[LB-SA0383] Shape and Texture Modeling of Hip Bone Density for Fracture Discrimination

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Abstract

Shape and Texture Modeling of Hip Bone Density for Fracture Discrimination
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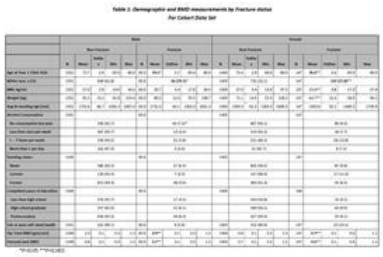
Objective: The objective for this study was to determine whether the shape and texture of bone, fat and lean masses are independently associated with incident hip fracture after adjusting for other known risk factors.

Methods: Baseline hip bone density for the Health Aging and Body Composition Study (Health ABC) was measured on 2986 of 3097 participants using a Hologic system (Hologic Inc., Marlborough, MA). Participants were 70-79 years (50% male) at baseline. Scans were reanalyzed in two steps. First, the dual-energy attenuations were used to soft for the fat/lean masses outside the bone area. The fat/lean over the bone was approximated by interpolating the percent fat over the bone resulting in complete images of fat, lean, and bone mass. Second, these images were automatically annotated to outline the bone shape using a Random Forest approach. Shape and texture modeling was applied to each image resulting in a principal component (PC) description of the bone shape (PCS_{bone}). The images for the entire population were then registered to the average shape using nonlinear warping techniques. Then the texture of the fat, %fat, lean, and bone (PCT_{fat}, $PCT_{\%fat}$, PCT_{lean}, PCT_{bone}) was described again using PCs. Proportional hazards regression analyses were employed to determine the associations (Hazard Ratios, HR) of each PC to incident hip fracture, separately for men and women, after adjustment for age, race, femoral neck (FN) BMD, BMI, self-reported health alcohol use, smoking status and education.

Results: The baseline mean (standard deviation) of age was 74 ± 3 years and BMI was 26.7 ± 4.3 kg/m^2 respectively. During the 16-year follow-up period, 230 participants sustained a hip fracture (Table 1). To describe 95% of the variance took 14 PCs for bone shape, 73, 21, and 42 for bone, fat and lean textures respectively. After full adjustment, no bone shapes were significantly associated to fractures. However, PCTs for bone, fat and lean mass texture were independently associated with fracture. In men PCT_{bone} 27, PCT_{Fat} 4, $PCT_{\%fat}$ 1, 3, 5, and 16 remained in our model with HR(95%CI) of 0.45(0.31-0.65), 0.62(0.47-0.8), 1.7(1.23-2.34), 2.05(1.46-2.89), 0.63(0.49-0.81), 0.53(0.39-0.73), and 1.39(1.07-1.81), respectively. In women, PCT_{bone} 1 and 28, PCT_{fat} 1 and 20, PCT_{lean} 10 were associated with fracture risk and HR = 1.8(1.15-2.83), 1.27(1.02-1.57), 1.28 (1.06-1.56), 1.27 (1.07-1.51), 0.65 (0.51-8.2), 0.79 (0.64-0.96), respectively (Table 2). The addition of these PCs to the risk factors alone improved the AIC from 576 to 536 for men and 1169 to 1149 for women.

Conclusion: The distribution of bone of the proximal hip and the surrounding fat and lean masses are independently related to hip fracture risk in older adults and may improve existing fracture risk models.



Disclosures:
Amir Pasha Mahmoudzadeh has nothing to disclose.