Bone Scintigraphy with ^{99m}Tc-Diphosphonate. (Comparative Study of ^{99m}Tc-Diphosphonate, ^{99m}Tc-Pyrophosphate and ^{87m}Sr)

T. Fukuda, K. Abe, T. Furukawa, T. Miyamoto, K. Hamada, H. Ochi, M. Tamaki,

Dept. of Radiology, Osaka City University Medical School, Osaka City.

T. Tsuchida, T. Oka

Shirokita Municipal Hospital, Osaka City.

Recent report by H. Pendergrass on excellent scintigraphic bone image with ^{99m}Tc-diphosphonate prompted us to undertake this comparative study.

(Purpose) Comparative evaluation of ^{99m}Tc-diphosphonate, ^{99m}Tc-pyrophosphate and ^{87m}Sr in experimental animals and clinical cases.

(Method) Measurements of blood clearance, organ distribution in rabbits, and blood clearance, urinary excretion rate in humans of these three bone-seeking agents were performed. The image quality of human bone scintigrams with three agents was also compared.

(Result and conclusion) Blood clearance in rabbits and humans of ^{99m}Tc-diphosphonate and ^{99m}Tc-pyrophosphate did not indicate significant difference. ^{87m}Sr was slower in clearance than the others. In human clearance study of ^{99m}Tc-diphosphonate, the dose remaining in the blood was 12.5% at 1hr, 7.4% at 2hr and 6.1% at 3hr after injection. The cumulative urinary excretion rate of ^{99m}Tc-diphosphonate was 51.3% up to 3hr after injection. ^{87m}Sr showed lowest rate. The organ distribution in rabbits of ^{99m}Tc-diphosphonate was similar to that of ^{99m}Tc-pxrophosphate except that the latter accumlated in the liver more than the former. Distribution of ^{87m}Sr in the muscle was highest among the three agents.

In human study, image quality of the bone scintigrams did not show significant difference between ^{99m}Tc-diphosphonate and ^{99m}Tc-pyrophosphate. On the other hand, the bone scintigram with ^{87m}Sr was most indistinct due to high background activity.

Unlike ^{87m}Sr, ^{99m}Tc-diphosphonate and ^{99m}Tc-pyrophosphate showed very high renal radioactivity. However this did not interfere with skeletal image of the lumbar spine. On the contrary, unilateral absence of renal image occasionally noted during bone scanning was contributory to detection of a urinary tract involvement in neoplastic disease. When urinary bladder was urine containing large amounts of radioactivety, it was difficult to observe scintigram of the pelvic area. But this can be avoided by patient's voiding just before the scan.

Preliminary results from out basic and clinical studies indicate that ^{99m}Tc-diphosphanate is most useful bone-seeking agent.