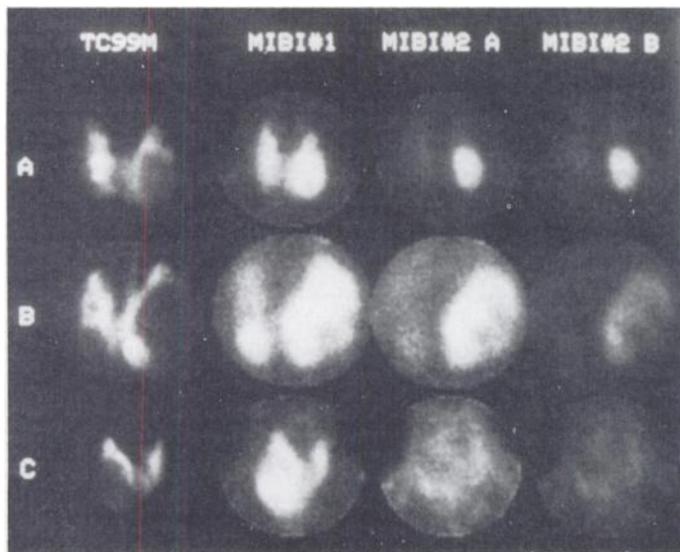


## Assessing Thyroid Malignancy with Double-Phase Scintigraphy Using Technetium-99m-MIBI

**TO THE EDITOR:** In a recent article, Kresnik et al. (1) reported on double-phase thyroid scintigraphy (30 min and 2 hr postinjection) with  $^{99m}\text{Tc}$ -sestamibi in patients with cold thyroid nodules and concluded that the uptake and retention of the tracer by thyroid nodules is not specific for malignancy.



**FIGURE 1.** All nodules appearing cold on the  $^{99m}\text{Tc}$  image (Patients A, B and C) show intense uptake of MIBI in the early image (MIBI #1). In the late image, the retention was present both in the raw image (MIBI #2A) and in the image normalized for acquisition time and  $^{99m}\text{Tc}$  decay (MIBI #2B) for Patients A and B, respectively. The retention was not present in Patient C. The washout rate was 21% per  $\text{hr}^{-1}$  and 13% per  $\text{hr}^{-1}$  for Patient A, 20% per  $\text{hr}^{-1}$  and 16% per  $\text{hr}^{-1}$  for Patient B and 20% per  $\text{hr}^{-1}$  and 20% per  $\text{hr}^{-1}$  for Patient C for normal thyroid tissue and for nodules, respectively. Histopathology revealed Hürthle cell tumor in Patient A, follicular carcinoma in Patient B and adenoma in Patient C.

We agree in part with their conclusions. In our experience (2), we have witnessed oxyphilic tumors take up and retain  $^{99m}\text{Tc}$ -sestamibi in contrast with other thyroid tumors (Fig. 1). We were able to conclude this by calculating the washout rate of the tracer from the nodule and from the normal thyroid tissue using double-phase scintigraphy (15–30 min and 3–4 hr postinjection). The washout rate was lower in oxyphilic tumors than in other nodules and in normal thyroid tissue. This index proved to be much more specific than visual inspection in evaluating such retention.

The uptake of sestamibi by thyroid nodules is related to vascularity and cellularity (3), but its retention is related mainly to mitochondrial concentration (4) and secondarily to the initial uptake. As a result, the retention could be either true or apparent according to the washout rate and initial uptake. Therefore, visual inspection could be misleading in such evaluation.

### REFERENCES

1. Kresnik E, Gallowsch H-J, Mikosch P, Gomez I, Lind P. Technetium-99m-MIBI scintigraphy of thyroid nodules in an endemic goiter area. *J Nucl Med* 1997;38:62–65.
2. Vattimo A, Bertelli P, Cintorino M, Burroni L, Volterrani D, Vella A. Identification of Hürthle cell tumor by single-injection, double-phase scintigraphy with technetium-99m-sestamibi. *J Nucl Med* 1995;36:778–782.
3. Vattimo A, Bertelli P, Burroni L. Effective visualization of suppressed thyroid tissue by means of baseline methoxy-isobutyl-isonitrite in comparison with Tc99m pertechnetate scintigraphy after TSH stimulation. *J Nucl Biol Med* 1992;36:315–318.

4. Carvalho PA, Chiu ML, Kronauge JF, et al. Subcellular distribution and analysis of technetium-99m-MIBI in isolated perfused rat hearts. *J Nucl Med* 1992;33:1516–1531.

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**REPLY:** We are pleased with the interest that our study on  $^{99m}\text{Tc}$ -MIBI scintigraphy of thyroid nodules published in the January issue of *JNM* (1) has raised, and in particular with the detailed interest by Vattimo et al.

In our study, 62 patients with single-injection, dual-phase scintigraphy were investigated. The scintigrams were rated visually by two experienced observers. There were 12 patients with thyroid carcinoma. Five patients were classified as  $^{99m}\text{Tc}$ -MIBI positive (superior tracer uptake to normal surrounding thyroid tissue). Seven patients were  $^{99m}\text{Tc}$ -MIBI negative (lower tracer uptake to surrounding thyroid tissue). There were 27 patients with thyroid adenoma (8 oxyphilic, 10 follicular and 9 microfollicular). All patients with microfollicular histological cell type were classified as  $^{99m}\text{Tc}$ -MIBI positive. Follicular and oxyphilic adenoma were positive in only 50% of cases.

Vattimo et al. (2) report in their study on double-phase scintigraphy with  $^{99m}\text{Tc}$ -MIBI that persistent tracer uptake seems to be characteristic of Hürthle cell tumor in contrast to other thyroid tumors. Visual inspection of the images was performed using a scoring method (0 = no uptake to 3 = uptake superior to the thyroid gland).

There was a group of eight patients that were scored 3 on the late-performed scans. Two patients revealed oxyphilic adenoma and three patients oxyphilic carcinoma, but the histology in three patients was not available. Perhaps it would be helpful also to provide the cytological or histological data from these patients. In another group of 23 patients, the late-performed scans showed no tracer retention; therefore, they were scored 0. Within this group, there were two patients with elevated nodular-to-extranodular normal thyroid tissue (N/T) ratios (1.35 in Patient 17 and 1.56 in Patient 18). It is not clear why they were not visible on the scan.

We agree with Vattimo et al. (2) that oxyphilic tumors have increased tracer uptake, but in our study, all patients with microfollicular adenomas, four patients with papillary carcinoma and one patient with follicular carcinoma also took up and retained the tracer. They were also all visible on the scan. The retrospective calculated mean values (nodule-to-thyroid counts, N/T) for microfollicular adenomas was  $1.28 \pm 0.22$  for early and  $1.48 \pm 0.28$  for the late-performed scan. The washout rate for the normal thyroid tissue was  $32\%/\text{hr} \pm 0.64\%/\text{hr}$  and for the nodules  $26.55\%/\text{hr} \pm 17\%/\text{hr}$ .

Similar results could be obtained in our study for the cationic complex  $^{99m}\text{Tc}$ -tetrafosmin dual-phase scintigraphy of thyroid nodules (3). There were 57 patients (11 carcinoma, 21 adenoma, 24 degenerative goiter and 1 Hashimoto's disease). All microfollicular and oxyphilic adenomas showed visible tracer uptake superior to the normal thyroid gland on the early scan and retention on the late images. On the delayed scan, the N/T ratio for microfollicular adenomas was  $1.38 \pm 0.28$  and  $1.70 \pm 0.43$  for oxyphilic adenomas. It also could be demonstrated that the tetrafosmin uptake by the adenomas exceeded that by the thyroid gland on the early scan, with mean values of  $1.46 \pm 0.5$  for microfollicular and  $1.75 \pm 0.45$  for oxyphilic adenomas. The mean washout rate for nodules was  $33.13\%/\text{hr} \pm 8.66\%/\text{hr}$ , and the washout rate for the normal thyroid tissue was  $30.96\%/\text{hr} \pm$