Annals of Nuclear Medicine Vol. 17, No. 4, 333–336, 2003

Accumulation of ^{99m}Tc-PMT in renal metastasis of hepatocellular carcinoma

Toshiki SHIOZAKI,* Katsumi HAYAKAWA,* Masato TANIKAKE,* Tomoyuki OIDA,** Shuichi HIDA,** Hiroshi YASUI,*** Yoji URATA,*** Akira TANAKA**** and Taisuke MORIMOTO****

*Departments of *Radiology, **Urology, ***Pathology, and ****Surgery, Kyoto City Hospital*

We describe here a case in which ^{99m}Tc-Sn-*N*-pyridoxy-5-methyltryptophan (^{99m}Tc-PMT) scintigraphy was useful in diagnosing renal metastasis of hepatocellular carcinoma (HCC). A 62-year-old man who had undergone hepatectomy for HCC presented 6 years after initial diagnosis with left flank pain and was found on CT and MRI to have a tumor in the left kidney. Hepatobiliary scintigraphy using ^{99m}Tc-PMT was performed, and ^{99m}Tc-PMT accumulation was found in the tumor. Nephrectomy was performed and metastasis of HCC was confirmed.

Key words: ^{99m}Tc-PMT, hepatocellular carcinoma, renal metastasis

INTRODUCTION

HEPATOCELLULAR CARCINOMA (HCC) is one of the most lethal and prevalent cancers in the world. Because therapy for HCC has improved, the prognosis has improved and the rate of extrahepatic metastasis detection has increased.

Hasegawa et al. first reported that ^{99m}Tc-Sn-*N*-pyridoxy-5-methyltryptophan (^{99m}Tc-PMT) is useful for detecting the metastases of HCC.[1] Since then ^{99m}Tc-PMT has been used in the metastatic work-up for HCC in tissues such as bone,[2] lung,[3] colon,[4] hypopharynx,[5] and orbit.[6] To our knowledge, no report has described the accumulation of ^{99m}Tc-PMT in renal metastases of HCC on scintigraphy. We describe a case of renal metastasis from HCC in which ^{99m}Tc-PMT scintigraphy was useful for tissue characterization of the lesion.

CASE REPORT

A 56-year-old man developed a palpable tumor in the left upper abdomen in 1996. Computed tomography (CT) revealed a tumor in the left lobe of the liver. Antibody tests to hepatitis C virus and surface antigen of hepatitis B were negative. A left lobectomy of the liver was done, and the tumor was diagnosed histologically as Edmondson type II–III HCC. In 1998 and 1999, the patient underwent two partial lung lobectomies for HCC metastases.

In April 2002, when the patient was 62 years old, he developed left flank pain and underwent an abdominal CT that showed a left renal tumor (Fig. 1). On MRI, the tumor was hypointense compared with normal kidney tissue on contrast T1-weighted image (Fig. 2). ^{99m}Tc-dimercaptosuccinic acid scintigraphy revealed a space-occupying lesion in the left kidney as a cold area (Fig. 3).

Because the AFP level was elevated, renal metastasis of HCC was suspected and ^{99m}Tc-PMT scintigraphy was performed. Posterior abdominal images were obtained at 10, 20, 30, 40, and 50 min after intravenous injection of 185 MBq of ^{99m}Tc-PMT. ^{99m}Tc-PMT images showed an accumulation in the tumor (Fig. 4).

Left nephrectomy was performed. A nodule was detected in the cortex of the kidney. Renal medulla was invaded by the tumor (Fig. 5-A). The location of the tumor corresponded to that of the accumulation of ^{99m}Tc-PMT. Light microscopy of hematoxylin-and-eosin-stained sections demonstrated a metastatic HCC tumor, Edmondson type II–III (Fig. 5-B). The patient recovered uneventfully and was discharged 1 month later.

DISCUSSION

HCC is one of the most common and fatal malignancies in the world. Treatment methods for HCC have advanced and now include such procedures as transcatheter arterial embolization, percutaneous ethanol injection, and

Received December 2, 2002, revision accepted March 18, 2003.

For reprint contact: Toshiki Shiozaki, M.D., Ph.D., Department of Radiology, Kyoto City Hospital, 1–2, Higashitakadacho, Mibu, Nakagyo-ku, Kyoto 604–8845, JAPAN.

E-mail: shiozaki@kuhp.kyoto-u.ac.jp

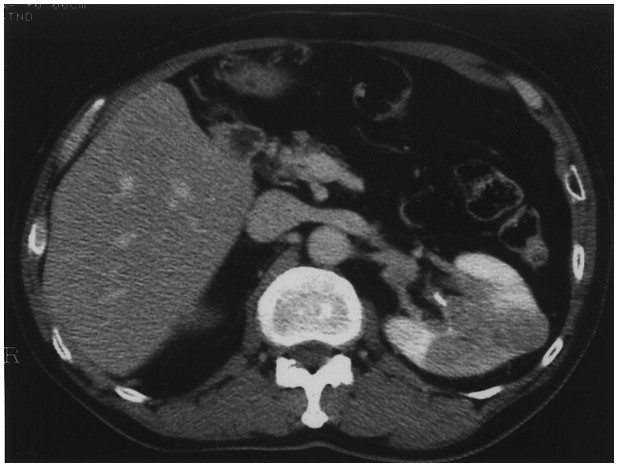


Fig. 1 Contrast-enhanced CT scan showed a tumor in the cortex and the medulla of the left kidney.

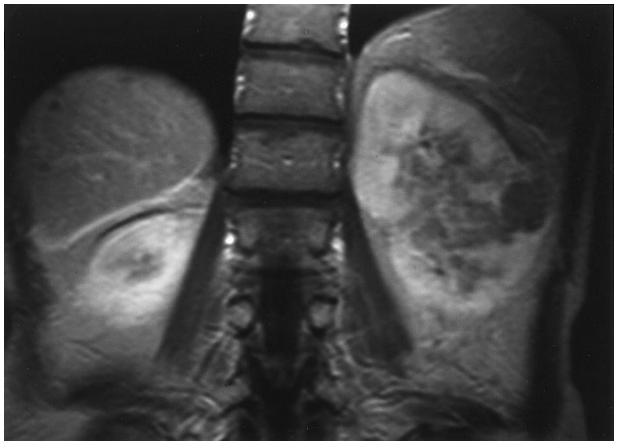


Fig. 2 Contrast-enhanced T1-weighted image showed a nodule in the cortex of the left kidney. The medulla of the left kidney was hypointense compared with normal kidney tissue.

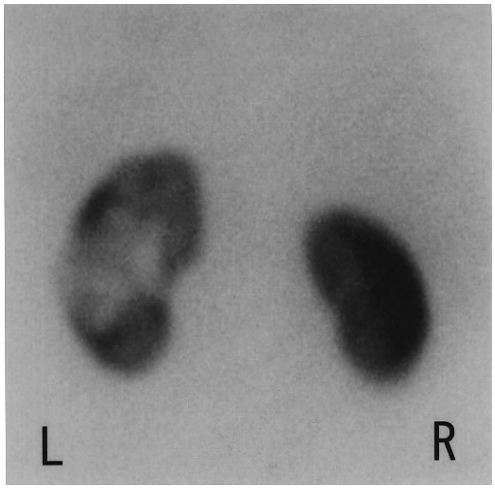


Fig. 3 ^{99m}Tc-dimercaptosuccinic acid scintigraphy from a posterior view. A space-occupying lesion in the left kidney was visualized as a cold area with ^{99m}Tc-dimercaptosuccinic acid.

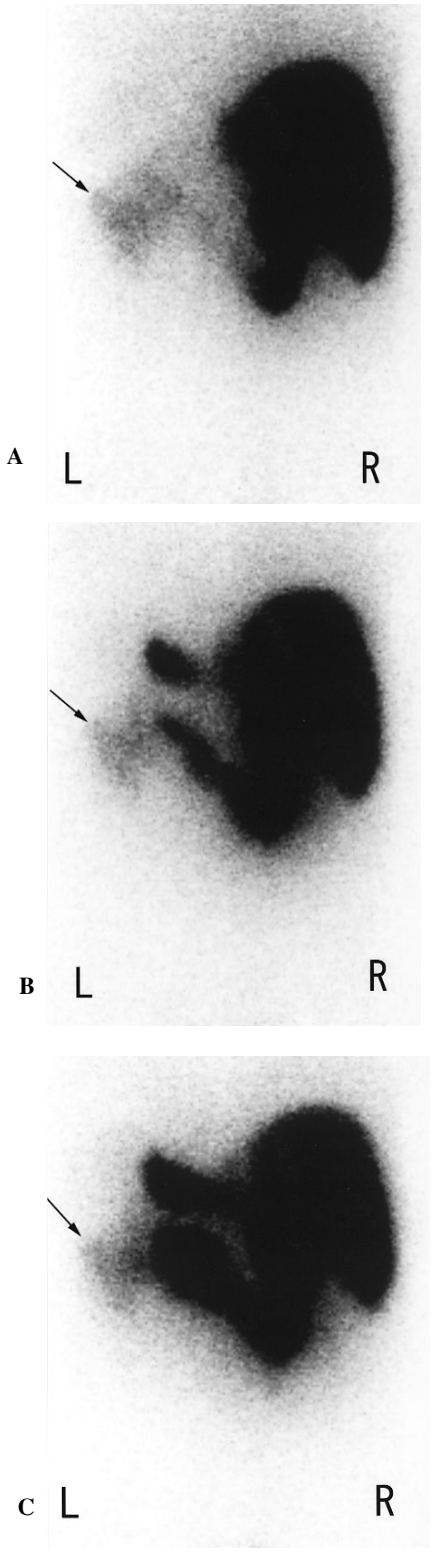
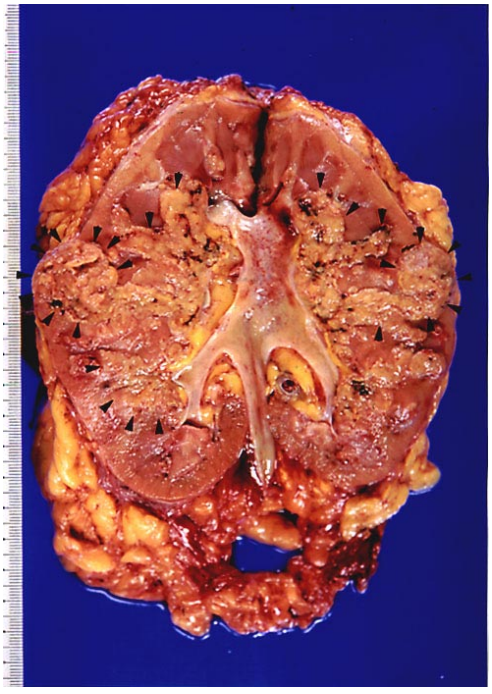
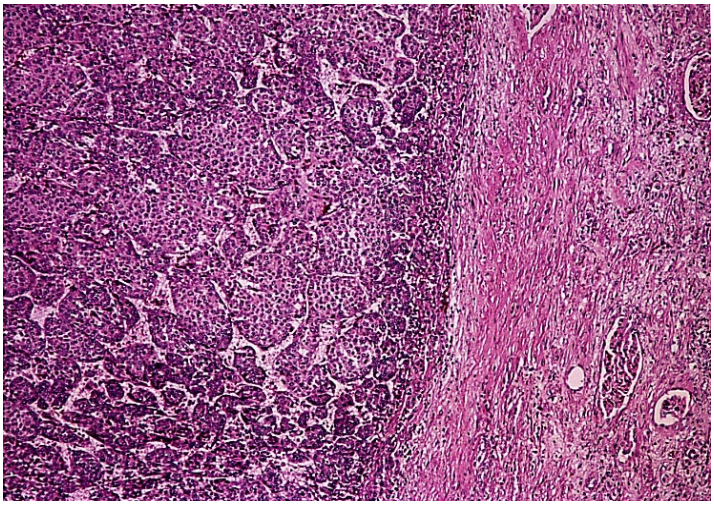


Fig. 4 ^{99m}Tc-PMT images from the posterior view at 10 (A), 20 (B), and 30 (C) min. A: ^{99m}Tc-PMT image from posterior view at 10 min shows slightly increased uptake at the known tumor in the left kidney (*arrow*). (The left lobe of the liver has been resected.) B, C: ^{99m}Tc-PMT image from posterior view at 20 and 30 min still shows a slightly increased uptake at the known tumor (*arrow*). The tracer excreted into the biliary system has flowed to the stomach and third portion of the duodenum.



A



B

Fig. 5 A: Photograph of cut surface of the resected left kidney. A nodule was detected in the cortex of the kidney. Renal medulla was invaded by the tumor (*arrowheads*). The location and the shape of the tumor corresponded to those of the accumulation of ^{99m}Tc-PMT. The location and the shape of the tumor agreed with that of ^{99m}Tc-PMT images. B: Microphotograph of resected kidney showing neoplastic growth of hepatocyte-like polygonal epithelial cells with thick trabecular structure, separated by sinusoid-like thin vascular stroma. These histopathological features are compatible with those of hepatocellular carcinoma. (Hematoxylin-and-eosin-stained, 40 ×)

percutaneous radiofrequency tumor ablation. Because therapy for HCC has improved, the prognosis has improved and the rate of detection of extrahepatic metastases has increased. Early initiation of therapy after early detection is crucial to maintaining patients' quality of life.

Hepatobiliary scanning agents such as ^{99m}Tc-PMT accumulate in the liver and are excreted into the biliary system. Some cells of HCC retain the capability to incorporate these agents in a way similar to that of normal hepatocytes. Accumulation of these agents in various metastatic lesions has been reported.[1–6]

In our patient, we could not exclude primary tumors such as renal cell carcinoma or transitional cell carcinoma before ^{99m}Tc-PMT scintigraphy was done. This is because renal metastasis of HCC is often not found until autopsy, and it is rare for this diagnosis to be confirmed while a patient still alive. In a search of the literature we found only 5 cases in which renal metastasis of HCC was diagnosed in living patients.[7–11] In Japan, at autopsy the incidence of renal metastasis in patients with HCC has been estimated at 3.8%.[12] To our knowledge, this is the first report of the usefulness of ^{99m}Tc-PMT in the diagnosis of renal metastasis of HCC.

Hasegawa et al. reported that the uptake of ^{99m}Tc-PMT is significantly correlated with the degree of histologic differentiation[13] and with the prognosis of patients with HCC.[14] In their study, the probability of HCC showing increased uptake of ^{99m}Tc-PMT was 105 times higher in patients with Edmondson type I tumors than in those with Edmondson type III. In our patient, the degree of ^{99m}Tc-PMT uptake in the tumor was faint. This may be consistent with Hasegawa's results.

The limitations of the report include difficulty in distinguishing the accumulation of ^{99m}Tc-PMT in the tumor from the urinary excretion of ^{99m}Tc-PMT. It was reported that the urinary excretion of ^{99m}Tc-PMT was low,[15] with only 2% of the dose escaping through the kidneys at 2 hr after injection.[16] In our patient, the accumulation of ^{99m}Tc-PMT corresponded to the location of the tumor in the resected kidney; hence we believe that the accumulation was due to a renal metastasis of HCC (Figs. 4, 5).

We suggest that ^{99m}Tc-PMT is useful for tissue characterization of lesions that are thought to be renal metastases of HCC.

REFERENCES

1. Hasegawa Y, Nakano S, Ibuka K, Hashizume T, Sasaki Y, Imaoka S, et al. Concentration of ^{99m}Tc-Sn-*N*-pyridoxyl-5-methyltryptophan, a biliary agent, in distant metastases of hepatomas. *Eur J Nucl Med* 1985; 10: 255–258.
2. Calvet X, Pons F, Bruix J, Bru C, Lomena F, Herranz R, et al. Uptake of technetium-99m DISIDA uptake by bone metastasis from a hepatoma. *Clin Nucl Med* 1988; 13: 280.
3. Archibeque F, Williamson MR, Rosenberg R, Eisenberg B, Davis M, et al. Hepatoma: Tc-99m DISIDA uptake in primary and metastatic lesions. *Clin Nucl Med* 1989; 14: 706.

4. Fukui H, Kashiwagi T, Shirai Y, Matsuda Y, Kawata S, Nishimura T, et al. Metastasis of Hepatocellular Carcinoma to the Colon Demonstrated by Tc-99m PMT Scintigraphy. *Clin Nucl Med* 1993; 18: 512–515.
5. Hayase N, Fukumoto M, Yoshida D, Kariya S, Akagi N, Kurohara A, et al. Extraosseous metastases of hepatocellular carcinoma detection and therapeutic assessment with Tc-99m PMT SPECT. *Clin Nucl Med* 1999; 24: 326–329.
6. Hosokawa C, Kawabe J, Okamura T, Kamino T, Ikeda H, Ochi H, et al. Usefulness of Tc-99m-PMT SPECT and F-18-FDG in diagnosing Orbital Metastasis of Hepatocellular Carcinoma. *KAKU IGAKU (Jpn J Nucl Med)* 1994; 31: 1237–1242.
7. Yoshida H, Tsuji K, Sakurai Y, Katanuma A, Jong-Hon K, Hayashi T, et al. A case of hepatocellular carcinoma with renal metastasis 1 year and 3 months after hepatectomy. *Nippon Shokakibyo Gakkai Zasshi* 2001; 98: 1283–1288.
8. Mezawa S, Homma H, Doi T, Takada K, Kukitsu T, Kinebuchi M, et al. Re: Spontaneous rupture of renal metastasis of hepatocellular carcinoma: management by emergency transcatheter arterial embolization. *Cardiovasc Intervent Radiol* 2001; 24: 143–144.
9. Fukushima M, Isoyama E, Sakaridani N, Sanematsu H, Kadowaki H, Hirakawa S, et al. Renal metastasis originated from liver cancer. *Nippon Hinyokika Gakkai Zasshi* 1996; 87: 710–713.
10. Hsu YB, Lee PH, Sheu JC, Chen DS, Hsu HC. Hepatocellular carcinoma with metastasis to the kidney: report of a case. *J Formos Med Assoc* 1994; 93: 713–714.
11. Ohkuma S, Ogasawara T, Kawamura H, Kashima K, Takahashi T, Takino T, et al. Right renal metastasis in a patient with hepatocellular carcinoma. *Nippon Shokakibyo Gakkai Zasshi* 1978; 75: 746–751.
12. Yuki K, Hirohashi S, Sakamoto M, Kanai T, Shimosato Y. Growth and spread of hepatocellular carcinoma. A review of 240 consecutive autopsy cases. *Cancer* 1990; 66: 2174–2149.
13. Hasegawa Y, Nakano S, Sobue T, Fujita M, Ishiguro S, Sasaki Y, et al. Analysis of factors affecting uptake of Tc-99m Sn-*N*-pyridoxyl-5-methyl tryptophan by hepatocellular carcinoma. *Ann Nucl Med* 1994; 8: 139–145.
14. Hasegawa Y, Nakano S, Hiyama T, Sobue T, Yoshida Y, Sasaki Y, et al. Relationship of Uptake of Technetium-99m(Sn)-*N*-Pyridoxyl-5-Methyltryptophan by Hepatocellular Carcinoma to Prognosis. *J Nucl Med* 1991; 32: 228–235.
15. Watanabe Y, Sugimoto S, Kobori K, Katsuyama N, Zeniya M, Kawakami K. Studies on the Clinical Usefulness of ^{99m}Tc-*N*- Pyridoxyl-5-Methyltryptophan as a Hepatobiliary Agent. *KAKU IGAKU (Jpn J Nucl Med)* 1982; 19: 1589–1593.
16. Kato-Azuma M. Tc-99m(Sn)-*N*-Pyridoxylaminates: A New Series of Hepatobiliary Imaging Agents. *J Nucl Med* 1982; 23: 517–524.