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Femoral neck BMD is a strong predictor of hip fracture susceptibility in elderly men and women

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Despite the sexual dimorphism of bone, hip fracture risk is very similar in men and women at the same absolute bone mineral density (BMD). A recent study was conducted with the objective of elucidating the main structural properties of bone that underlie the measured BMD and that ultimately determine the risk of hip fracture in elderly men and women [1]. This study is part of the Rotterdam Study (a large prospective population-based cohort) and included 147 incident hip fracture cases in 4806 participants with DXA-derived hip structural analysis (mean follow-up, 8.6 y). Indices compared in relation to fracture included neck width, cortical thickness, section modulus (an index of bending strength), and buckling ratio (an index of cortical bone instability). A mathematical model was used to calculate the hip fracture distribution by femoral neck BMD, BMC, bone area, and hip structure analysis (HSA) parameters (cortical thickness, section modulus narrow neck width, and buckling ratio) and compared it with prospective data from the Rotterdam Study.

In the prospective data, hip fracture cases in both sexes had lower BMD, thinner cortices, greater bone width, lower strength, and higher instability at baseline. In fractured individuals, men had an average BMD that was significantly higher than women, whereas no significant difference in buckling ratios was seen. Modeled fracture distribution by BMD and buckling ratio levels were in concordance to the prospective data and showed that hip fractures seem to occur at the same absolute levels of bone instability (buckling ratio) in both men and women.

The buckling ratio (an index of bone instability) portrays in both sexes the critical balance between cortical thickness and bone width. These findings suggest that extreme thinning of cortices in expanded bones plays a key role in local susceptibility to fracture.

1. Rivadeneira F et al. *J Bone Miner Res*. 2007;22:1781–1790.

Bone instability and the risk of fracture

These are the proposed changes that cross-sections of the femoral neck will exhibit in aging men and women, showing the relation between inner (endosteal) and outer (periosteal apposition) bone expansion, with its consequences on bone density, strength, and bone instability (propensity of thinner cortices in wide diameters to buckle). Men have wider and thicker bones than women at all ages, yet the same instability thresholds apply for both sexes.