PURPOSE: To investigate in vitro the calcaneal trabecular bone structure in elderly human donors with high spatial resolution magnetic resonance (MR) imaging at 3.0 T and 1.5 T, to quantitatively compare MR measures of bone microarchitecture with those from micro-computed tomography (CT), and to compare the performance of 3.0-T MR imaging with that of 1.5-T MR imaging in differentiating donors with spinal fractures from those without spinal fractures. MATERIALS AND METHODS: The study was performed in line with institutional and legislative requirements; all donors had dedicated their body for educational and research purposes prior to death. Sagittal MR images of 49 human calcaneus cadaveric specimens were obtained (mean age of donors, 79.5 years +/- 11 [standard deviation]; 26 male donors, 23 female donors). After the spatial coregistering of images acquired at 3.0-T and 1.5-T MR imaging, the signal-to-noise-ratios and structural parameters obtained at each magnetic field strength were compared in corresponding sections. Micro-CT was performed on calcaneus cores obtained from corresponding regions in 40 cadaveric specimens. Vertebral deformities of the thoracic and lumbar spine were radiographically classified by using the spinal fracture index. Diagnostic performance of the structural parameters in differentiating donors
with vertebral fractures from those without was assessed by using receiver operator characteristic (ROC) analysis, including area under the ROC curve (A(z)). RESULTS: Correlations between structural parameters at 3.0-T MR imaging and those at micro-CT were significantly higher (P .05). CONCLUSION: MR imaging at 3.0 T provided a better measure of the trabecular bone structure than did MR imaging at 1.5 T. There was a trend for better differentiation of donors with from those without osteoporotic vertebral fractures at 3.0 T than at 1.5 T.