《招待講演 1》

Clinical Assessment of Bone Remodeling by Radiophosphate Imaging and Bone Densitometry

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There is still controversy about the precise mechanism by which Tc-99m-phosphate is deposited in bone. Not all investigators consider it to be entirely a simple and direct adsorption onto the mineral front, although this kind of adsorption probably takes place in metastatic or dystrophic soft tissue calcification. There is evidence from a number of sources that the bone matrix plays a role, and since matrix renewal is a function of osteoblastic activity, deposition of radiophosphate is intimately associated osteoblastic activity. The various contemporary theories based on experimental results will be discussed.

Radiophosphate bone imaging (MDP) and dual energy x-ray absorptiometry (DEXA) reflect different aspects of bone remodeling. The deposition of MDP is a function of osteoblastic activity. Osteoblastic and osteoclastic activity are functionally coupled, so that an increase or decrease in one component is matched by a compensatory change in the other in order to maintain a normal bone complement. When the change is not completely offset by the other component the net result in bone will be either osteopenia or osteosclerosis, depending on which component is dominant. In the case of accelerated osteoblastic activity MDP uptake will be increased regardless of the net result. DEXA measurements vary directly with mineral content.

Renal osteodystrophy typifies the variable manifestations of MDP and bone mineral density (BMD), depending on the underlying histological stage, which can vary from aluminum toxicity to severe end-stage secondary hyperparathyroidism. The former can show poor uptake of MDP and low BMD, while the latter exhibits a high accretion of MDP and variable levels of BMD. Post total parathyroidectomy is associated with decreasing MDP uptakes with time, but stable BMD.

Another focus of recent attention is periprosthetic bone remodeling in hip implants as a function of time. It is well known that there is a high MDP uptake that decreases to near normal levels by one year, with little or no bone loss by x-ray, but the more sensitive DEXA measurements may show regional mineral losses as high as 40% within the first 6 months. These remodeling changes have obvious application in prosthesis design to maximize longevity. Different designs of the femoral component were shown to have different regional uptakes of radiophosphate by quantitative analysis and BMD measurements.

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