Annals of Nuclear Medicine Vol. 9, No. 2, 101–104, 1995

Scintigraphic detection of recurrence of medullary thyroid cancer

Mitsuru KOIZUMI,* Yasuhiko YAMADA,* Etsuji NOMURA,* Maki AMANO,** Yuji OKAJIMA,** Hiromi OKIZUKA,** Keiko YAMADA,** Seishi SAWANO,** Takashi KITAHARA,** Takashi YAMASHITA,** Minoru NAKANE*** and Toshio ISHIKAWA***

*Departments of *Nuclear Medicine, **Radiology and ***Internal Medicine, Cancer Institute Hospital*

A case of recurrent medullary thyroid cancer (MTC) was evaluated with ^{123}I-MIBG, ^{99m}Tc(V)-dimercaptosuccinic acid (DMSA), and ^{201}Tl scintigraphy. This patient had been operated on for MTC in the right thyroid. Recently a left neck mass was noticed, and was suspected of being a recurrence of MTC based on increased plasma calcitonin (CT) and carcinoembryonic antigen (CEA). He was operated on for the neck mass which revealed MTC, and papillary thyroid cancer was incidentally found in the left thyroid, but the CT and CEA levels remained high, and remaining MTC tumor was suspected. But the location of the tumor was unknown. Although ^{99m}Tc(V)-DMSA scintigraphy is generally believed to be superior in sensitivity to ^{123}I-MIBG scintigraphy, it did not demonstrate the tumor site but ^{201}Tl and ^{123}I-MIBG did. Furthermore, ^{123}I-MIBG scintigraphy has greater specificity for tumors which arise in the neural crest. Judging from the results of this case and cases reported in the literatures, both ^{123}I-MIBG and ^{99m}Tc(V)-DMSA should be performed in the detection of recurrent MTC.

Key words: medullary thyroid cancer (MTC), ^{123}I-MIBG, ^{99m}Tc(V)-DMSA, ^{201}Tl

INTRODUCTION

MEDULLARY THYROID CANCER (MTC) originates in the parafollicular cells or C cells of the thyroid. At least 10% of MTC cases are familial, usually appearing as a component of multiple endocrine neoplasia II. MTC may present as a thyroidal mass or be clinically silent and unpalpable. The diagnosis is usually established by increased serum levels of calcitonin (CT) and/or carcinoembryonic antigen (CEA).[1]

It is often difficult to delineate the boundaries of recurrent MTC. Several scintigraphic methods have been proposed as markers of MTC. Thallium-201 (^{201}Tl),[2–5] $^{123/131}$I-meta-iodobenzyl-guanidine (MIBG)[6–9] and ^{99m}Tc(V)-dimercaptosuccinic acid (DMSA)[10–13] were reported to accumulate in MTC, and ^{99m}Tc(V)-DMSA was reported to have higher sensitivity for MTC than MIBG.[7–9] In this paper, we describe a patient with recurrent MTC whose recurrent tumor was studied with ^{201}Tl, ^{123}I-MIBG and ^{99m}Tc(V)-DMSA scintigraphy. ^{201}Tl and ^{123}I-MIBG showed positive results and ^{99m}Tc(V)-DMSA did not accumulated in the recurrent MTC tumor.

Received November 28, 1994, revision accepted February 13, 1995.

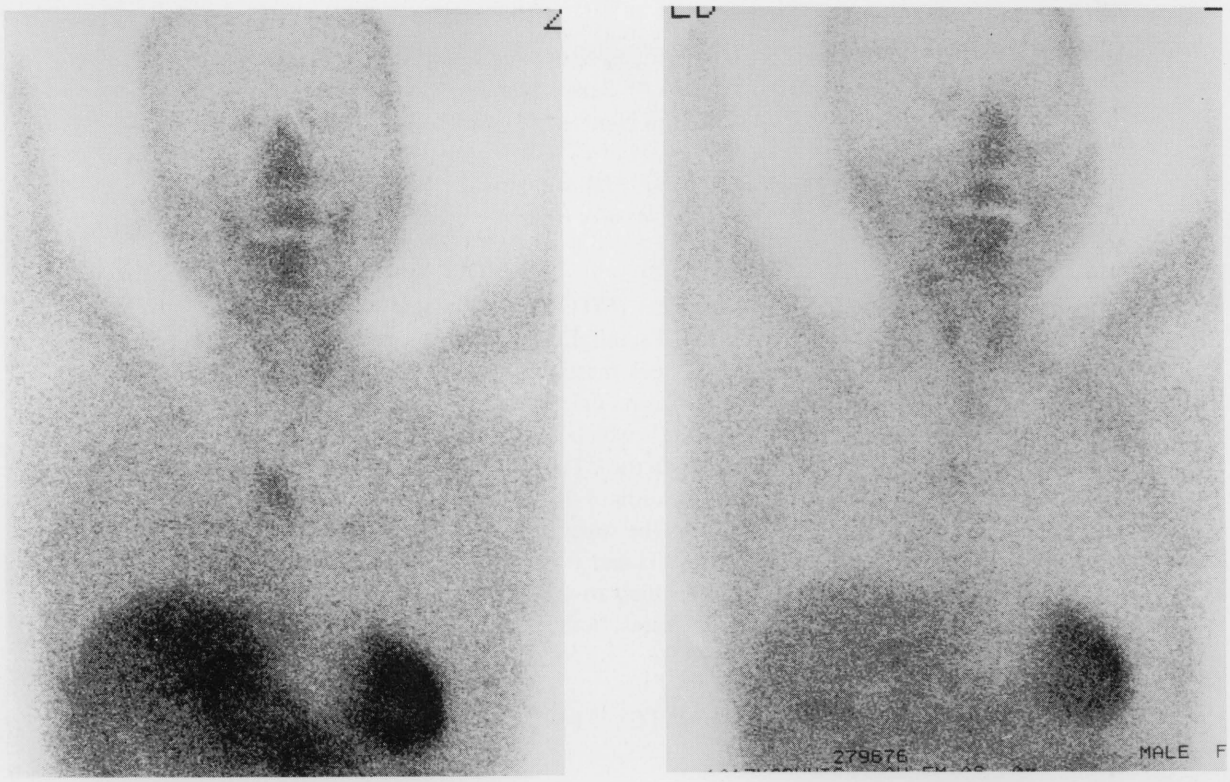
For reprint contact: Mitsuru Koizumi, M.D., Department of Nuclear Medicine, Cancer Institute Hospital, 1–37–1, Kami-Ikebukuro, Toshima-ku, Tokyo 170, JAPAN.

CASE REPORT

A 62-year-old man who had been operated on for MTC of the right thyroid lobe 22 years ago noticed a left neck mass and was admitted to our hospital. Increased CT (16,000 pg/d*l*) and CEA (397 ng/d*l*) levels indicated the recurrence of MTC and the left thyroid and left cervical lymph nodes were resected. Histological examination of the resected tissue revealed an MTC recurrent mass and primary papillary thyroid cancer. Serum CT and CEA levels remained high after the operation (Table 1) and a remaining MTC was suspected. A ^{201}Tl scan showed positive accumulation in the mediastinum at the early scan and rapid clearance of activity at the delayed scan (Fig. 1). A ^{123}I-MIBG scan was also performed which showed a positive image in the mediastinum (Fig. 2). The uptake of ^{123}I-MIBG in the right submandibular gland was higher than that in the left, and the patient had sympathetic nerve dysfunction in the left half of the face after left thyroidectomy and lymph node dissection. The difference in ^{123}I-MIBG uptake in the salivary glands should be due to the impairment of sympathetic function

Table 1 Calcitonin and CEA

1994	1/19	1/31 2/1 (ope)	2/16	3/7	5/16	6/24	8/4
Calcitonin (pg/m*l*)	16,000	12,000	16,000	19,000	19,000	14,000	18,000
CEA (ng/m*l*)	397		400	396	398	416	436



early scan delayed scan

Fig. 1 ^{201}Tl scintigrams taken at early (taken at 20 minutes) and delayed (3 hours) phase were shown. Definite uptake was noted in the mediastinum at the early scan, and this uptake faded at the delayed scan.

on the left side of the face.[14] No abnormal mass was detectable in the right neck region. But, ^{99m}Tc(V)-DMSA prepared by the method of Hirano et al.[13] showed no abnormal uptake (Fig. 3). Computed tomography of the chest done with the scintigraphic information showed an abnormal mass adjacent to the superior vena cava (Fig. 4). In this way, the diagnosis and location of recurrent MTC was established.

DISCUSSION

The diagnosis of MTC is usually established on the basis of the serum levels of CT and/or CEA.[1] Ultrasonography (US) is used to detect intrathyroidal and neck masses. US findings of MTC are characteristic but the features are nonspecific, and US cannot be used for systemic survey.[15,16] Computed tomography and magnetic resonance imaging play a role in the evaluation of thyroid tumors, but these methods are also difficult to use in systemic surveys.

Several scintigraphic methods have been used both for primary and recurrent MTC. ^{123}I or $^{99m}TcO_4^-$ scintigraphy is the most common thyroidal study method. MTC usually appears as a defect in the thyroid with these radionuclides, and they are not used to detect recurrent MTC. ^{201}Tl accumulation in recurrent MTC has been reported.[2–5] In our case, ^{201}Tl uptake at the early scan and rapid clearance were noted. We also previously reported this pattern of ^{201}Tl uptake in a case of primary MTC.[5] But, ^{201}Tl accumulation is also seen in other types of thyroid cancer. Because our patient had both MTC and papillary thyroid cancer, it was difficult to make a differential diagnosis scintigraphically.

^{123}I-MIBG accumulation was reported in MTC,[6] but a review of the literature showed that MIBG accumulation in sporadic cases of MTC was not high, indicating a preponderance of familial MTC cases.[7–9] MIBG scan was not sufficiently sensitive to detect MTC, and MIBG has proven to be of value in the management of MIBG-positive MTC patients. ^{99m}Tc(V)-DMSA was developed

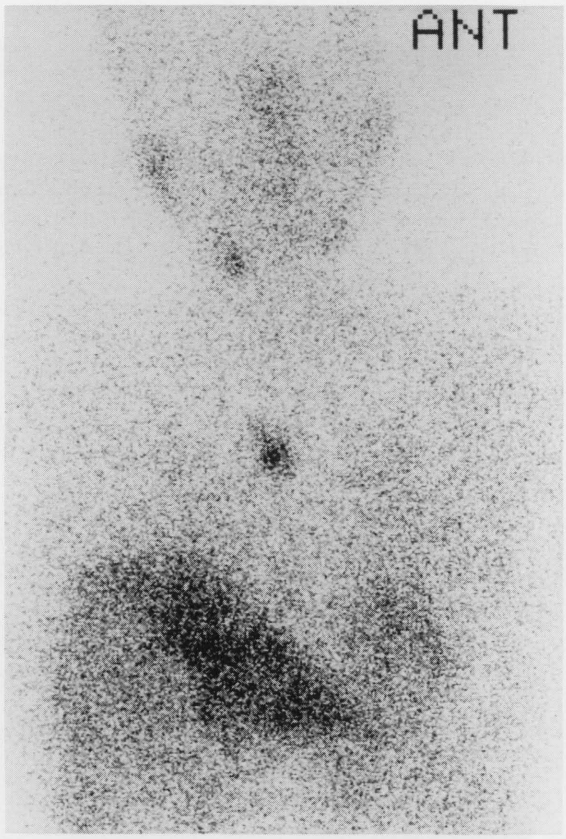


Fig. 2 ^{123}I-MIBG scintigram taken at 24 hours post injection showed an accumulation in the mediastinum and right salivary gland.

Fig. 3 ^{99m}Tc(V)-DMSA scintigram taken at 2 hours after injection showed no accumulation in the mediastinum.

by Yokoyama et al.,[17] and has been reported to be useful in detecting MTC.[10] Several reports agreed that DMSA had high sensitivity for detecting both primary and recurrent MTC.[11–13] Some authors compared the sensitivity of MIBG and DMSA in MTC, and concluded that DMSA was more sensitive than MIBG.[7–9] But, our case showed positive MIBG and negative DMSA scans. Even though DMSA scans are more sensitive for MTC than MIBG, both methods may be complementary in the detection of recurrent MTC.

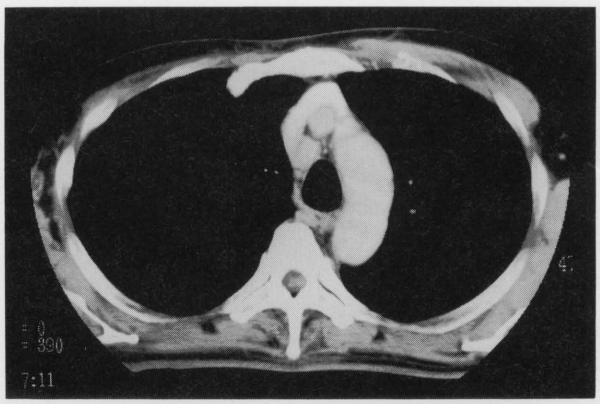


Fig. 4 Computed tomography of the chest taken with the scintigraphic information demonstrated a mass (arrow) measuring 15 mm in diameter adjacent to the superior vena cava.

REFERENCES

1. Busnardo B, Girelli ME, Simioni N, Nacamulli D, Busnardo E. Nonparallel patterns of calcitonin and carcinoembryonic antigen levels in the follow-up of medullary thyroid carcinoma. *Cancer* 53: 278–285, 1984.
2. Parathasarathy KL, Shimaoka K, Bakshi SP, Razack MS. Radiotracer uptake in medullary carcinoma of the thyroid. *Clin Nucl Med* 5: 45–48, 1980.
3. Arnstein NB, Juni JE, Sisson JC, Lloyd RV, Thompson NW. Recurrent medullary thyroid carcinoma of the thyroid demonstrated by thallium-201 scintigraphy. *J Nucl Med* 27: 1564–1568, 1986.
4. Hoefnagel CA, Delprat CC, Marcuse HR, de Vijlder JJM. Role of thallium-201 total body scintigraphy in follow-up of thyroid carcinoma. *J Nucl Med* 27: 1854–1857, 1986.
5. Koizumi M, Watari T, Hirabayashi K. Accumulation of thallium-201 in medullary thyroid cancer with negative serum calcitonin and carcinoembryonic antigens: A case report. *Ann Nucl Med* 7: 53–56, 1993.
6. Endo K, Shiomi K, Kasagi K, Konishi J, Torizuka K, Nakao K, et al. Imaging of medullary thyroid cancer with ^{131}I-MIBG. *Lancet* ii: 233, 1984.
7. Guerra UP, Pizzocaro C, Terzi A, Giubbini R, Maria G, Pagliani R, et al. New tracer for the imaging of the medul-

lary thyroid cancer. *Nucl Med Commun* 10: 285–295, 1989.
8. Clarke SE, Lazarus CR, Wraight P, Sampson C, Maisey MN. Pentavalent [^{99m}Tc] DMSA, [^{131}I] MIBG, and [^{99m}Tc] MDP—an evaluation of three imaging techniques in patients with medullary carcinoma of the thyroid. *J Nucl Med* 29: 33–38, 1988.
9. Baulieu JL, Guilloteau D, Delisle MJ, Perdisot R, Gardet P, Delepine N, et al. Radioiodinated meta-iodobenzylguanidine uptake in medullary thyroid cancer. *Cancer* 60: 2189–2194, 1987.
10. Ohta H, Yamamoto K, Endo K, Mori T, Hamanaka D, Shimazu A, et al. A new imaging agent for medullary cell carcinoma of the thyroid. *J Nucl Med* 25: 323–325, 1984.
11. Mojiminiyi OA, Udelsman R, Soper ND, Shepstone BJ, Dudley NE. Pentavalent Tc-99m DMSA scintigraphy. Prospective evaluation of its role in the management of patients with medullary carcinoma of the thyroid. *Clin Nucl Med* 16: 259–262, 1991.
12. Patel MC, Patel RB, Ramanathan P, Ramamoorthy N, Kristina BA. Clinical evaluation of ^{99m}Tc(V)-dimercapto succinic acid (DMSA) for imaging medullary carcinoma of thyroid and its metastasis. *Eur J Nucl Med* 13: 507–510, 1988.
13. Hirano T, Tomiyoshi K, Zhang YJ, Ishida T, Inoue T, Endo K. Preparation and clinical evaluation of technetium-99m dimercaptosuccinic acid for tumor scintigraphy. *Eur J Nucl Med* 21: 82–85, 1994.
14. Sandler ED, Hattner RS, Paris M. Asymmetry of salivary gland I^{123} metaiodobenzylguanidine (MIBG) uptake in a patient with cervical neuroblastoma and Horner's syndrome—a possible etiologic mechanisms. *Pediatr Radiol* 22: 225–226, 1992.
15. Gorman B, Charboneau JW, James EM. Medullary thyroid carcinoma: role of high-resolution US. *Radiology* 162: 147–150, 1987.
16. Simeone JF, Daniels GH, Hall DA, McCarthy K, Kopans DB, Butch RJ, et al. Sonography in the follow-up of 100 patients with thyroid carcinoma. *Am J Roentgenol* 148: 45–49, 1987.
17. Yokoyama A, Hata N, Horiuchi K, Masuda H, Saji H, Ohta H, et al. The design of pentavalent ^{99m}Tc-dimercaptosuccinate complex as a tumor imaging agent. *Int J Nucl Med Biol* 12: 273–279, 1985.