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Technetium-99m-Tetrofosmin Whole-Body Scintigraphy in the Follow-up of Differentiated Thyroid Carcinoma

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The purpose of this study was to evaluate prospectively the reliability of the new nonspecific tumor-searching tracer tetrofosmin in the postoperative follow-up of differentiated thyroid carcinoma (DTC) during TSH suppressive thyroid hormone treatment. **Methods:** Whole-body scintigraphy was performed in 114 patients under TSH suppressive L-T4 treatment 20 min after intravenous injection of 370 MBq ^{99m}Tc-tetrofosmin by means of a dual-head gamma camera followed by three-dimensional SPECT in case of suspicious tracer uptake. The results of serum thyroglobulin, ultrasonography of the neck, ^{131}I whole-body scintigraphy, chest radiograph, transmission CT or MRI, and bone scintigraphy were also available. **Results:** A group of 68 patients without thyroid remnants who were tumor free and had no history of metastases or tumor recurrence showed a negative ^{99m}Tc-tetrofosmin whole-body scan. Another 24 patients (papillary carcinoma pT1N0M0) were also in complete remission, but had sonographically proven remnants (echonormal). Sixteen of them (67%) exhibited ^{99m}Tc-tetrofosmin accumulation in the thyroid bed, which corresponded excellently to the localization of the remnant. The third group comprises seven cases of local recurrence confirmed by histopathology after reoperation or by cytology after fine-needle aspiration where tetrofosmin scintigraphy clearly revealed relapse of malignancy in all cases. A total of 17 patients had distant metastases (11 pulmonary, 3 bone, 2 bone and pulmonary, 1 bone and soft tissue) discovered by different modalities, resulting in 44 lesions to be evaluated. Of the 23 radioiodine negative metastases, 17 were detected by tetrofosmin (74%), whereas all 21 radioiodine accumulating lesions also showed tetrofosmin positive scans. The overall sensitivity of ^{99m}Tc-tetrofosmin in detecting distant metastatic lesions was 86%. Four additional cases with radioiodine-negative disseminated lung metastases showed diffuse pulmonary tetrofosmin uptake. **Conclusion:** Technetium-99m-tetrofosmin is a promising tracer to detect malignant recurrence and distant metastases in the follow-up of DTC without the necessity of thyroid hormone withdrawal.

Key Words: technetium-99m-tetrofosmin; whole-body scintigraphy; differentiated thyroid carcinoma

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In the follow-up of differentiated thyroid carcinoma (DTC), ^{131}I whole-body scintigraphy and the measurement of thyroglobulin (Tg) have been well-established methods for many years. The value of nonspecific tumor searching radionuclides such as ^{201}Tl or tracers such as ^{99m}Tc-sestamibi is a controversial point in the literature. For ^{201}Tl, several authors found sensitivities ranging from 45% to 94% (*1–5*); similar sensitivities ranging from 43% to 93% are given for ^{99m}Tc-sestamibi (*6–10*).

When the new cationic complex tetrofosmin [1,2-bis-(bis[-2-ethoxyethyl) phosphino]ethane] was introduced, which had been primarily developed for myocardial perfusion scintigraphy, we decided to investigate whether this tracer was suitable as a tumor-searching agent. The most likely mechanism for cellular uptake is diffusion of the lipophilic cation across the sarcolemmal and mitochondrial membranes in response to electrical potential (*11*). Initial preliminary in vitro uptake studies in tumor cell lines were performed by Wolf et al. (*12*). Just like ^{99m}Tc-sestamibi, it is still not known how cellular tumor uptake and intracellular binding mechanisms work for ^{99m}Tc- tetrofosmin. However, several preliminary clinical studies have shown that ^{99m}Tc-tetrofosmin accumulates in viable tumor tissue, including thyroid, breast and lung cancer (*13–19*).

Encouraged by a patient with extremely elevated Tg (32.720 ng/ml) but a negative post-therapeutic ^{131}I whole-body scan, whose ^{99m}Tc-tetrofosmin whole-body scan showed multiple pulmonary and bone metastases with excellent image quality, we started a prospective study in 1994 using ^{99m}Tc-tetrofosmin whole-body scans in the follow-up of our DTC patients.

MATERIALS AND METHODS

From November 1994 to November 1995, 114 consecutive patients (87 women; age 24–82 yr; mean 53 yr; 27 men; age 34–86 yr; mean 56 yr) were investigated with ^{99m}Tc-tetrofosmin whole-body scintigraphy while under TSH suppressive thyroid hormone treatment in the follow-up of DTC. With the exception of papillary carcinoma pT1N0M0 (lobectomy or subtotal thyroidectomy without radioiodine ablation), all patients underwent total thyroidectomy followed by radioiodine ablation of the remnant with 2960-3700 MBq ^{131}I.

Histology revealed papillary carcinoma in 73 patients (64%) and

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TABLE 1
Histological Classification of Primary Tumor in 114 Patients with DTC

	pT1	pT2	pT3	pT4	pTx
Pap	24	16	4	16	6
Pap oxy	–	1	2	4	–
Foll	1	9	12	11	–
Foll oxy	–	2	1	5	–

Pap = papillary; pap oxy = papillary oxyphilic variant; foll = follicular; foll oxy = follicular oxyphilic variant.

follicular carcinoma in 41 patients (36%). The histological classification is shown in Table 1.

Technetium-99m-tetrofosmin whole-body scan was performed 20 min after intravenous injection of 370 MBq ^{99m}Tc-tetrofosmin using a dual-head, high-resolution gamma camera with LEHR collimator. Because of the rapid bilary excretion of tetrofosmin, early abdominal images were done as soon as 5 min postinjection. When there were doubtful planar images, SPECT was performed of the suspicious region followed by three-dimensional reconstruction. All scans were independently reviewed by two nuclear medicine physicians from our department. In vitro quality control of the freshly prepared tetrofosmin tracer using paper chromatography revealed labeling efficiency of 97.2% ± 1.35%.

Follow-up also included a clinical examination, ultrasonography of the neck, a chest radiograph, determination of free T4, total T3, basal TSH and thyroglobulin in the serum as well as urinary iodine excretion. All Tg levels reported were measured under L-T4 treatment of the patients. Thyroglobulin was measured by an immunoradiometric coated tube assay with a functional assay sensitivity (20% between assay c.v.) of 0.5 ng Tg/ml. Thyroglobulin recovery was considered normal between 70% and 130%. The results of ^{99m}Tc-tetrofosmin whole-body scan were compared to those of Tg measurement, ultrasonography of the neck, TCT or MRI, bone scan and, in case of elevated Tg and/or pathologic ^{99m}Tc-tetrofosmin whole-body scan, ^{131}I whole-body scan (185 MBq ^{131}I, whole-body scan 48/72 hr and/or 3700–7400 MBq ^{131}I, whole-body scan 7 days after administering ^{131}I) 3 wk after withdrawing thyroid hormones (bTSH > 30 mU/l; I/g Kr < 100 μg).

Four groups were defined based on all previous and current surgical and follow-up data:

Group 1. Tumor free patients, no history of metastases or tumor recurrence, no remnants (n = 68).

Group 2. Patients with papillary thyroid carcinoma pT1N0M0 who only underwent lobectomy or subtotal thyroidectomy (no radioiodine ablation of the remnant) and therefore had sonographically proven remnants (n = 24); none had a history of tumor recurrence or metastases.

Group 3. Patients who developed local tumor recurrence after a tumor-free interval (negative Tg level, negative ultrasonography of the neck, negative ^{131}I whole-body scan); however, none of them had benign thyroid remnants (n = 7).

Group 4. Patients with distant metastases, no remnants (n = 17).

RESULTS

Group 1

This group of 68 patients had no remnants. During the follow-up period (range 6–120 mo, median 36 mo), their ^{131}I whole-body scan (postablation dose and later on for diagnostic purposes) neither showed any thyroidal or pathological extrathyroidal uptake nor were metastases or tumor recurrence clinically evident or detected by other methods. Ultrasonography of the neck did not disclose any suspicious abnormalities and chest radiographs were always normal. Their serum Tg remained undetectable even under thyroid hormone withdrawal. In all of these cases representing complete remission, ^{99m}Tc-tetrofosmin whole-body scan showed no thyroidal or pathological extrathyroidal uptake.

TABLE 2
Technetium-99m-Tetrofosmin Whole-Body Scintigraphy, Ultrasonography, Thyroglobulin Levels and Histological Classification of Patients with Local Recurrent Disease

Patient no.	US	Tetro	Histo-P	Tg	Histo-R
1	pos (0.7 cm)	pos left	pap pT3	7, 4	MR
2	pos (1.5 cm)	pos right	pap pT3	34	MR
3	pos (2.5 cm)	pos right	foll oxy pT4	39	MR
4	pos (2.0 cm)	pos left	foll pT3	156	MR
5	pos (2.6 cm)	pos right	foll oxy pT4	61	MR*
6	pos (6.0 cm)	pos right	foll pT4	714	MR*
7	pos (6.5 cm)	pos right	foll pT4	223	MR

*Additional distant metastases (local recurrence confirmed by cytology).
Histo-P = primary histology; Histo-R (Cyto-R) = histology or cytology of recurrent disease; MR = malignant recurrence; pap = papillary; folloxy = follicular oxyphilic variant.

Group 2

A second group of patients (n = 24) were initially treated only by subtotal thyroidectomy or lobectomy. All of them had papillary carcinoma pT1N0M0 with ultrasonographically detectable echonormal remnants ranging longitudinally from 0.5–4.0 cm postsurgery. No history of metastases or tumor recurrence were evident (observation period 6–60 mo, median 24 mo). These patients were also considered to be currently in a complete remission, but the ^{99m}Tc-tetrofosmin whole-body scan was negative in eight patients only, whereas the remaining 16 patients exhibited more or less clear uptake in the thyroid bed with extremely good spatial correspondence to the location of the remnants.

Group 3

A third group of patients (n = 7) stood out because of their Tg positive values given in Table 2. Ultrasonography revealed hypoechogenic lesions from 0.7 cm up to 6.5 cm. Technetium-99m-tetrofosmin whole-body scan showed clear uptake in all local lesions (Fig. 1). It is worth pointing out that in two of these patients, additional distant metastases were located by tetrofosmin (Fig. 2). In the five patients without distant metastases, surgery and histology definitely confirmed the presence of malignant local recurrence. Six weeks after tumor resection, the serum Tg decreased to values below 0.5 ng/ml, indicating negative Tg. Repeat ^{99m}Tc-tetrofosmin scans were also negative. In the two patients with additional distant metastases, local tumor relapse was confirmed by cytopathology after fine-needle aspiration.

Group 4

Seventeen patients had distant metastases (Tables 3 and 4), including two already mentioned in Group 3. Except for one patient with Hürthle cell carcinoma (papillary oxyphilic subtype pT3; Tg < 0.5 ng/ml), all patients in this group had serum Tg levels above 10 ng/ml (19-93079 ng/ml). Four patients, in whom TCT/MRI had detected multiple small metastases in the

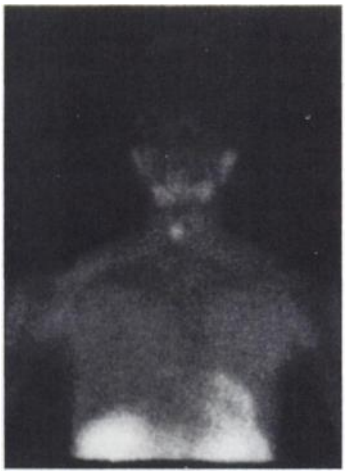

FIGURE 1. Anterior projection of the neck and chest supplies evidence of malignant recurrence on the right cervical region due to pathological ^{99m}Tc-tetrofosmin uptake. This malignant recurrence was confirmed by surgery and histology.

lung, showed no radioiodine uptake even after a therapeutic dose of 7400 MBq ^{131}I.

Pulmonary ^{99m}Tc-tetrofosmin uptake was, however, rather diffuse, making lesion-by-lesion evaluation impossible (Patients 1–4 in Table 3, Fig. 3).

In the remaining five patients (Patients 5–9 in Table 3), the diagnostic and post-therapeutic ^{131}I whole-body scans were also negative. TCT/MRI and bone scans, however, identified a total of 17 lesions. Of these 17 radioiodine-negative metastases, 11 were clearly positive on the ^{99m}Tc-tetrofosmin whole-body scan and two were newly detected in the soft tissue and were confirmed by surgery.

Another six patients (Patients 10–15 in Table 4) had a total of 14 lesions, most of them in the lung. These were confirmed by TCT/MRI and bone scan results. All lesions were clearly detected on the ^{99m}Tc-tetrofosmin scan.

The last two patients (Patients 16, 17 in Table 4) in this group had three lesions (two of them negative on the post-therapeutic ^{131}I whole-body scan) and ten lesions (four of them radioiodine-negative), respectively. In the first patient, all three lesions were positive on the ^{99m}Tc-tetrofosmin whole-body scan; in the second, 8 of the 10 locations of metastatic spread could be detected (Fig. 4).

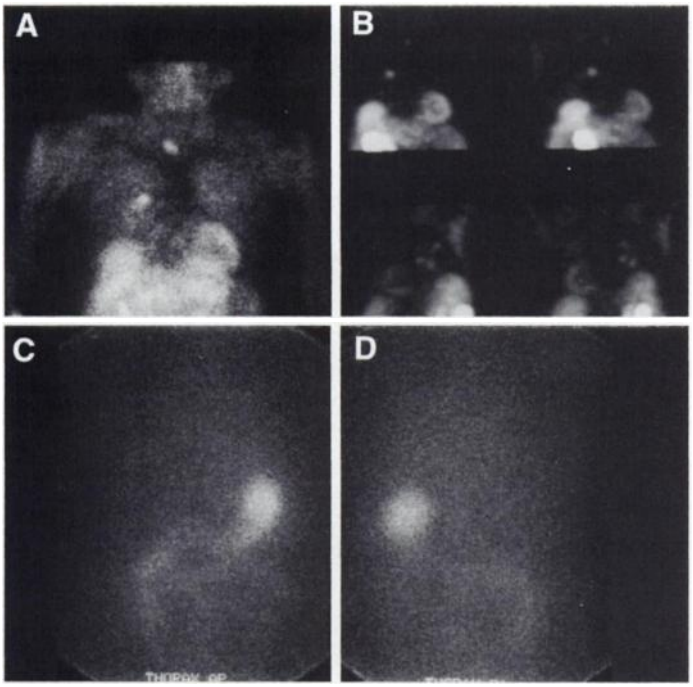

FIGURE 2. Anterior projection of the chest shows pathologic ^{99m}Tc-tetrofosmin uptake in the right retroclavicular region as well as in the right lung (A). SPECT and three-dimensional reconstruction revealed two additional lesions in the posterior part of the lung (B), which did not, however, provide any evidence of ^{131}I uptake in post-therapeutic ^{131}I whole-body scan (C, D).

TABLE 3
Comparison of Various Imaging Tests and Thyroglobulin Levels in Patients with Distant Metastases and Negative Post-Therapeutic Iodine-131 Whole-Body Scintigraphy

Patient no.	^{99m}Tc-Tetro lung	^{99m}Tc-Tetro bone	^{99m}Tc-Tetro soft tissue	CT/MRI	BS	Tg (ng/ml)	Histology
1	d	–	–	m	–	547	foll oxy pT3
2	d	–	–	m	–	256	pap foll pT4
3	d	–	–	m	–	912	foll oxy pT4
4	d	–	–	m	–	12763	foll pT4
5	–	–	2	2	1	<0.5	pap oxy pT3
6	3	–	–	3	–	831	foll oxy pT4
7	1	–	–	1	–	477	foll pT4
8	3	–	–	3	–	61	foll oxy pT4
9	4	–	–	7	–	13423	foll pT4

TCT = transmission computed tomography; MRI = magnetic resonance imaging; BS = bone scintigraphy; d = diffuse uptake; m = multiple disseminated metastases; foll oxy = follicular oxyphilic variant; pap oxy = papillary oxyphilic variant.

Overall sensitivity of ^{99m}Tc-tetrofosmin whole-body scan in detecting metastatic lesions was 86%. Of the 17 patients with tetrofosmin-positive metastases, nine were completely ^{131}I-negative, six ^{131}I positive and two partially positive and negative on post-therapeutic whole-body scans.

DISCUSSION

In this prospective study, ^{99m}Tc-tetrofosmin was evaluated in 114 consecutive follow-up patients with a history of DTC. Although ^{131}I whole-body scans are extremely specific for the detection of metastases originating from DTC, discrepancies in relation to serum Tg show that diagnostic and even post-therapeutic ^{131}I whole-body scans are not entirely reliable in excluding disease (*20–22*). It is well known that not all tumors collect ^{131}I and, therefore, other agents have been used for diagnosis, although their value is somewhat controversial (*1–10*).

However, with the introduction of [^{18}F]deoxyglucose PET, the importance of ^{131}I-negative metastases could be demonstrated very clearly (*23*). Like [^{18}F]deoxyglucose, nonspecific

TABLE 4
Comparison between Technetium-99m-Tetrofosmin and Iodine-131 Whole-Body Scintigraphy in Patients with Positive Distant Metastases on Post-Therapeutic Iodine-131 Scans

Patient no.	^{99m}Tc-tetro pos. lesions	^{131}I pos. lesions	Total number (CT/MRI/BS)	Tg (ng/ml)	Histology
10	1	1	1	969	pap foll pT4
11	4	4	4	253	foll pT4
12	1	1	1	19	foll pT4
13	1	1	1	89	foll pT4
14	4	4	4	714	foll pT4
15	3	3	3	587	foll pT3
16	3	1	3	2356	foll oxy pT4
17	8	6	10	93079	foll pT4

BS = bone scintigraphy.

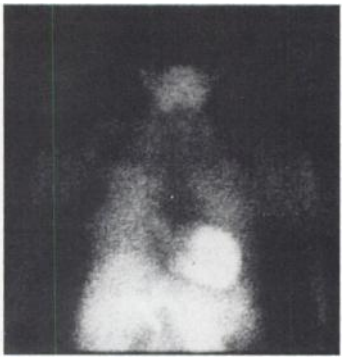

FIGURE 3. A 78-yr-old female patient showed an increasing Tg level but negative diagnostic and post-therapeutic ^{131}I whole-body scan 4 yr after thyroidectomy and high dose radioiodine ablation due to follicular-oxyphilic DTC pT4. Technetium-99m-tetrofosmin whole-body scan shows diffuse tracer uptake in the planar views, which were confirmed to be disseminated pulmonary lesions by MRI.

tumor searching tracers such as tetrofosmin identify viable tumor tissue, including most iodine-positive lesions (*13–16*).

Technetium-99m-tetrofosmin accumulates in viable tumor tissue under TSH suppressive L-T4 therapy independently of the recurrence or metastases capacity to store iodine (*13,16*). Although the exact mechanism of tetrofosmin uptake in tumor cells is not completely understood, several studies have been able to show that ^{99m}Tc-tetrofosmin accumulates in differentiated tumors with peak activity as early as 120 sec and a distinct retention up to 150 min (*13,17*). It appears to be proportionally related to blood flow and dependent on the transmembrane and mitochondrial potential (*11*). A comparative study between ^{99m}Tc-tetrofosmin, ^{99m}Tc-sestamibi and ^{201}Tl whole-body scan in 12 patients with metastasizing thyroid carcinoma by Gallowitsch et al. (*13*) showed that ^{99m}Tc-tetrofosmin has the best tumor-to-background ratio at 1.76 (±0.34) compared with 1.59 (±0.39) for ^{201}Tl (ns) and 1.51 (±0.31) for ^{99m}Tc-sestamibi ($p = 0.05$) and, therefore, the best image quality. In this preliminary investigation, we could also demonstrate a slight advantage of tetrofosmin concerning the detection rate of lesions.

In the actual prospective study, which includes patients in remission as well as those with recurrent and metastatic disease, ^{99m}Tc-tetrofosmin scintigraphy detected all malignant regional foci, whereas distant metastases achieved a sensitivity of 86%. However, existing remnants have to be considered as complicating factors when interpreting regional images. In 67% of patients with papillary carcinoma pT1N0M0, ^{99m}Tc-tetrofosmin scintigraphy showed slight uptake in the nonmalignant remnant with rapid washout; the remaining 33% of this group had negative tetrofosmin scintigraphy, but the remnants were less than 1 cm in diameter and Tg levels below 0.5 ng/ml.

All regional recurrent foci were found on planar images with tetrofosmin because of their superficial localization. Tracer retention in malignant recurrences up to 150 min postinjection as demonstrated for some patients in Group 3 might be of importance for probe-guided surgery in case of negative iodine accumulation.

In contrast to local recurrences, several distant metastases, especially lung lesions, could only be detected on the ^{99m}Tc-tetrofosmin scan by SPECT and three-dimensional reconstruction, although all patients underwent anterior and posterior planar views simultaneously using a dual-head gamma camera. Similar results were found by Charkes et al. (*4*) for ^{201}Tl.

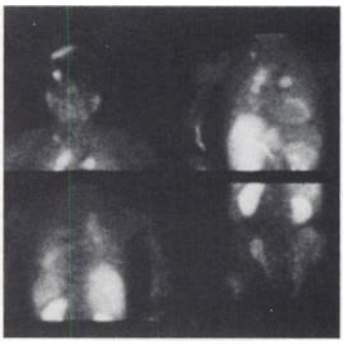

FIGURE 4. Technetium-99m-tetrofosmin whole-body scan in a patient with follicular DTC pT4 and strongly elevated serum Tg shows multiple positive lesions in the skull, lung and pelvis, which only showed partial ^{131}I uptake in the post-therapeutic whole-body scan.

From a methodological point of view, early abdominal images 5 min postinjection are necessary to detect lesions in this area and to avoid physiological gut overlapping due to rapid bilary excretion of tetrofosmin. Using a nonspecific tracer such as tetrofosmin for further follow-up, it is possible to detect iodine-positive as well as iodine-negative recurrences or metastases under TSH suppressive thyroid hormone treatment if the serum Tg level should rise. In this situation, in addition to surgery, therapy necessitates a high dose of ^{131}I after withdrawal of thyroid hormone (*21,22*).

A further advantage of nonspecific tracers, which also detect iodine-negative metastases, might be that, in addition to Tg measurement, tetrofosmin could be suitable in the follow-up of patients with less differentiated thyroid carcinoma who undergo chemotherapy (e.g., Aclarubicin + Intron A).

Note, however, that the detection rate of bone metastases for tetrofosmin is much lower than for pulmonary or soft-tissue lesions. Therefore, bone metastases should be considered if Tg is elevated and the ^{99m}Tc-tetrofosmin whole-body scan is negative. In these patients, a bone scan combined with bone marrow imaging using ^{99m}Tc-labeled MAb BW 250/183 is probably the best method for detecting early bone (marrow) metastases (*24*).

CONCLUSION

Our results with ^{99m}Tc-tetrofosmin whole-body scintigraphy in the follow-up of 114 patients with DTC show that this cationic nonspecific, tumor-searching complex seems promising in the detection of malignant recurrence and distant metastases. The higher target-to-background ratio compared to ^{201}Tl or ^{99m}Tc-sestamibi, better image quality and the fact that it is not necessary to withdraw thyroid hormone treatment make ^{99m}Tc-tetrofosmin whole-body scintigraphy a favorable additional method in the follow-up of DTC.

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Evaluation of Technetium-99m-MIBI Scintigraphy in Metastatic Differentiated Thyroid Carcinoma

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Technetium-99m-methoxyisobutyl isonitrile (^{99m}Tc-MIBI) was evaluated for its ability to detect metastases from thyroid carcinoma. **Methods:** Twenty-seven thyroidectomized patients with metastatic differentiated thyroid carcinoma, of whom 20, 9 and 12 had lung, lymph node and bone metastases, respectively, were examined with ^{99m}Tc-MIBI. The scan results were compared with those of ^{201}Tl and ^{131}I whole-body scans. **Results:** Increased accumulation of ^{99m}Tc-MIBI was observed in lung metastases of 15 patients (75.0%), 12 lymph node metastases (100.0%) and 29 of 31 bone metastases (93.5%). Increased accumulations of ^{201}Tl and ^{131}I scans were seen in, respectively, 16 (80.0%) and 17 (85.0%) of the 20 patients with lung metastases, 12 (100.0%) and 5 (41.7%) of the 12 lymph node metastases and 28 (90.3%) and 27 (87.1%) bone metastases. Because of its better image quality, ^{99m}Tc-MIBI detected more lesions in the lung (n = 38) than ^{201}Tl did (n = 17). **Conclusion:** Technetium-99m-MIBI is clinically useful for detecting metastases from differentiated thyroid carcinoma and deserves clinical application in the postoperative follow-up of such patients.

Key Words: technetium-99m-MIBI; metastatic thyroid cancer; thallium-201; iodine-131

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Serum thyroglobulin measurements and whole-body scintigraphy using ^{131}I and ^{201}Tl have been performed to follow postoperative patients with differentiated thyroid carcinoma (*1–5*). Like ^{201}Tl, ^{99m}Tc-MIBI has been reported to localize in various tumors (*6–8*). It also accumulates in thyroid tissues with various pathological conditions, such as Graves' disease (*9*), primary thyroid lymphoma (*10*), thyroid nodules (*11*), Hürthle cell carcinoma (*12*), medullary thyroid cancer (*13*) and distant metastases of thyroid cancer (*14–17*). Our present study evaluated the ability of ^{99m}Tc-MIBI scintigraphy, as compared with ^{201}Tl and ^{131}I scintigraphy, to successfully detect metastases from differentiated thyroid carcinoma.

MATERIALS AND METHODS

Patients

Twenty-seven patients (18 women, 9 men; age 58.2 ± 13.3 yr; range 27–82 yr; mean ± s.d.) with metastatic differentiated thyroid carcinoma who visited Kyoto University Hospital from 1993 to 1995 were studied. All patients had previously undergone a total thyroidectomy. The diagnosis was made on the basis of histological findings observed in the resected specimen. Eighteen and nine patients were diagnosed as having papillary and follicular carcinomas, respectively. All patients were examined for metastatic sites using both ^{99m}Tc-MIBI and ^{201}Tl within an interval of less than 2 wk and then immediately treated with 3.7–5.55 GBq ^{131}I. Thus, most of these patients were hypothyroid at the time of scanning. One week after treatment, whole-body ^{131}I scanning was performed.

A diagnosis of metastases from thyroid carcinoma was based on findings of radiography, CT and MRI, histological findings, increased serum thyroglobulin levels after total thyroidectomy, negative in vitro test results for other tumor markers and absence of nonthyroidal tumors evaluated by radiographic examinations. The diagnosis was confirmed later in those who had a positive ^{131}I scan. Clinical information on all 27 patients is presented in Table 1. Of the 27 patients, 20, 9 and 12 had lung, lymph node and bone metastases, respectively.

Scintigraphy

Ten to 30 min and 3 hr after intravenous administration of 600 MBq ^{99m}Tc-MIBI, whole-body scanning was performed (early and delayed scans, respectively) at 10 cm/min, with both anterior and posterior view images obtained. Spot images of pathological areas were taken if necessary. These images were obtained using a gamma camera and a high-resolution collimator appropriate for low (less than 180 keV) energy. A photopeak of 140 keV with symmetrical 20% window was used.

Whole-body scanning was also performed 10 min after intravenous injection of 74 MBq ^{201}Tl chloride at 10 cm/min. Planar anterior and posterior images were obtained with the same gamma camera and collimator as used for ^{99m}Tc-MIBI scanning. A window at the 80 keV ± 20% was used for photon collection. In some patients, spot images were used to compare ^{99m}Tc-MIBI and ^{201}Tl scans (800-1000 kcts/view versus 400-500 kcts/view, respectively).

When post-therapy ^{131}I scanning was performed, a large field-of-view gamma camera with a high-energy, parallel-hole collimator was used at 10 cm/min. The photopeak was 364 KeV with a symmetrical 20% window.

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