

## Thallium-201 Imaging in Thyroid Carcinoma— Appearance of a Lymph-node Metastasis

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*Before surgery, thallium-201 chloride detected a supraclavicular metastasis from a mixed follicular and papillary adenocarcinoma of the thyroid.*

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Radioactive thallium has been used for myocardial imaging (1), renal medullary imaging (2), and tumor detection (3,4). Previously we have observed marked thyroid uptake of Tl-201 in patients with goiter, in-

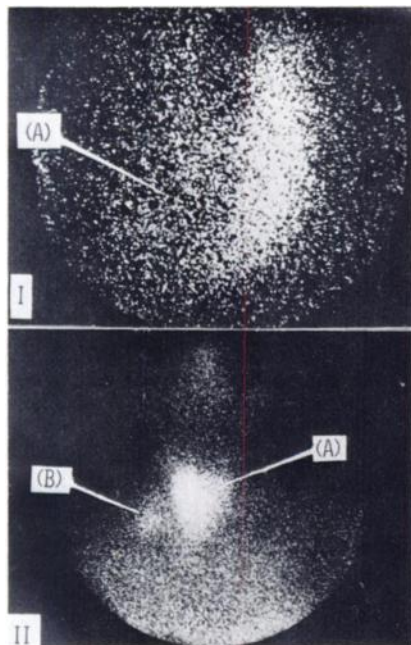
cluding nontoxic nodular goiter. The case reported in this paper was examined to obtain information on thyroid uptake of Tl-201, and a metastasis in a lymph node was detected.

Thallium-201 chloride was used. Its radionuclidic purity was specified as Tl-201 > 99.0%, Tl-203 < 1.0%, and Pb-203 < 0.2%, and its chemical purity as  $Tl^{2+} < 2 \mu g/ml$ , and  $Ca^{2+} < 2 \mu g/ml$ . The spectrum and biologic behavior of Tl-201 chloride used in this study were similar to those of thallium-201 from other commercial sources.

One mCi of Tl-201 chloride was given intravenously by bolus injection and storage of counts was started 3 min later for thyroid imaging. The instrument was a gamma camera with a collimator having 10,000 parallel holes for thyroid imaging, collimator-to-patient distance was 6 cm.

### CASE REPORT

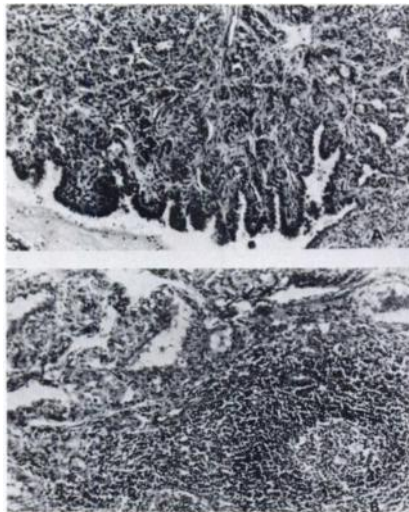
A 29-year-old woman, who has had a hard nodule (3.0 × 3.5 cm) in the right lobe of the thyroid for 5 yr, was admitted to hospital with systemic lupus erythematosus (SLE). Results of thyroid-function tests were as follows:  $T_3$ -resin uptake 30.8%,  $T_3$  128 ng/dl,  $T_4$  7.0  $\mu g/dl$ , and TSH 1.3  $\mu U/ml$ . Thyroid



**FIG. 1.** Scintigraphic images obtained with iodine-131 and thallium-201 chloride. I: I-131 image shows defect due to cold nodule in right lobe of the thyroid (A); II: marked uptake of Tl-201 is observed in a thyroid nodule (A), and also in a supraclavicular lymph node to its right (B).

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**FIG. 2.** Photomicrographs of nodule in right thyroid lobe (A), and a supraclavicular lymph node on the right side (B). Histologic diagnosis was mixed follicular and papillary adenocarcinoma.

scintigraphy using I-131 showed a cold nodule in the right thyroid lobe (Fig. 1, I). No appreciable uptake of I-131 was observed in the extrathyroidal region. Three weeks later, Tl-201 imaging was performed and marked uptake of Tl-201 was observed in the right thyroid lobe. In addition, however, there was obvious concentration of Tl-201 in the right supraclavicular area (Fig. 1, II).

A right hemithyroidectomy, with removal of the lymph nodes on the right side, was performed for thyroid cancer with suspected metastases to the cervical nodes. Exploration revealed a nodule measuring about  $5.5 \times 3.5$  cm in the right thyroid lobe, and in a single supraclavicular lymph nodes, about  $2.0 \times 2.0$  cm in size, on the right side. Other cervical lymph nodes, however, were of normal size.

The surgical specimens showed mixed follicular and papillary adenocarcinoma of a nodule in the right thyroid lobe (Fig. 2A), and metastatic adenocarcinoma of a right supraclavicular lymph node (Fig. 2B). Of the eight lymph nodes obtained from the right-sided neck dissection, five showed the foregoing microscopic picture.

#### DISCUSSION

Recently Tl-201 has been found useful for various diagnostic purposes (1-4), but there are no reports of the uptake of Tl-201 in the lymph-node metastasis

of patients with cancer. It has long been known that the uptake of radioactive iodine can occur in the metastases of certain patients with thyroid cancer (5). In the present case, however, marked uptake of Tl-201 was observed, not only in the primary nodule but in a cervical metastasis as well—both being nonfunctioning by I-131 scintiscan.

Thallium-201 has biologic properties like those of potassium. It can replace potassium in the activation of pyruvate kinase (6), and in the Na-K ATPase system (7). It is well known that other potassium analog such as cesium-131 and potassium-42 can localize in some neoplastic tissues (8,9). It seems likely, therefore, that the mechanism of thallium uptake in our patient's neoplasm was similar to that of the other potassium analogs.

Our patient's scintiphoto, however, did not show Tl-201 in the deep superior cervical metastases. Perhaps this was due to the normal size of these nodes and their deep location.

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