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BONE SCINTIGRAPHY IN METABOLIC BONE DISEASES.
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It was well known that bone scintigraphy using Tc-99m phosphorus compound was a useful method in the detection of bone metastasis of malignant tumor, the diagnosis of primary bone tumor, the visualization of osteomyelitis and the exact location of fracture. On the other hand, it is not clear how bone scintigraphy plays a role in metabolic bone disease and abnormal Ca metabolism (hyper- and hypo-parathyroidism, osteomalacia, Paget's disease of bone, hypercalcemia associated with malignancy and renal osteodystrophy (ROD) in chronic renal failure on hemodialysis).

It is reported that uptake mechanism of Tc-99m phosphorus compound to bone depends on the size of surface area in bone crystal or the grade of blood flow. Therefore, in diseases with abnormal bone metabolism, we could anticipate the state of bone metabolism from the degree of accumulation of radionuclide.

In typical hyper- or hypo-parathyroidism and osteomalacia the characteristic bone image was obtained; the increased accumulation in skull and mandible was observed in hyperparathyroidism, the relatively increased accumulation in soft tissue in hypoparathyroidism, and the findings of pseudo- or microfracture and the visualization of costochondral junctions in osteomalacia. Paget's disease of bone shows the strong accumulation of radionuclide in diseased

bone. In half of these cases, bone scintigraphy gave a clue to the correct diagnosis. The calculation of RI uptake ratio of diseased bone to control bone was useful index in assessment of therapeutical effect. In hypercalcemia associated with malignancy, not only the apparent finding of bone metastasis but also normal image or diffusely increased accumulation of radionuclide to bone were observed. These findings were interested in considering the cause of hypercalcemia, and the possibility of humoral hypercalcemia (the production of osteolytic substance from cancer). In ROD various bone images, showing poor accumulation to bone, osteomalacia or hyperparathyroidism, were obtained. Furthermore, the bone images were studied in relation to histological findings of bone biopsy specimens. The etiology of ROD is complicated and the treatment is different. Therefore, if the pathophysiology of ROD could be classified by bone scintigraphy, many informations will be given to the selection of therapy.

It was shown that bone scintigraphy in metabolic bone diseases is a useful method in evaluating the state of bone metabolism, in addition to the visualization of diseased bone.

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CLASSIFICATION OF BONE SCINTIGRAM AND QUANTITATIVE EVALUATION ON BONE MINERALIZATION WITH X-CT AND SPECT IN RENAL OSTEODYSTROPHY
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1. Bone scintigraphy was performed in 52 patients with chronic renal failure. These scintigrams were classified into 4 groups.

Group I (32 patients) showed increased RI accumulation in the bone, particularly in the calvarium, maxilla, mandible and vertebra (high activity of the bone type; hyperparathyroidism type). Subtotal parathyroidectomy (PTX) was performed in 17 of 32 patients and revealed hyperplasia of the parathyroid glands on surgery.

Group II (9 patients) showed higher background activity than group I (high background activity type; osteomalacia type). Group IIa showed clear bone image with fractural hot spots and Group IIb demonstrated unclear bone images. Bone biopsy was done in 2 of 9 patients and varified histologically osteomalacia in both cases.

Group III showed extraosseous RI accumulation (extraosseous accumulation type). Group IIIa (4 patients) had metastatic calcification in the lung and the kidney (visceral type). Group IIIb (7 patients) showed massive calcification in the soft tissue (soft tissue type).

Group IV (1 patient) showed normal bone scintigraphic pattern.

The level of ALP and c-PTH was very high in Group I and that of Ca x P product was high in Group III. Serum Ca and P were not

correlated to each group. The duration of hemodialysis on group I and III was longer than that on group II. Our scintigraphic classification might aid in diagnosis of patho-physiological bone changes and in choice of treatment on ROD.

2. Subtotal parathyroidectomy (PTX) was employed in 18 patients with ROD in order to improve bone lesions. These patients were studied before and after surgery using 6 different procedures; 1. conventional radiography (phalanges, calvarium, vertebra), 2. microdensitometry (MD) on the metacarpal bone, 3. bone mineral analysis (BMA) on the radius, 4. measurement of EMI number with X-CT (frontal bone), 5. bone scintigraphy (whole body), 6. radionuclide (RN) activity ratio (frontal bone/brain) with SPECT.

Each procedure detected improvement of demineralization after surgery. Mild improvement of bone change was detected using the MD, BMA and X-CT. On the bone scan, the diffuse increased activity in the calvarium, maxilla and mandible remarkably decreased after surgery in 17 patients (Group I).

To quantify the bone changes revealed by the bone scan, the RN activity ratio was measured. The RN activity ratio markedly decreased after surgery. The measurement of RN activity ratio seems to be most useful method for detecting dynamic bone mineral change.

Soft tissue calcification was decreased in size in 2 patients after surgery.