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MEASUREMENT OF BONE MINERAL CONTETENT USING A SINGLE PHOTON DENSITOMETER

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Bone density in the radius was measured using a single-photon densitometer (Norland-Cameron) in normal volunteers and in patients with primary hyperparathyroidism, osteomalacia and osteoporosis before and after treatment. Density at "1/3" site from the distal end of the radius was scanned and the values was expressed as bone mineral content/bone width. In healthy adults, females have lower bone mass than males between the ages of 20 to 85 years, and a marked decrease in the bone mass in women after the age 45-50, and in men after the age 65. In patients with primary hyperparathyroidism (n=25), 17 showed a prominent decrease in the bone mass preoperatively (-2SD to -5SD), in whom 3 showed no abnormal X ray findings. In all these subjects, a marked increase of the bone mass was observed several months after resection of the parathyroid tumor (20%max. when expressed as the percent change from the preoperative value). Though the values have increased, they remained low comparing to the age-matched control levels even two years after the operation. In patients with osteomalacia (n=11), eight subjects showed a decrease in the bone mass, while three patients have normal bone mass. Treatment with 1α(OH) vitamin D (3-9 μg/day) or tumor resection in a patient with haemangiopericytoma-induced osteomalacia prevented the further bone loss. In patients with bone-biopsy-identified osteoporosis using tetracycline double labelling method (n=32 of high turnover osteoporotics, n=2 of low turnover osteoporotics), few cases who's bone mass were within the normal ranges were found. In five patients treated with 200mg EHDP daily for six months, five patients showed a decrease of the bone resorption and three patients showed an increase of the bone formation. Percent change of BMC/BW from the untreated level was ranged from 0 to 9.2%. These results indicate that measurement of bone mineral content using a single-photon densitometer is useful to assess the change of bone mass in various diseases.

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MRI OF THE BONE DISORDERS.

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In our hospital we started the clinical application of MRI in August, 1984. MRI is used most frequently in cases of central nervous system disorders. At first MRI of the bone disorders were not interested in because the bone cortex has no NMR signal. Because MRI is very sensitive to the changes of bonemarrow and has efficient contrast between bone and surrounding soft tissues, the reports concerning MRI of bone disorders are increasing. In this report we describe the values and problems of MRI in the diagnosis of disorders of bone, especially those of vertebrae, pelvic bones and extremities.

The MRI unit at our hospital uses a resistive magnet (Toshiba MRT-15A) which is used at a field strength of 0.15 Tesla. Usually we use two kinds of spin echo (SE), inversion recovery (IR) and calculated T_1 image. Pulse sequences used included mainly SE(30,320), SE(30,1600) and IR(400,2000). Forty-three patients with bone disorders were examined. Their ages ranged 9-72 years (mean 51.6). The pathologic states we examined were tuberculous spondylitis(6), rheumatoid arthritis(10), pyogenic osteomyelitis of the vertebrae(2), primary bone tumors(9) and metastatic bone tumors(16).

As for tuberculous spondylitis and vertebral metastasis which sometimes cannot be distinguished easily from each other, we cannot distinguish them by short SE or IR. But, in long SE image, the signal intensity of them were different considerably. The former mainly showed higher signal intensity than that of normal bonemarrow, and the latter showed mainly lower signal intensity. T_1 values of the former were lengthened and showed wider distribution than the latter.

As for merits of MRI concerning diagnosis of bone disorders, we considered as follows. 1) No artifact due to bone or air was seen. 2) It was useful for evaluating extent of the lesion of the bone and surrounding soft tissues because free scan section was obtained. 3) It could delineate direct images of the bonemarrow and the intervertebral disk and was sensitive to lesions of those tissues. 4) We can see the oppression of spinal cord due to disorders of vertebrae, because it is possible to differentiate the spinal cord from the cerebrospinal fluid without contrast material.

As the history of clinical application of MRI is short, there are some problems to improve, for example, 1) it takes long scan time which degrade the image because of motion artifacts, 2) it is not suitable for bone disorders of whole body, limiting to scan field, 3) it has little informations of bone cortex or calcification, having little ^1H, 4) if there is a magnetic substance in the body it makes diagnosis difficult by artifacts.