Monitoring Response to Therapy with Thallium-201 and Technetium-99m-Sestamibi SPECT in Nasopharyngeal Carcinoma

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This study prospectively assessed the value of ^{201}Tl and ^{99m}Tc-sestamibi (MIBI) SPECT in monitoring disease regression/progression as compared with MRI findings in patients with nasopharyngeal carcinoma (NPC) having radiotherapy with or without chemotherapy. **Methods:** Eighteen patients (age range 15–76 yr, mean 45 yr) had consecutive SPECT imaging using a dual-head gamma camera after the injection of 111 MBq ^{201}Tl and 555 MBq MIBI before therapy and at 3 mo and 6 mo after completion of therapy. A total of 106 SPECT studies was correlated with contemporaneous MRI studies. Tumor-to-background ratios were obtained on coronal slices. Visually detectable lesions in the region of the nasopharynx and cervical lymph nodes were considered positive for residual disease. The gold standard for the presence of disease was the combination of repeat MRI scans, endoscopic examination and clinical evaluation performed 12–15 mo after completion of therapy. **Results:** MIBI-SPECT proved superior to both ^{201}Tl SPECT and MRI after 3 or 6 mo follow-up in predicting complete response. Accuracy rates in the detection of residual disease in the nasopharynx are 39%, 72% and 89% for MRI, ^{201}Tl and MIBI, respectively, for the 3-mo evaluation; 71%, 71% and 94% for MRI, ^{201}Tl and MIBI, respectively, for the 6-mo evaluation. **Conclusion:** MIBI SPECT could be used as a screening test in predicting response to therapy in patients with NPC.

Key Words: nasopharyngeal carcinoma; therapy; thallium-201; technetium-99m-sestamibi

J Nucl Med 1997; 38:1009–1014

The need for a staging consensus has been satisfied by incorporating CT or MRI into the screening tools for patients with nasopharyngeal carcinoma (NPC) at initial presentation. However, a satisfactory imaging tool has not been provided that either differentiates post-therapy changes from residual disease or monitors response to treatment in this patient population. After therapy, the fundamental obstacle that impedes evaluating the response to therapy has always been the presence of residual masses in 45%–65% of patients (*1*). Proper evaluation of response to therapy within an early period may have important therapeutic and prognostic implications (*2*). Thus, more precise imaging modalities that could be used as a gold standard for differentiating viable tumor from post-therapy changes may define those patients in need of additional therapy by avoiding both unnecessary further treatment options and suboptimal therapy. In this regard, gadolinium-enhanced MRI proved superior to CT, but its false-positive rate is still unacceptably high (*3,4*). Recently, PET using FDG and ^{11}C-methionine has acquired recognition in differentiating between inflammatory changes and viable tumor in head and neck cancers (*5–9*). Nonetheless, its availability and cost constitute major drawbacks in its widespread use. On the other hand, ^{201}Tl and MIBI have been shown to be effective tumor imaging agents in detecting various malignancies (*10–13*). However, there has been a paucity of data on the influence of scintigraphic studies in evaluating response to treatment, distinguishing between residual/recurrent tumor from post-therapy changes and detecting regression or progression of disease as early as possible in the treatment period (*14,15*).

This study evaluates both ^{201}Tl and ^{99m}Tc-MIBI as potential agents in differentiating residual/recurrent disease from post-therapy changes early in the post-therapy period and compares the results with radiographic modalities in patients with NPC. The initial and follow-up scans were performed within the same patient group to avoid variabilities that could stem from different patient populations.

MATERIALS AND METHODS

We prospectively monitored response to therapy in 18 patients with histologically proven NPC. There were 13 men and five women with a mean age of 45 yr (range 15–76 yr). Thirteen patients had undifferentiated carcinoma (WHO Type III), and five had squamous-cell carcinoma or nonkeratinizing epidermoid carcinoma (WHO Types I and II) (*16*). The findings of ^{201}Tl and MIBI scintigraphy were correlated with contemporaneous CT or MRI studies in all patients.

All patients had ^{201}Tl and MIBI scintigraphy and contemporaneous CT or MRI studies before baseline therapy was initiated. Thallium-201, MIBI scintigraphy, CT (12 patients) or MRI (six patients) studies, endoscopic and clinical examination were repeated at 3 and 6 mo after therapy to evaluate the response to treatment. For the 6-mo evaluation, all patients had the same examinations except that all had MRI, and none had CT. Eight patients had nasopharyngeal biopsy confirmation performed within 7–15 days after scintigraphic and radiographic studies at either 3 mo (four patients) or 6 mo (four patients). We obtained 12- to 15-mo follow-up data in all patients including those who had biopsies. The gold standard for the presence of residual disease was the histopathologic (four patients) and/or endoscopic/physical examination for the 3-mo and histopathologic (four patients) and/or 12- to 15-mo clinical follow-up data for the 6-mo evaluation. Considering the possible false-negative endoscopic examinations that could be obtained at 3 mo, we compared those endoscopic results negative for residual disease with the 12- to 15-mo clinical follow-up data. Those with persistently negative endoscopic, biopsy and negative clinical follow-up data for presence of disease were retrospectively considered true-negative. At the 6-mo evaluation, when endoscopy was negative, biopsy was obtained only in those patients with residual disease on imaging. All patients received 60–70 Gy to the nasopharynx, 50–70 Gy to the cervical

Received Aug. 5, 1996; revision accepted Nov. 7, 1996.

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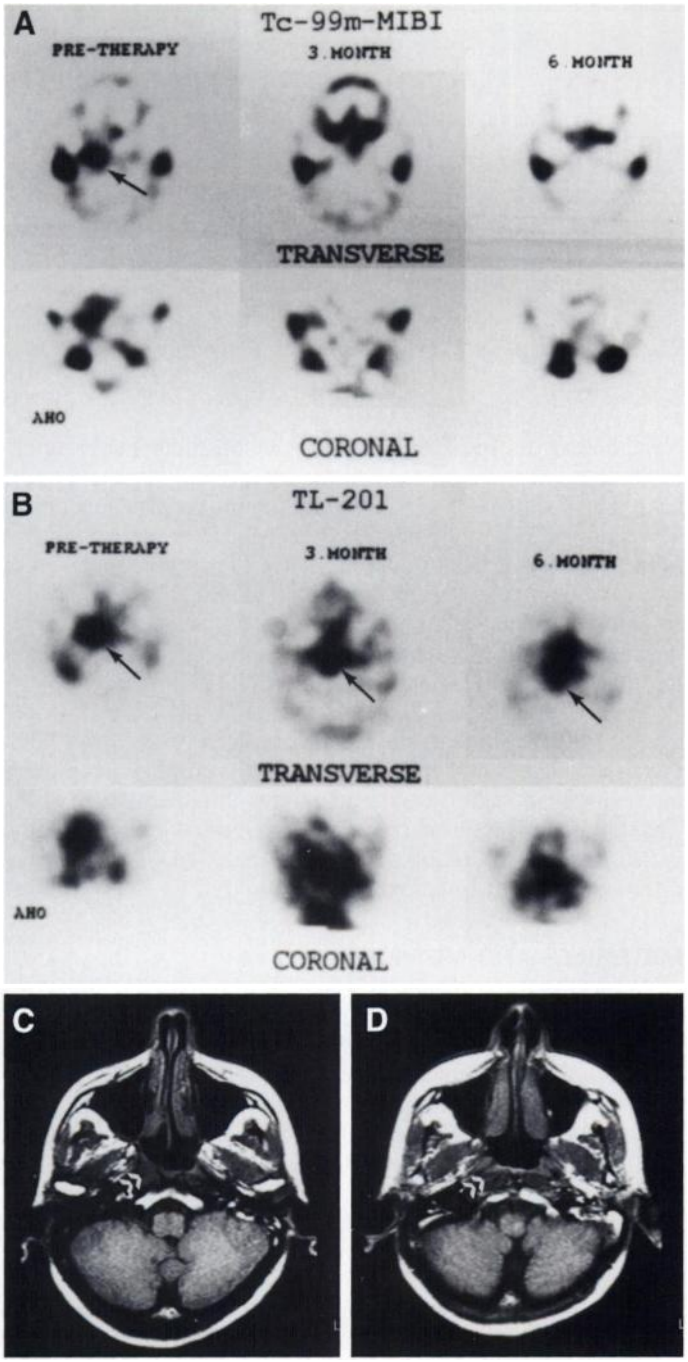

FIGURE 1. (A) Transverse (upper panels) and coronal slices (lower panels) of MIBI-SPECT studies performed before therapy (left column) demonstrate intense radiotracer uptake in the right nasopharyngeal meatus (arrow), consistent with NPC. After therapy, 3- and 6-mo MIBI-SPECT studies (middle and right columns, respectively) reveal no evidence of residual disease in the corresponding region consistent with complete response to therapy. (B) Transverse (upper panels) and coronal slices (lower panels) of ^{201}Tl SPECT studies performed before therapy (left column) demonstrate increased radiotracer uptake in the right pharyngeal recess (arrow), corresponding to the uptake seen on MIBI-SPECT study. After therapy, 3- and 6-mo ^{201}Tl SPECT studies (middle and right columns, respectively) reveal increased uptake in the same region consistent with residual NPC. (C) MRI study of the nasopharynx performed 3 mo after therapy demonstrates a mass obliterating the right pharyngeal recess (arrow heads) consistent with residual NPC. Endoscopic/physical examination was negative for residual disease. (D) MRI study of the nasopharynx performed 6 mo after therapy still demonstrates a residual mass in the right pharyngeal recess (arrowheads) consistent with residual disease in the NPC. Endoscopic/physical examination was negative for residual disease. Fifteen months after completion of therapy, the patient was endoscopically and clinically free of disease.

lymph nodes and 46–50 Gy to the supraclavicular lymph nodes. Nine patients also received cisplatin-based concomitant chemotherapy consisting of cisplatin and 5-fluorouracil.

Imaging Studies

A dual-head ADAC Genesys camera interfaced with an ADAC Pegasys SP10 computer system was used for image acquisition. A low-energy general-purpose collimator and a low-energy high-resolution collimator were used for ^{201}Tl and MIBI imaging. The time interval between ^{201}Tl and MIBI imaging ranged from 2 hr to 2 days in all except one patient in whom the interval was 10 days. Thallium-201 scintigraphy was performed before MIBI imaging in all patients except one. The patients were not pretreated with potassium perchlorate (6 mg/kg) for suppressing the physiological uptake in the salivary glands based on the findings in previous attempts (*17*). All patients underwent whole-body scintigraphy and SPECT of the head and neck 30 min after administration of 111 MBq ^{201}Tl and 555 MBq MIBI. SPECT was performed using a matrix size of 64 × 64 × 16 and a zoom factor of 1.85. Tumor-to-background ratios were obtained using ROIs drawn in consecutive coronal slices that contained the entire tumor volume. Physiologic uptake in the head and neck was observed in the pituitary glands, nasal and oral cavity, pharyngeal recesses bilaterally, maxillary sinuses, parotids, palatine, submandibular and sublingual salivary glands. Any uptake other than physiologic was considered positive for residual/recurrent disease. The scintigraphic studies were interpreted by two nuclear physicians, and a consensus was reached regarding the findings.

CT scans were obtained using Philips Tomoscan SR 7000 scanner, 3- to 5-mm sections, and using intravenous contrast. MRI imaging was performed using Philips Gyroscan TII in multiple planes with both T1- and T2-weighted pulse sequences with a slice thickness of 3–5 mm using intravenous Gd-DTPA. The images were interpreted as either suggesting residual/recurrent mass or as normal by an experienced radiologist.

Statistical analysis was performed using a statistical package program, SPSS for Windows version 5.01. The sensitivity, specificity and accuracy of scintigraphic and radiographic modalities were calculated accordingly by taking biopsy data in four patients, endoscopic nasopharyngeal evaluation in 14 patients for the 3-mo evaluation, biopsy data in four patients and clinical follow-up data in all patients as the gold standard for 6-mo evaluation. Cochran Q-test and McNemar test adjusted for multiple comparisons were used for comparing accuracy of the methods. The confidence intervals for positive predictive values were calculated according to binomial distribution.

RESULTS

Based on the design of the study, only those sites that were initially positive for disease in the nasopharynx or lymph nodes (31 sites) on either ^{201}Tl or MIBI scintigraphy were included in the post-therapy evaluation. Those that were initially negative on both scintigraphic methods were precluded (five sites, all lymph nodes). There were no patients with metastatic disease on initial evaluation. The nasopharynx and cervical lymph nodes were evaluated separately for the presence of post-therapy residual/recurrent disease.

Three-Month Evaluation

The findings are summarized in Tables 1, 2 and 3 for the primary site and the regional lymph nodes. Of 31 sites (18 patients) evaluated at initial presentation, there were nine sites (five patients) with residual disease (five nasopharynx, four lymph nodes) as proven by either biopsy (four patients) or endoscopic/physical examination. The accuracies of CT/MRI, MIBI and ^{201}Tl scintigraphy were statistically different from

TABLE 1
Post-Therapy 3-Month Evaluation by Thallium-201, MIBI and MRI

Patient no.	Tl-201		MIBI		MRI		Nasopharynx		
	NPX†	LN‡	NPX	LN	NPX	LN	Bx*	& PE	
1	TP	FN	TP	TP	TP	TP	+	−FN	Chemotherapy
2	TP	§	TP	§	TP	§		+	
3	TP	§	TP	§	TP	§		−FN	Chemotherapy
4	TP	TP	TP	TP	TP	TP		+	
5	FP	TN	TN	TN	FP	TN	−	−	
6	TN	TN	TN	TN	TN	FP		−	
7	FP	TP	TN	TP	FP	TP		−	
8	TP	FN	TP	TP	TP	TP		+	Chemotherapy
9	FP	TN	FP	TN	FP	TN		−	Chemotherapy
10	TN	TN	TN	TN	FP	TN	−	−	Chemotherapy
11	TN	TN	TN	TN	FP	TN		−	Chemotherapy
12	TN	§	TN	§	FP	§		−	
13	TN	TN	TN	TN	FP	TN		−	Chemotherapy
14	TN	TN	TN	TN	FP	FP	−	−	Chemotherapy
15	TN	TN	TN	TN	TN	TN		−	
16	TN	TN	TN	TN	FP	TN		−	
17	FP	§	TN	§	FP	§		−	
18	FP	§	FP	§	FP	§		−	Chemotherapy

Patients who were on concomitant chemotherapy protocol are indicated at the end of the lines.
TP = true-positive; FP = false-positive; FN = false-negative; TN = true-negative.
*Biopsy was performed in the nasopharynx only.
†Nasopharynx.
‡Involved lymph nodes.
§These patients did not have any metastatic lymph nodes.

one another in differentiating benign post-therapy changes from viable disease in the nasopharynx ($p = 0.0009$, Cochran Q-test). Further analysis using McNemar's test revealed that the accuracy of MIBI was significantly different from that of CT (12 patients) or MRI (six patients) ($p = 0.0012$). There was no statistical difference between the accuracies of ^{201}Tl and MRI ($p < 0.1$, McNemar). MIBI SPECT was true-negative in 20 (11 patients) when ^{201}Tl and MRI were false-positive in three (three patients) and 11 (eight patients) corresponding sites, respectively (Figs. 1A, B, C and 2A, B, C). MIBI was false-positive in two sites (two patients, nasopharynx) when both ^{201}Tl and MRI were also false-positive in the same sites. There were no false-negative MIBI or MRI studies. However, ^{201}Tl was false-negative in two sites (two patients, lymph nodes; Table 1, Cases 1 and 8) that measured 0.8 cm and 1.0 cm, respectively. There was no difference between MIBI, ^{201}Tl and MRI for detecting residual disease in the lymph nodes ($p = 0.37$, Cochran Q-test). The positive predictive values for MIBI, ^{201}Tl and CT/MRI were 82%, 58% and 41%, respectively (Table 3).

Six-Month Evaluation

The findings are summarized in Tables 2, 3 and 4. There were only four sites (four patients) with residual disease as proven by biopsy (four patients) and/or long-term clinical follow-up. Biopsy data revealed chronic inflammation and/or necrotic tissue in all specimens negative for tumor. In order to avoid sampling errors, we also confirmed the negative biopsy results with the patients' 12- to 15-mo clinical follow-up data. MIBI was true-negative in 25 of 31 sites (13 of 18 patients) when MRI was true-negative in only 21 sites (nine patients). MRI and ^{201}Tl were false-positive in five sites (five patients; Fig. 1A, B, D). MIBI was false-positive in only one site (one patient,

TABLE 2
Statistical Analysis of Post-Therapy Evaluation by Thallium-201, MIBI and MRI

	3-Month evaluation						6-Month evaluation					
	Tl-201		MIBI		CT/MRI		Tl-201		MIBI		MRI	
	NPX	LN	NPX	LN	NPX	LN	NPX	LN	NPX	LN	NPX	LN
TP	5	2	5	4	5	4	3*	0	3	0	3	0
TN	8	9	11	9	2	7	9	12	13	12	9	12
FP	5	0	2	0	11	2	5	0	1	0	5	0
FN	0	2	0	0	0	0	0	0	0	0	0	0
Sensitivity (%)	100	50	100	100	100	100	100	*	100	*	100	*
Specificity (%)	62	100	85	100	15	78	64	100	93	100	64	100
Accuracy (%)	72	85	89	100	39	85	71	100	94	100	71	100

*As one patient died after 3-mo evaluation, there were a total of 31 sites at 3-mo evaluation and 29 sites for 6-mo evaluation considering nasopharynx and lymph nodes as separate sites.
TP = true-positive; TN = true-negative; FP = false-positive; FN = false-negative.

TABLE 3
Positive Predictive Values of Thallium-201, MIBI and MRI

	3-Month evaluation PPV (%95 CI)	6-Month evaluation PPV (%95 CI)
MRI	40.9 (20.7–63.7)	37.5 (8.5–75.5)
^{201}Tl	58.3 (0.3–52.7)	37.5 (8.5–75.5)
MIBI	81.8 (48.2–97.7)	75 (19.4–99.1)

PPV = positive predictive value; CI = confidence interval.

nasopharynx). In this particular patient, MRI was also false-positive when ^{201}Tl was true-negative.

Overall Findings

Of 11 false-positive MRI studies obtained at 3-mo evaluation, six converted to normal at 6-mo evaluation when MIBI was already true-negative at 3-mo evaluation in nine coinciding sites (nine patients) (Fig. 2). On the other hand, there were five false-positive ^{201}Tl studies in five patients at the 3- and 6-mo evaluation, however, only two patients with persistent disease coincided at these two different periods (Tables 1 and 4, Cases 17 and 18) (Fig. 1B). Three sites (three patients) converted to true-negative at 6 mo while three other sites (three patients) all of which were true-negative at 3-mo evaluation converted to false-positive at 6 mo. Although the primary site was negative for residual disease, two patients developed bone metastases, both of which were positive on bone scintigraphy and MRI. Thallium-201 and MIBI could not demonstrate all metastases in these two patients. None of the patients with false-positive ^{201}Tl and true-negative MIBI studies had received concomitant chemotherapy except one patient, as shown in Tables 1 and 4.

The accuracies of ^{201}Tl, MRI and MIBI were not statistically different from one another for predicting residual/recurrent disease in the nasopharynx and lymph nodes due to the limited number of patients ($p = 0.14$, Cochran Q-test). However, specificity and accuracy of MIBI results (93% and 94%, respectively) were higher than those of ^{201}Tl and MRI (64% and 71% for both tests, respectively). The positive predictive values for MIBI, ^{201}Tl and MRI were 75%, 37.5% and 37.5%, respectively (Table 3).

The mean tumor-to-background ratio was 2.53 ± 1.25 (range 1.94–4.80) for MIBI and 1.75 ± 0.90 (range 1.4–2.81) for ^{201}Tl imaging for all true-positive cases for residual disease. There was a statistically significant difference between the ratios obtained from ^{201}Tl and MIBI scintigraphy ($p < 0.0001$, Wilcoxon test). The mean tumor-to-background ratios were 1.67 ± 0.17 and 1.73 ± 0.22 for false-positive MIBI and ^{201}Tl imaging, respectively. A cutoff value could not be determined for the presence of residual disease due to the inadequate number of patients with residual/progressive disease to counterbalance those with disease regression.

DISCUSSION

Following radiotherapy, the clinical situation is usually complicated with post-therapy residual masses which encumber the evaluation of response to therapy in patients with NPC (*1,3,18*). When there is persistent viable tumor, booster dose irradiation, intracavitary brachytherapy and/or radical neck dissection or innovative combined therapy approaches could be added to the therapeutic protocol (*2,19–23*). Although histologic confirmation is the currently approved gold standard for the presence of

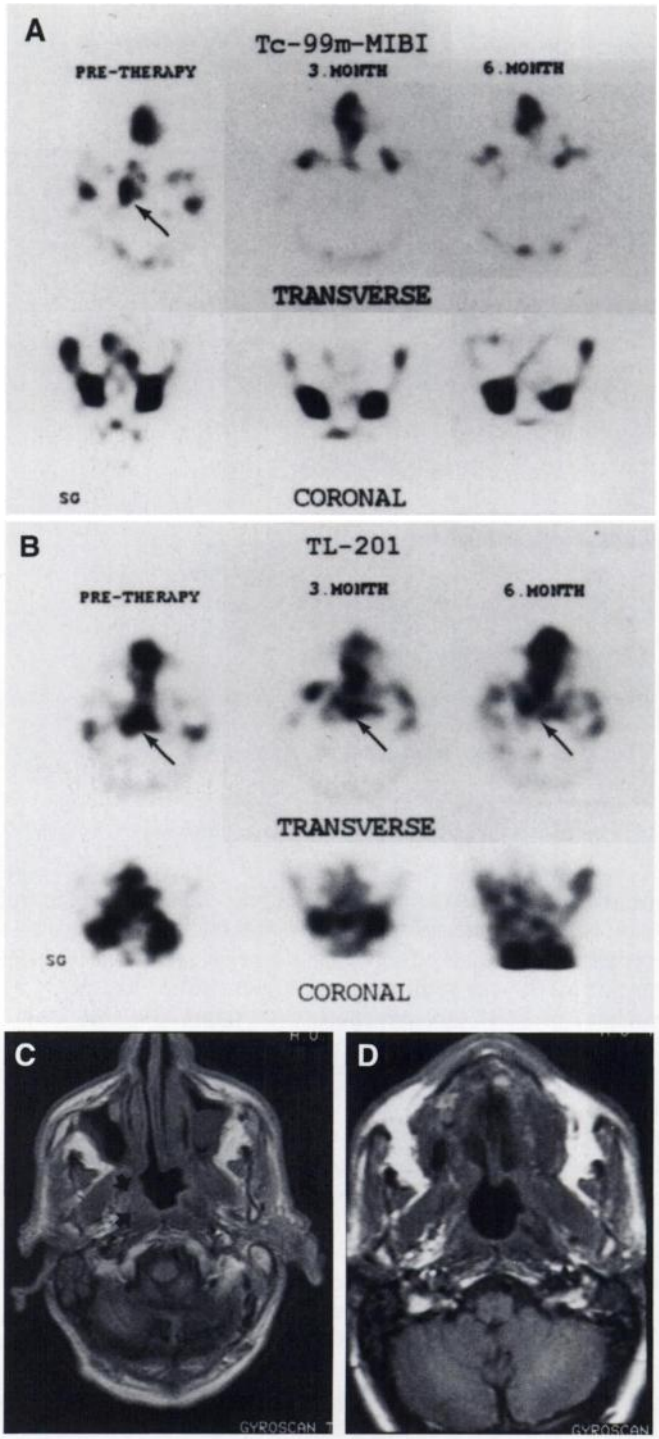

FIGURE 2. (A) Transverse (upper panels) and coronal slices (lower panels) of MIBI-SPECT studies performed before therapy (left column) demonstrate increased radiotracer uptake in the right pharyngeal recess (arrow) consistent with NPC. After therapy, 3- and 6-mo SPECT studies (middle and right columns, respectively) show no appreciable uptake in the same region consistent with complete response to therapy. (B) Transverse (upper panels) and coronal slices (lower panels) of ^{201}Tl SPECT studies performed before therapy (left column) depict increased radiotracer uptake in the right pharyngeal recess (arrow) corresponding to the uptake seen on MIBI-SPECT study. After therapy, 3- and 6-mo ^{201}Tl SPECT studies (middle and right columns, respectively) reveal low-grade increased uptake in the same region consistent with residual NPC. (C) MRI study of the nasopharynx performed 3 mo after therapy reveals a mass located in the right pharyngeal recess (arrows) consistent with residual disease. Endoscopic/physical examination was negative for residual disease. (D) MRI study of the nasopharynx performed 6 mo after therapy does not demonstrate any residual mass in the nasopharynx. Endoscopic/physical examination was negative for residual disease. Twelve months after completion of therapy, the patient was endoscopically and clinically free of disease.

TABLE 4
Post-Therapy Six-Month Evaluation by Thallium-201, MIBI and MRI

	^{201}Tl		MIBI		MRI					
	NPX	LN†	NPX	LN	NPX	LN	Bx*	Nasopharynx	12–15-mo follow-up	
1	NA‡	NA	NA	NA	NA	NA		NA	Exitus	Chemotherapy
2	TP	§	TP	§	TP	§		+	Progression	
3	TP	§	TP	§	TP	§	+	−FN	Residual	Chemotherapy
4	TP	TN	TP	TN	TP	TN		+	Residual	
5	TN	TN	TN	TN	TN	TN		−	Normal	
6	TN	TN	TN	TN	TN	TN		−	Normal	
7	TN	TN	TN	TN	TN	TN		−	Normal	
8	TN	TN	TN	TN	TN	TN		−	Normal	Chemotherapy
9	TN	TN	TN	TN	TN	TN		−	Normal	Chemotherapy
10	TN	TN	TN	TN	TN	TN		−	Normal	Chemotherapy
11	TN	TN	FP	TN	FP	TN	−	−	Normal	Chemotherapy
12	FP¶	§	TN	§	FP	§	−	−	Normal	
13	TN	TN	TN	TN	TN	TN		−	Normal	Chemotherapy
14	TN	TN	TN	TN	FP	TN	−	−	Normal	Chemotherapy
15	FP¶	TN	TN	TN	TN	TN		−	Normal	
16	FP¶	TN	TN	TN	TN	TN		−	Normal	
17	FP	§	TN	§	FP	§		−	Normal	
18	FP	§	TN	§	TN	§		−	Normal	Chemotherapy

*Biopsy was performed in the nasopharynx only.
†Involved lymph nodes.
‡The patient died before 6-mo evaluation.
§These patients were precluded from post-therapy evaluation because there was no metastatic lymph nodes at initial presentation.
¶These patients had clinically ongoing acute infection in the nasopharynx during imaging.
Patients who were on concomitant chemotherapy protocol are indicated at the end of the lines. NPX = nasopharynx.

residual tumor, its invasiveness and high incidence of sampling errors should not be disregarded. Therefore, a specific functional imaging modality is most needed when radiographic modalities depict a mass indistinguishable from residual/recurrent tumor. In this study, we performed consecutive imaging studies within the same patient group to avoid variabilities that could stem from different patient populations. MIBI imaging was found superior to ^{201}Tl and radiographic modalities both at 3- and 6-mo evaluation with higher specificity, accuracy and positive predictive values (Tables 2, 3). Although it has been suggested previously that ^{201}Tl imaging should be used to monitor response to therapy in NPC, the number of patients studied was inadequate (12 patients) for obtaining statistically powerful results (*15*). In the current study, MIBI was false-positive in two patients when both ^{201}Tl and MRI were also false-positive at 3-mo evaluation. However, as an inherent shortcoming of this study, the gold standard set for the presence of residual disease was the endoscopic/physical examination in 14 patients, including these two particular patients for the 3-mo evaluation. Since regression of macroscopic changes in the anatomic planes might precede microscopically ongoing process of cell death, false-negative endoscopic studies could lead to underestimation of the diagnostic accuracy of imaging techniques. Nevertheless, when we retrospectively compared all negative endoscopic evaluation obtained at 3 mo with those of 12- to 15-mo follow-up data, the MIBI results compared favorably. In considering endoscopic examinations as true-negative in these two patients, prolonged post-therapy inflammatory processes could account for false-positive imaging studies. On the other hand, during 12- to 15-mo follow-up some false-positive MRI studies convert to true-negative while MIBI was already true-negative at 3- and 6-mo evaluation (Fig. 1A, B, C, D).

At the 6-mo evaluation, there was only one false-positive MIBI when MRI was also false-positive and ^{201}Tl was true-negative. However, as an exception to the rest of the patient population, on this particular patient MIBI imaging was performed 10 days before ^{201}Tl imaging. Although the effect of radiotherapy is expected within the first 3 mo, it may extend up to 6 mo in some patients. The accumulation of MIBI might have occurred passively as a result of altered permeability of injured cell membranes in the process of irreversible cell death.

Recent investigations have indicated that MIBI was a transport substrate recognized by p-glycoprotein, a membrane protein encoded by multidrug-resistance gene (*24–26*). In our study group, we further evaluated the patient with false-positive ^{201}Tl and true-negative MIBI for the possible influence of a p-glycoprotein pump on MIBI accumulation. There was no patient whose disease had progressed over the interval of 12–15 mo when MIBI was negative, a situation that might be indicative of outward transport of MIBI from the cell secondary to overexpression of the p-gp pump. There was only one patient who had received cisplatin that might have induced p-gp-related drug resistance, but long-term follow-up also proved MIBI true-negative.

In this study, we could not determine a tumor-to-background ratio that could be accepted as a cutoff value for the presence of viable residual disease since we did not have sufficient numbers of patients with residual or progressive disease to counterbalance those with disease regression for an accurate statistical analysis. Additionally, there was an inadequate number of patients with false-positive MIBI studies to determine the tumor-to-background ratio that could be accepted as a threshold for true-positive scans.

Improvements in irradiation techniques have increased local control, but distant failures remain the major problem in patients with bulky disease (*1,3*). Similarly, in our population, although complete response was achieved for the primary disease, three patients developed skeletal metastases. Notwithstanding the detection of metastatic bone disease by both

scintigraphic methods, not all the sites observed on bone scintigraphy could be detected. False-negative sites obtained for bone metastases might be ascribed to the lower extraction fraction of radiotracers by the skeleton as reported before (*17*).

According to the literature, nearly 80% of the failures occur within the first 3 yr after treatment. Therefore, our current study does not lend MIBI as a test of choice for predicting patient outcome since we had only 12–15 mo follow-up data (*21*). A larger group of patients and more prospective studies are required to improve the statistical validity of our observations and more precisely test the predictive value of MIBI for patient outcome.

CONCLUSION

MIBI imaging was found to have higher accuracy and positive predictive value for the presence of residual disease as compared with ^{201}Tl and CT or MRI both at 3-mo and 6-mo evaluations. This finding emphasizes the rationale for incorporating MIBI-SPECT into the work-up of patients with NPC after therapy to elucidate the nature of persistent masses. The number of patients studied to date is small. Accordingly, MIBI scintigraphy does not obviate the need for close clinical follow-up and repeated histologic evaluation. Further evaluation of this technique would be worthwhile in establishing the role of ^{99m}Tc-MIBI for this purpose in patients with nasopharyngeal carcinoma.

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