Multiparametric Imaging of Bone Architecture: a Cadaveric Study.

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Osteoporosis is a disease that mainly affects the elderly and is characterized by disrupted bone architecture and reduced bone mineral density. These features leave patients with a higher susceptibility for fractures. Conventional measurements, such as bone mineral density analysis, are not perfect predictors of osteoporotic fractures. In the present study several imaging modalitities (plain film, MRI, CT, and μCT), multiple image analysis parameters (Genant: vertebral size, volume; QCT: density; μCT: trabecular analysis), and several bone sites (vertebra, iliac crests, distal radii and middle phalanx) were used to determine their utility in assessing vertebral fracture risk. The subjects for this study were female cadavers (n =5; ages 80-96). Although historically vertebral fractures have been assessed by plain film, the present results demonstrated that the MRI and CT can give added information that are missed in the single plain film image. Both CT and MRI allow one to look at many slices through a vertebra. This can often show degenerative changes within the vertebra that were not obvious on the plain film. Furthermore, the MRI allowed one to access prevalent versus incident fractures. Analysis of the number and severity of vertebral fractures led to a spinal deformity index (SDI) for each subject (0, 2, 4, 7 and 11). When nonfractured vertebrae from the five cadavers were analyzed by QCT, it appeared that the lowest bone density measurents correlated with highest SDIs. We also hope to show that the high SDI and low bone density measurements will be correlated with fewer and thinner trabeculae in the μCT images of the nonfractured vertebrae. Finally, as part of ongoing research, μCT images of the iliac crests, distal radii and middle phalanx will be analyzed and compared to the SDI for each cadaver. It is quicker, cheaper and takes less radiation to take CT images of the distal radius or phalanx. If these sites correlate well to a high SDI, these screening measures may prove beneficial for determining veterbral fracture risk in our aging population.