 at L3. In non-menopausal women, we show that only weight has a significant relationship with BMD (MANOVA $P< 0.007$), while age, height and skin thickness do not.

Conclusions: In the postmenopausal woman, a combination of weight, height, age and skin thickness allows the prediction of 30% of the BMD at the femoral neck and 25% of the BMD at L3. Measuring these variables is simple and inexpensive, and would allow large scale screening programmes for people at risk, thus reducing morbidity, mortality and costs arising from fracture.