Increased cortical porosity in type 2 diabetic postmenopausal women with fragility fractures.

Abstract:

The primary goal of this study was to assess peripheral bone microarchitecture and strength in postmenopausal women with type 2 diabetes with fragility fractures (DMFx) and to compare them with postmenopausal women with type 2 diabetics without fractures (DM). Secondary goals were to assess differences in nondiabetic postmenopausal women with fragility fractures (Fx) and nondiabetic postmenopausal women without fragility fractures (Co), and in DM and Co women. Eighty women (mean age 61.3 ± 5.7 years) were recruited into these four groups (DMFx, DM, Fx, and Co; n = 20 per group). Participants underwent dual-energy X-ray absorptiometry (DXA) and high-resolution peripheral quantitative computed tomography (HR-pQCT) of the ultradistal and distal radius and tibia. In the HR-pQCT images volumetric bone mineral density and cortical and trabecular structure measures, including cortical porosity, were calculated. Bone strength was estimated using micro-finite element analysis (μFEA). Differential strength estimates were obtained with and without open cortical pores. At the ultradistal and distal tibia, DMFx had greater intracortical pore volume (+52.6%, p = 0.009; +95.4%, p = 0.020), relative porosity (+58.1%, p = 0.005; +87.9%, p = 0.011) and endocortical bone surface (+10.9%, p = 0.031; +11.5%, p = 0.019) than DM. At the distal radius DMFx had 4.7-fold
greater relative porosity ($p < 0.0001$) than DM. At the ultradistal radius, intracortical pore volume was significantly higher in DMFx than DM (+67.8%, $p = 0.018$). DMFx also displayed larger trabecular heterogeneity (ultradistal radius: +36.8%, $p = 0.035$), and lower total and cortical BMD (ultradistal tibia: -12.6%, $p = 0.031$; -6.8%, $p = 0.011$) than DM. DMFx exhibited significantly higher pore-related deficits in stiffness, failure load, and cortical load fraction at the ultradistal and distal tibia, and the distal radius than DM. Comparing nondiabetic Fx and Co, we only found a nonsignificant trend with increase in pore volume (+38.9%, $p = 0.060$) at the ultradistal radius. The results of our study suggest that severe deficits in cortical bone quality are responsible for fragility fractures in postmenopausal diabetic women.