Increased sensitivity in detection of a porcine high-turnover osteopenia after total gastrectomy by dynamic 18F-fluoride ion PET and quantitative CT.

METHODS: Six months after total gastrectomy (n = 7) or sham operation (n = 6), bone blood flow and bone metabolic activity (K(i), K(flux)) were calculated from dynamic PET measurements from vertebral bodies and compared with corresponding QCT bone mineral density (BMD) measurements. RESULTS: Total gastrectomy resulted in a significant reduction of the BMD (-21%; P < 0.005), whereas 1,25-(OH)(2)-vitamin D, serum phosphate, and parathyroid hormone were significantly increased compared with that of sham-operated animals. Because of the significant increase of the rate constant k(3) (+325%; P < 0.05), describing chemisorption and incorporation of (18)F-fluoride onto or into the bone matrix, K(i) (+36%) and K(flux) (+37%) were significantly elevated after total gastrectomy compared with that of control animals (P < 0.01), whereas bone blood flow was not significantly different between groups. The normalization of K(i) and K(flux) values by the specific bone mass (K(i/BMD); K(flux/BMD)) largely increased the...
differences between groups (K(i/BMD), +74%; K(flux), +76%; P< 0.001). CONCLUSION: Dynamic 
(18)F-fluoride ion PET revealed that porcine bone loss after total gastrectomy is related to a 
high-turnover bone disease without significant changes in bone blood flow. In mini pigs, the increased 
bone metabolism is probably related to an elevated parathyroid hormone secretion, thus maintaining 
serum calcium homeostasis at the expense of the bone mineral content. Normalizing bone metabolic 
activity by the specific bone mass increases the sensitivity in the detection of osteopenic high-turnover 
bone diseases. Therefore, the combination of QCT and (18)F-fluoride ion PET seems to be the 
method of choice for the classification of metabolic bone diseases and for monitoring treatment effects 
quantitatively.