

Metastatic calcification: Accumulation of a bone tracer during dynamic data acquisition

Seigo KINUYA,* Junichi TAKI,* Masahiko FUJIOKA,** Takatoshi MICHIGISHI*
and Norihisa TONAMI*

**Department of Nuclear Medicine, Kanazawa University School of Medicine*

***Department of Internal Medicine, Noto General Hospital*

Metastatic calcification is often detected by bone scintigraphy. We recently saw metastatic calcification in the stomach and kidneys of a patient on continuous ambulatory peritoneal dialysis. Tc-99m HMDP accumulation into both organs was noted even in the first frame of dynamic data acquisition of 4 min/frame, suggesting that calcium deposits may create an aggressive process and we may obtain information on the calcium deposit rate to better understand the mechanism of metastatic calcification.

Key words: metastatic calcification, continuous ambulatory peritoneal dialysis, Tc-99m HMDP, dynamic data acquisition

INTRODUCTION

METASTATIC CALCIFICATION is often found in cases with chronic renal disease, hemodialysis, parathyroid tumor, malignancy and hypervitaminosis D.¹⁻⁶ It is thought that accumulation of bone tracers represents the metabolic activity of calcium deposit.^{5,6}

In this report, we show a case of gastric and renal metastatic calcifications which were delineated during a dynamic data acquisition after the tracer administration indicating a dynamism of metastatic calcification.

CASE REPORT

A 67-year-old woman on continuous ambulatory peritoneal dialysis due to diabetic nephropathy for a year was performed with bone scintigraphy to assess the possibility of renal osteodystrophy. Whole body image obtained at 3 hr after the administration of 740 MBq of Tc-99m hydroxymethylene diphosphonate (HMDP) did not show an abnormal bone turnover associated with renal osteodystrophy (Fig. 1), but abnormal accumulation in the left

upper abdomen was incidentally observed, indicating gastric uptake. No tracer uptake in the thyroid gland or salivary glands was seen, suggesting that the gastric uptake was not caused by contaminated Tc-99m pertechnetate. Furthermore, scintigraphy performed in a different patient with the same radiopharmaceutical preparation did not show any gastric, thyroidal or salivary uptake, either. The gastric uptake in this case was therefore considered to be due to metastatic calcification of the stomach. Renal accumulation without urinary radioactivity also indicated calcification in the kidneys. The findings were reproduced in a repeat bone scintigraphy. The gastric and renal uptakes of Tc-99m HMDP were obvious even in the first frame of dynamic data acquisition of 4 min/frame (Fig. 2). Tc-99m HMDP SPECT at 3 hr after the administration confirmed the gastric accumulation (Fig. 3). X-ray CT did not show any mass lesion or abnormal density of the stomach or kidney. Endoscopic examination revealed nothing except atrophic gastritis. Serum calcium ranged from 8.5 to 13.2 mg/dl (normal 8.0-10.0 mg/dl) and serum phosphate from 3.7 to 6.2 mg/dl (normal 2.0-5.0 mg/dl) in last few months, and were 13.2 mg/dl and 5.3 mg/dl, respectively, on a day preceding the scintigraphic studies. Alkaline phosphatase had increased to 314 IU/l (normal 70-250 IU/l). Although serum PTH was not examined just before the scintigraphic studies, it was within the normal range in an examination performed several months later.

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For reprint contact: Seigo Kinuya, M. D., Department of Nuclear Medicine, Kanazawa University School of Medicine, 13-1 Takara-machi, Kanazawa, Ishikawa 920, JAPAN.



Fig. 1 Tc-99m HMDP bone scintigraphy in a 67-year-old woman on continuous ambulatory peritoneal dialysis imaged at 3 hr after the administration. There is no finding of an abnormal bone turnover associated with renal osteodystrophy. Abnormal accumulation in the left upper abdomen without thyroidal or salivary uptake indicates metastatic calcification of the stomach. Renal accumulation without urinary radioactivity also indicates calcification in the kidney. Horseshoe kidney is seen. These findings were reproduced in a repeat study.

DISCUSSION

Detection of metastatic calcification with bone scintigraphy is not rare in patients with chronic renal disease on hemodialysis.³⁻⁵ Metastatic calcification is a calcium deposit caused by abnormal calcium and phosphate metabolism and it is generally believed that increased $\text{Ca} \times \text{P}$ product is related to the deposit.^{5,6} It is likely that calcification in the present case would also have resulted from hypercalcemia and hyperphosphatemia, but there was a report showing that serum calcium and phosphate concentrations and $\text{Ca} \times \text{P}$ product were not related to the presence of metastatic calcification.⁷

The stomach and kidneys as well as the lungs and heart are common sites of metastatic calcification.¹⁻⁶ Renal uptake of Tc-99m HMDP in our case was considered to delineate renal calcification because of the absence of radioactivity in the urinary bladder which would indicate no production of urine.⁵ Furthermore, renal visualization

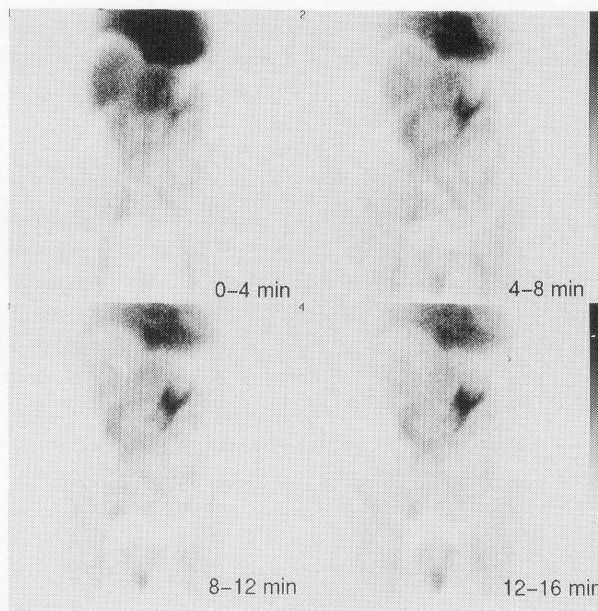


Fig. 2 The gastric and renal uptakes of Tc-99m HMDP are obvious even in the first frame of dynamic data acquisition of 4 min/frame in a repeat study.

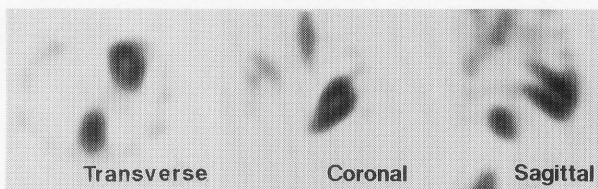


Fig. 3 SPECT at 3 hr postinjection confirmed the gastric accumulation.

in the repeat scintigraphy was obvious even in the dynamic acquisition. It is unlikely, in a patient on dialysis, that renal perfusion would be preserved to be seen in dynamic scintigraphy. The reason why we intended to obtain dynamic images was to eliminate the possibility of artificial gastric uptake of contaminated pertechnetate. Since pertechnetate accumulates in gastric mucosa soon after intravenous injection, we expected non-visualization of stomach in the dynamic phase. Contrary to our expectation, gastric accumulation as well as renal accumulation was noted already in the first frame of the dynamic study, but we are sure that the accumulations were caused by metastatic calcification, because the findings were reproduced and we did not find gastric uptake in a different patient injected with the same radiopharmaceutical preparation.

We could not confirm the anatomical presence of calcification as seen by others.^{2,4-6} Bone scintigraphy and anatomical radiographic images may have different roles

from each other in the assessment of metastatic calcification. Scintigraphy can be an indicator of a continuing process of the calcium deposit, and anatomical images can define inactive calcification that will be missed by scintigraphy.

Hwang et al. reported a case of primary hyperparathyroidism in which Tc-99m MDP uptakes in the lungs, liver, stomach and thyroid disappeared with the normalization of serum calcium and phosphorus levels one week after the removal of parathyroid adenoma.⁶ Such resolution of Tc-99m MDP uptake was also reported in a case of chronic renal failure after renal transplantation.⁴ These findings indicate that metastatic calcification, or a calcium deposit, is a dynamic process and the accumulation of a bone tracer may represent it. We think that Tc-99m HMDP accumulation in metastatic calcifications of our case may further indicate this dynamism. As shown in Fig. 2, the tracer accumulations were obvious even in the first frame of dynamic data acquisition when the majority of the tracer remained as blood pool activity. The faster accumulation into the metastatic calcification than into the normal skeleton would indicate that the process of calcification is quite harsh.

The results obtained in present case suggest that calcium deposits may create an aggressive process. We can know, with the accumulation of a bone tracer on a delayed bone scintigraphy, that the calcium deposit would be on an active process. Furthermore, we may obtain information on the calcium deposit rate with dynamic data acquisition. Factors determining the development of metastatic calcification are still unclear,⁷ and we hope that scintigraphy

will help us to better understand the mechanism of metastatic calcification.

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