

^{99m}Tc -tetrofosmin, ^{131}I Whole Body Scan Thyroglobulin

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^{99m}Tc -tetrofosmin, ^{131}I Whole Body Scan and Thyroglobulin in Detecting Differentiated Thyroid Carcinoma Metastases

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Purpose: The purpose of this study was to assess the detectability of differentiated thyroid carcinoma metastases by ^{99m}Tc -tetrofosmin and to compare these results with a ^{131}I whole body scan (^{131}I WBS). The results of two scans were also compared with the T4 off-thyroglobulin (Tg) concentration.

Methods: A prospective study was performed on 43 patients (40 females, 3 males) with differentiated thyroid carcinomas (41 papillary, 2 follicular) having undergone a total thyroidectomy, and received 100–200 mCi (3,700–7,400 MBq) of radioiodine for ablation of residual thyroid tissue, or treatment of metastasis. All patients (n=43) had a ^{99m}Tc -tetrofosmin scan, and a ^{131}I WBS following the discontinuation of thyroid hormone replacement. The T4 off-Tg level was checked immediately prior to the radioiodine therapy, with T4 off-Tg levels above 20 ng/ml defined as positive for metastasis or a remnant disease.

Results: Cervical metastases were considered in 6 patients and distant metastases in 7, based on the clinical, radiological, and histopathological findings. The ^{131}I WBS (70.2%) was much more sensitive than the ^{99m}Tc -tetrofosmin scan (29.8%) in demonstrating the residual thyroid tissue following surgery. The ^{131}I WBS revealed cervical metastases in 3 of the 6 patients, but only 2 of the 6 were revealed by the

^{99m}Tc -tetrofosmin scan. Of the 3 patients with negative ^{131}I WBS, two were detected by the ^{99m}Tc -tetrofosmin scan. The sensitivities of the ^{131}I WBS and ^{99m}Tc -tetrofosmin scan in diagnosing distant metastases were comparable (71%, and 57% respectively), but in 2 patients with negative ^{131}I WBS, the ^{99m}Tc -tetrofosmin revealed distant metastases. The specificities of the ^{131}I WBS and ^{99m}Tc -tetrofosmin scan were not comparable (100%, 97%, respectively) in the diagnosis distant metastases. The mean T4 off-Tg level of the patients with cervical or distant metastases was 317 ng/ml, with a sensitivity and specificity of 100%, and 83% respectively. In the patients with a T4 off-Tg level above 50 ng/ml, the two scans and clinical studies could not reveal any metastases in 3 of the patients.

Conclusion: Although the specificity of the ^{99m}Tc -tetrofosmin scan was slightly lower than that of the ^{131}I WBS, it is a useful tool for detecting cervical or distant metastases in differentiated thyroid carcinomas and does not require prior withdrawal from thyroid hormones. Therefore the concomitant use of a ^{99m}Tc -tetrofosmin scan, a ^{131}I WBS and Tg, is more effective in detecting metastases in differentiated thyroid carcinomas. (J Korean Surg Soc 2002;63:366-371)

Key Words: Differentiated thyroid carcinoma, ^{99m}Tc -tetrofosmin scan, ^{131}I whole body scan, Thyroglobulin

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^{131}I whole body scintigraphy (^{131}I WBS) thyroglobulin (Tg) (1,2)

^{131}I WBS

(2,3) . Thallium-201 scan, ^{99m}Tc-sestamibi (MIBI), ¹¹¹In-octreotide, ^{99m}Tc-tetrofosmin, 18F-fluorodeoxyglucose ^{99m}Tc-tetrofosmin scan . ^{99m}Tc-tetrofosmin scan ¹³¹I WBS . ^{99m}Tc-tetrofosmin scan . ^{99m}Tc-tetrofosmin scan . ^{99m}Tc-tetrofosmin scan ¹³¹I WBS Tg .

1995 1 2001 6 가 . ^{99m}Tc-tetrofosmin scan ¹³¹I WBS 43 . 43 . 가 , ¹³¹I WBS Tg radioiodine . 가 6 , 7 , 6 5 . 43 (T3) 2 3 ^{99m}Tc-tetrofosmin scan , 100 200 mCi (3,700 7,400 MBq) ¹³¹I WBS 3 . anti-thyroglobulin antibody Tg , T₄ off-Tg cut-off 20 ng/ml . 43 ^{99m}Tc-tetrofosmin scan, ¹³¹I WBS, T₄ off-Tg

1) 43 40 , 가 3 . 22 66 44.3 . 41 , 2 .

2) ¹³¹I WBS ^{99m}Tc-tetrofosmin scan ¹³¹I WBS 43 31 (70.2%) , 12 (29.8%) . ^{99m}Tc-tetrofosmin scan 2 (4.6%) 41 (95.4%) (Table 1). 가 2 , 12 , 14 . ¹³¹I WBS .

3) ¹³¹I WBS ^{99m}Tc-tetrofosmin scan Tg 43 6 , ^{99m}Tc-tetrofosmin scan 3 , ¹³¹I WBS 2 2 ¹³¹I WBS (Table 2). 6 T₄ off-Tg 200 ng/ml (Table 3).

Table 1. Remnant Thyroid Uptake in ¹³¹I WBS and ^{99m}Tc-tetrofosmin scan

	¹³¹ I WBS	^{99m} Tc-tetrofosmin scan
Positive uptake	31 (72%)	2 (4.6%)
Negative uptake	12 (28%)	41 (95.4%)
Total	43	43

Table 2. Uptake of clinically metastasized cervical L/N in ¹³¹I WBS and ^{99m}Tc-tetrofosmin scan

	¹³¹ I WBS	^{99m} Tc-tetrofosmin scan
Positive	3 (50%)	2 (33.3%)
Negative	3	4
Total	6	6

Table 3. Comparison of two scans and Tg level in patients with clinically metastasized cervical L/N

	¹³¹ I WBS	^{99m} Tc-tetrofosmin scan	T ₄ off-Tg
1	-	-	+ (500)
2	+	-	+ (450)
3	+	-	+ (339)
4	-	+	+ (205)
5	+	-	+ (251)
6	-	+	+ (215)

Table 4. Sensitivity and specificity of two scans in detection of distant metastasis (n=7)

	¹³¹ I WBS	^{99m} Tc-TF scan
Sensitivity	71.4%	57.1%
Specificity	100%	97.3%

Table 5. Comparison of two scans and Tg level in patients with distant metastasis

	¹³¹ I WBS	^{99m} Tc-TF scan	T ₄ off-Tg
1	-	+	+ (500)
2	+	+	+ (450)
3	+	+	+ (339)
4	+	-	+ (205)
5	+	-	+ (251)
6	-	+	+ (76)
7	+	-	+ (500)

Table 6. Sensitivity and specificity of Tg level in patients with local lesion or distant metastasis (n=8)

Sensitivity	100%
Specificity	83%
Mean Tg level	317 ng/ml

Table 7. Patients with elevated serum Tg level but negative in two scans

	T ₄ off-Tg	¹³¹ I scan	^{99m} Tc-TF scan
1	+ (53)	-	-
2	+ (101)	-	-
3	+ (69)	-	-

4) ¹³¹I WBS Tg scan 가 43 7 , 4 , 2 , , .

¹³¹I WBS 71.4%, 100%
^{99m}Tc-tetrofosmin scan 57.1% 97.3%
 가 (Table 4). ¹³¹I WBS
 2 ^{99m}Tc-tetrofosmin scan 가 7
 T₄ off-Tg 50 ng/ml
 (Table 5).

5) Tg 가 43 가 T₄ off-Tg 8 Tg 100% 83% 8 Tg 317 ng/ml (Table 6).

6) Tg ¹³¹I WBS ^{99m}Tc-tetrofosmin scan 가 43 Tg (50 ng/ml) 가 3
 (Table 7).

¹³¹I WBS , , (1,2) , 가 , 가 (2,3) ¹³¹I WBS ¹³¹I , , , (2-5) ¹³¹I WBS (111 185 MBq) 10%가

(6) Tc-99m-1,2-bis-[bis(2-ethoxyethyl) phosphino] ethane (tetrofosmin) lipophilic phosphine sestamibi

(7) Tetrofosmin sestamibi tetrofosmin

(8) Tetrofosmin (9-11) ^{99m}Tc-tetrofosmin scan 120 가 , 150 (9, 11) ^{99m}Tc-tetrofosmin scan 가 , ^{99m}Tc-tetrofosmin scan ¹³¹I WBS, Tg ¹³¹I WBS가 가 (12-15) Ñnal (3) 41 ¹³¹I WBS 9 thallium-201 scan (201 TI scan) ^{99m}Tc-tetrofosmin scan 3 ¹³¹I WBS 43 ¹³¹I WBS 31 , ^{99m}Tc-tetrofosmin scan 2 ¹³¹I WBS Nishiyama (16) ^{99m}Tc-tetrofosmin scan 201 TI scan , ¹³¹I WBS Ñnal (3) Gallowitsch (6) ¹³¹I WBS 22.2%, ^{99m}Tc-tetrofosmin scan 90% 가 43 6 ¹³¹I WBS 6 3 , ^{99m}Tc-tetrofosmin scan 2 ¹³¹I WBS ^{99m}Tc-tetrofosmin scan Lind Gallo-witsch (14) 146 가 44 36 가 ^{99m}Tc-tetrofosmin scan , ¹³¹I WBS

21 가 , ¹³¹I WBS 17 ^{99m}Tc-tetrofosmin scan ^{99m}Tc-tetrofosmin scan Kosuda (7) Klain (17) ^{99m}Tc-tetrofosmin scan Ñnal (3) 가 23 21 가 201 TI scan ^{99m}Tc-tetrofosmin scan , ¹³¹I WBS 17 ^{99m}Tc-tetrofosmin scan 201 TI scan ¹³¹I WBS , ¹³¹I WBS 201 TI scan ^{99m}Tc-tetrofosmin scan . Brendel (13) 201 TI scan 6 ¹³¹I WBS 43 가 가 7 ¹³¹I WBS 5 , ^{99m}Tc-tetrofos-min scan 4 ¹³¹I WBS 71.4%, 100%, ^{99m}Tc-tetro-fosmin scan 57.1% 97.3% 131 I scan 가 ¹³¹I WBS ^{99m}Tc-tetrofosmin scan 2 Tg radioimmunoassay Tg 가 (2, 18, 19) Tg scan 가 (20, 21, 22) 가 100% 83% Tg 43 Tg (50 ng/ml) ¹³¹I WBS ^{99m}Tc-tetrofosmin scan 가 3 FDG PET . Feine (23), Grunwald (24), Chung (25) FDG positron emission tomography ¹³¹I WBS 가

	¹³¹ I WBS	^{99m} Tc-tetrofosmin scan	
thyroglobulin	가	가	^{99m} Tc-tetro-
fosmin scan	¹³¹ I WBS		¹³¹ I WBS
2			thyroglobulin
	¹³¹ I WBS	^{99m} Tc-tetrofosmin scan	

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