Background and objective

Bone strength estimates from Computed Tomography-based Finite Element models have been recently proposed to classify osteoporotic fractures, with promising but inhomogeneous results among published studies [1,2,3,4]. A comparison among existing studies is not easy since they rely on different methodologies and different study design, which can influence the results, although to an unknown extent.

We recently developed a CT-based FE model that correlates well with femur strength in vivo (R2=0.9, 14 femurs) [5,6].

The present study aimed to verify if and to what extent our FE model is associated with osteoporotic fractures in three differently designed case-control studies in post-menopausal women: a retrospective and a prospective study on proximal femur fracture, and a retrospective study on prevalent osteoporotic fractures. The same association was sought for aBMD, and results compared.

Modelling

Clinical studies

Prevalent fractures

Retrospective

Prospective

Results

Group differences (cases vs controls, box plots and Mann-Whitney test)

Fracture classification (Odds or Hazard Ratios and Area Under Curve)

Conclusions

In postmenopausal women, i.e. the population at the highest risk of bone fracture, our simple FE model was highly associated with proximal femur fracture.

FE-strength estimates from multiple loading conditions add important information to aBMD in classifying proximal femur fractures.

Site-specific use of proximal femur FE models seems crucial, since they are associated with femur fractures, but not with prevalent osteoporotic fractures at other skeletal sites.