

Technetium-99m-Sestamibi Uptake by Recurrent Hurthle Cell Carcinoma of the Thyroid

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Technetium-99m-sestamibi has been reported to localize in various tumors. Scintigraphic results for a patient with recurrent Hurthle cell carcinoma of the thyroid whose tumor was imaged with both ^{99m}Tc -sestamibi and ^{201}Tl , but not with ^{131}I , are presented.

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Technetium-99m-sestamibi has recently been approved for use as a myocardial perfusion imaging agent. It is an isonitrile whose myocardial distribution is proportional to regional blood flow. Once intracellular, it is sequestered largely within the mitochondria (1).

Like ^{201}Tl , ^{99m}Tc -sestamibi has been reported to localize in various types of lung carcinoma (2,3), thyroid carcinoma (4) and in osteogenic sarcoma (5). Visualization of suppressed normal thyroid tissue has been also described (6).

We present a patient with recurrent Hurthle cell carcinoma of the thyroid, which was successfully imaged with both ^{99m}Tc -sestamibi and ^{201}Tl -chloride, but not visualized with ^{131}I .

CASE REPORT

A 65-yr-old male underwent total thyroidectomy for Hurthle cell carcinoma 17 yr previously. Fifteen years after the initial surgery, a neck recurrence was resected. Three months later another neck mass was found necessitating re-operation. One month following the second resection, the serum thyroglobulin was unmeasurable. However, 3 mo later, a 6.5-cm neck mass was palpated. Iodine-131 imaging at that time revealed iodine-accumulating tissue in the neck for which the patient received an ablative dose of 181 mCi of ^{131}I .

A follow-up ^{131}I scan of the neck and chest 1 yr later (5 mo prior to sestamibi scintigraphy) was obtained 6 wk after thyroid hormone discontinuation with the patient on a low-iodine diet for the last 10 days before the study. Two hundred thousand-count images obtained 48 hr following the oral administration of 5 mCi of ^{131}I -sodium iodide revealed no abnormal uptake (Fig.

1), however, serum thyroglobulin levels were gradually rising, reaching a value of 430 ng/ml (normal less than 25 ng/ml) at the time of the ^{131}I scan. There was no palpable mass in the neck and the chest x-ray was negative. A subsequent CT scan of the chest revealed a 1.5 cm right suprasternal mass. Despite the resection of this now third recurrence, serum thyroglobulin levels increased further to 527 ng/ml over the next few months. Since the previous ^{131}I neck and chest study failed to identify iodine-accumulating tissue, the patient was referred for a ^{201}Tl study. Whole-body and 1 million count neck and chest images were obtained at 1 and 4 hr after the i.v. administration of 5 mCi of ^{201}Tl -chloride utilizing a large field of view camera with a high-resolution collimator. The images demonstrated two foci of abnormal thallium uptake within the inferior portion of the right neck (Fig. 2A-B), corresponding to a palpable 2-cm mass. No additional sites of abnormal thallium accumulation were present.

One week following thallium scintigraphy, whole-body and 1 million count neck and chest images were acquired 1 hr after i.v. administration of 20 mCi of ^{99m}Tc -sestamibi, again using a high resolution collimator. The images revealed findings concordant with those demonstrated following thallium administration (Fig. 3A-B). In comparison to the thallium images, however, the abnormalities seen with the technetium tracer were more sharply defined and displayed a much better target-to-background ratio.

Pathologic examination of the resected mass showed recurrent Hurthle cell carcinoma.

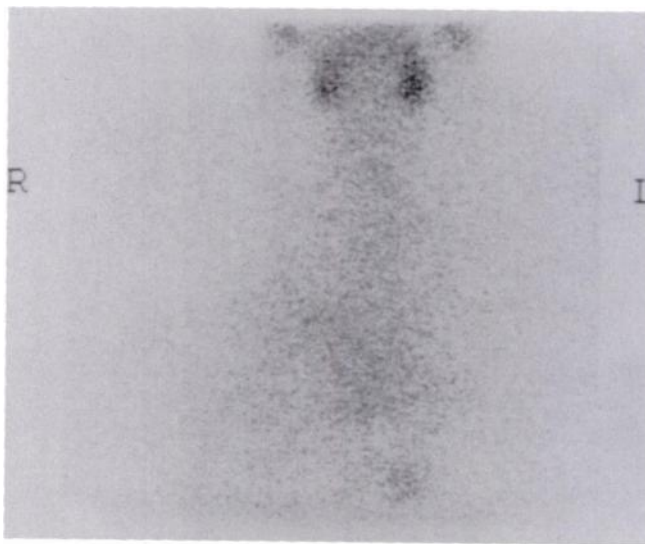


FIGURE 1. Anterior view of the neck and chest obtained 48 hr after the oral administration of 5 mCi of ^{131}I fails to demonstrate any abnormal iodine accumulating tissue.

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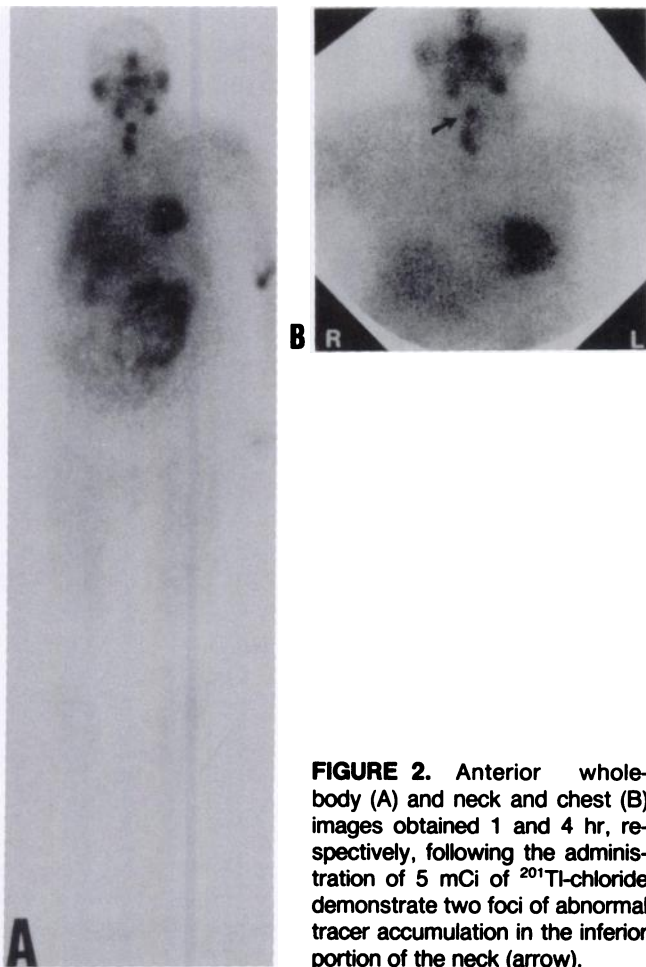


FIGURE 2. Anterior whole-body (A) and neck and chest (B) images obtained 1 and 4 hr, respectively, following the administration of 5 mCi of ^{201}Tl -chloride demonstrate two foci of abnormal tracer accumulation in the inferior portion of the neck (arrow).

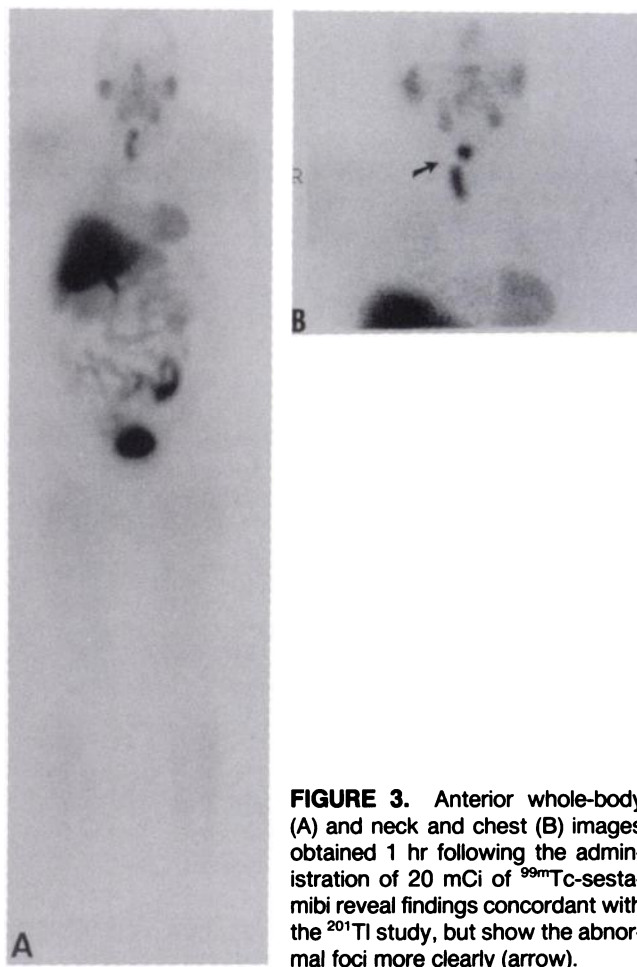


FIGURE 3. Anterior whole-body (A) and neck and chest (B) images obtained 1 hr following the administration of 20 mCi of $^{99\text{m}}\text{Tc}$ -sestamibi reveal findings concordant with the ^{201}Tl study, but show the abnormal foci more clearly (arrow).

DISCUSSION

Hurthle cell carcinomas comprise less than 10% of thyroid carcinomas (7,8). They are classified as a variant of follicular carcinoma (9,10) and are composed of histologically distinct, large oxyphilic cells (Hurthle cells, oncocytes) containing abundant mitochondria (10,11).

The clinical course and prognosis of Hurthle cell carcinoma is essentially similar to follicular carcinoma (8,11-14), though some believe it may be slightly worse. Hurthle cell carcinomas tend to recur, invade locally and metastasize by either the lymphatic or the hematogenous route.

Unlike follicular or papillary carcinomas, most Hurthle cell neoplasms do not accumulate radioiodine but are capable of synthesizing thyroglobulin (7). Therefore, imaging of these tumors with radiotracers other than [^{131}I] sodium iodide has been sought. Visualization of Hurthle cell carcinoma with ^{201}Tl (15) and with ^{131}I -labeled anti-CEA antibody (16) has been reported.

We postulate that it is the abundance of mitochondria within Hurthle cells that accounts for $^{99\text{m}}\text{Tc}$ -sestamibi uptake in this tumor type. Sestamibi (hexakis 2-methoxy isobutyl isonitrile) is a monovalent cation with six lipophilic ligands that passively crosses cell membranes and is

concentrated primarily within the mitochondria (1). Our patient's recurrent Hurthle cell carcinoma demonstrated no ^{131}I uptake but was well visualized with ^{201}Tl and $^{99\text{m}}\text{Tc}$ -sestamibi. In addition, discontinuation of thyroid hormone therapy and a restrictive low-iodine diet was not required.

In comparison to the thallium images, the $^{99\text{m}}\text{Tc}$ -sestamibi images were of superior quality due to the optimal physical characteristics of the radionuclide. The physical properties of $^{99\text{m}}\text{Tc}$ allow administration of up to ten times higher doses of the radiopharmaceutical with dosimetry comparable to ^{201}Tl . The higher count rate and the superior image quality obtained with $^{99\text{m}}\text{Tc}$ -sestamibi should, at least theoretically, improve our ability to identify small tumor sites.

Further investigation of Hurthle cell tumor imaging with $^{99\text{m}}\text{Tc}$ -isonitriles is required, however, to substantiate our hypotheses.

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