siderably manifested abnormalities by scintigraphy.

A hundred and sixty-nine patients were performed the scintigraphy with $^{99m}$Tc-MDP for the detection of bone metastasis, and 52 of them showed abnormalities. In twenty-three of 118 patients of breast cancer, the scintigrams showed abnormalities and definite metastases were confirmed in 13 patients. Patient with prostatic carcinoma and lung cancer also showed abnormalities in high ratio.

We have already experienced bone scintographies of more 1,000 patients using $^{99m}$Tc EHDP, and noticed that, in comparison with $^{99m}$Tc EHDP, $^{99m}$Tc MDP is more suitable agent of scintigraphy for the skeletal survey of patients with malignant tumors, because of its rapid blood clearance and urinary excretion.

**Evaluation of the Clinical Utility of $^{99m}$Tc-MDP Bone Scan Compared with PYP and EHDP**

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The purpose of the present study is to evaluate clinically bone images obtained by using currently available three bone scanning agents of $^{99m}$Tc-MDP (methylene diphosphonate), EHDP (ethane hydroxy diphosphonate) and PYP (pyrophosphate). The image itself is remarkably improved by Micro Dot Imager whole body $\gamma$ scanner compared with 3 inch whole body scanner.

The results were as follows: 1) The quality of the images were defined into three categories. By using $^{99m}$Tc-MDP 59% of good, 28% of fair and 14% of poor images were obtained. By using $^{99m}$Tc-PYP 14% of good, 50% of fair and 36% of poor images were obtained. By using $^{99m}$Tc-EHDP no good case, 57% of fair and 43% of poor images were obtained. 2) The half time of blood clearance of $^{99m}$Tc-MDP, EHDP and PYP were 16±4, 17±7 and 35±3 minutes respectively. 3) The 24 hours urinary excretion rate of $^{99m}$Tc-PYP, MDP and EHDP were 40±19, 47±19 and 60±16% of injected doses respectively. 4) A case of prostate cancer was scanned by using three bone scanning agents. The quality of the image of $^{99m}$Tc-MDP, PYP and EHDP were good, fair and poor respectively. 5) Generally speaking the aged cases showed frequently unsatisfied bone scans than the cases of adult.

In conclusion, the bone scan using $^{99m}$Tc-MDP could provide us with better quality image than those using $^{99m}$Tc-PYP or EHDP.

**Scintigraphy with $^{99m}$Tc-Methylene Diphosphonate**

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The use of $^{99m}$Tc-Methylene diphosphonate (MDP) for bone scanning has become increasingly common. This is the report of our experience using this agent. The accumulation rate of this agent in each bone increased markedly until 2 hours after administration, and reached a plateau at 2–3 hours except for the spine which showed a minimal increase then.

The count rate of each ROI in the bone showed a plateau at 2–3 hour, but that of kidney or background was decreasing. This suggests the adequate timing for the bone scanning to be at
about 3 hours after administration.

Scintigrams with $^{99m}$Tc-MDP were equal or superior to those with $^{99m}$Tc-Diphosphonate. We conclude $^{99m}$Tc-MDP is the best radiopharmaceutical for bone scanning available at present.

**Evaluation of Pre- and Postoperative Scintigraphy for Detecting Skeletal Metastases in Cases of Breast Cancer**

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A preoperative bone metastatic survey using skeletal scintigraphy was carried out on 29 patients clinically diagnosed when first admitted as having early breast cancer. 82 other patients who had undergone mastectomy or radiotherapy, a majority of whom complained of pain in the spine and extremities, were studied to detect sites of metastatic bone lesions.

After the administration of Tc-99m EHDP in the dosage of 10–15 mCi IV, whole body scans were performed using a Toshiba gamma camera (type 202). At approximately the same time as the skeletal scintigraphy was carried out, each patient also had a radiological skeletal survey and biochemical tests.

Occult skeletal metastases were visible on the scintigrams of 10% of the patients who had been clinically diagnosed as having early breast cancer, and who had undergone simple mastectomy followed by chemotherapy. Radiographs had failed to detect the metastases in two thirds of the cases, showing that bone scintigraphy with Tc-99m is superior to conventional radiography for the detection of early metastatic bone lesions.

Overall in this study, 76% of the bone scans in postoperative cases revealed abnormalities. Over 56% of the patients with skeletal abnormalities had lesion in the thorax and vertebrae while abnormalities were detected in skull, pelvis and extremities in 39%, 25% and 26% of the cases, respectively.

Finally, it is recommended that all candidates for radical mastectomy and/or radiotherapy have a preoperative bone scan and that the procedure be repeated during and following therapy in order to assess the response to treatment or detect recurrent sites of the diseases. The procedure should preferably be performed at least once per year for three years following mastectomy even in the absence of symptoms.

**Evaluation on Diagnostic Capability of $^{99m}$Tc-Pyrophosphate Bone Scintigraphy on Bone Metastasis of Breast Cancer**

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The diagnostic capability of bone scintigraphy using $^{99m}$Tc pyrophosphate was discussed. The scintigraphy was performed 78 patients of breast cancer. The results were summarized as follows:

1) In 18 cases with bone metastasis, 13 cases (72%) were previously diagnosed by bone scintigraphy.
2) The over-all accuracy ratio was 79.5% in 78 cases and 75.7% in 118 scintographies.
3) The incidence of false positive was 45.5% in 118 scintographies, and common causes were high accumulations of radioisotope in the breast bone, lumbar vertebrae and hip-joint.
4) The incidence of false negative was 5%, and the focuses of all these cases were metastatic focuses in the ribs.