

# Thymic Uptake of Iodine-131 in the Anterior Mediastinum

Irini E. Veronikis, Peter Simkin and Lewis E. Braverman

Departments of Medicine and Nuclear Medicine, University of Massachusetts Medical Center, Worcester, Massachusetts

Two thyroidectomized patients with a history of differentiated thyroid carcinoma are presented who had nonmetastatic mediastinal  $^{131}\text{I}$  uptake following therapeutic doses of  $^{131}\text{I}$ . Chest CT scans in both patients demonstrated an anterior mediastinal mass. Surgical excision in one patient and a percutaneous CT-guided fine needle aspiration biopsy in the other disclosed normal thymus tissue. Iodine-131 uptake in the anterior mediastinum in patients thyroidectomized for follicular or papillary thyroid carcinoma may represent the thymus.

**Key Words:** thymus; thyroid carcinoma; mediastinum; iodine-131 therapy

**J Nucl Med 1996; 37:991-992**

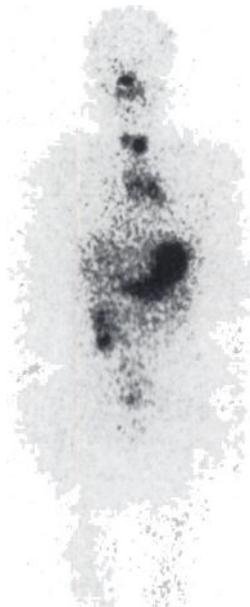
Nonmetastatic mediastinal radioiodine ( $^{131}\text{I}$ ) uptake has been reported in young adults with differentiated carcinoma of the thyroid who had previously undergone total thyroidectomy and  $^{131}\text{I}$  therapy, but no mention of thymus  $^{131}\text{I}$  uptake was made (1,2). Initially, the mediastinal uptake was thought to represent ectopic thyroid tissue or secretions in the tracheobronchial tree and it is only recently that thymic hyperplasia was proposed to be the underlying cause in four reported patients (3,4).

We report two young adults with anterior mediastinal uptake following  $^{131}\text{I}$  therapy due to thymic tissue, similar to other recent reports (3,4). Anterior mediastinal uptake in younger patients following  $^{131}\text{I}$  therapy for thyroid cancer does not, therefore, always represent mediastinal metastases.

## CASE REPORTS

### Patient 1

A 20-yr-old man with a history of a multinodular goiter was found to have a 4 × 5-cm cold nodule in the right lower lobe of the thyroid. Fine needle aspiration biopsy revealed abundant follicular and Hurthle cells. A near total thyroidectomy revealed follicular carcinoma of trabecular pattern with multifocal capsular and vascular invasion in the right thyroid lobe. Radioiodine ablation with 95 mCi  $^{131}\text{I}$  was carried out postoperatively due to small residual uptake in the thyroid bed. Serum thyroglobulin was 0.8 ng/ml, antithyroglobulin antibodies were negative and TSH was elevated to 35  $\mu\text{U}/\text{ml}$  prior to  $^{131}\text{I}$  therapy. Post-treatment whole-body imaging demonstrated uptake in the anterior-superior mediastinum as well as the thyroid bed (Fig. 1). CT scan of the chest revealed an anterior-superior mediastinal mass. Percutaneous CT-guided needle aspiration biopsy of the mass was performed and cytological examination disclosed cells consistent with thymic tissue. The patient is now being treated with TSH suppressive



**Patient 1**

**FIGURE 1.** Anterior view of the 95-mCi post-therapy  $^{131}\text{I}$  whole-body scan of Patient 1 who had undergone total thyroidectomy for follicular thyroid carcinoma. Anterior mediastinal uptake is shown below the thyroid bed uptake.

doses of L-thyroxine (0.3 mg/day) and remains well. An L-thyroxine withdrawal  $^{131}\text{I}$  scan has not as yet been obtained.

### Patient 2

A 21-yr-old man with a history of Hashimoto's thyroiditis at age 15 yr was diagnosed with papillary carcinoma of the thyroid metastatic to the cervical, submandibular, supraclavicular and paratracheal lymph nodes bilaterally. Near total thyroidectomy and bilateral node dissection and radioiodine ablation with 159 mCi  $^{131}\text{I}$  for residual uptake in the thyroid bed was performed. Close follow-up for the next 6 mo revealed cancer recurrence in the left cervical and supraclavicular nodes which were excised surgically. Four years later, routine total body scanning following L-thyroxine withdrawal (TSH = 80  $\mu\text{U}/\text{ml}$ ) demonstrated a small area of uptake in the thyroid bed. Iodine-131 (116 mCi) was administered. Post-treatment total body scanning demonstrated  $^{131}\text{I}$  uptake in the left upper mediastinal region (Fig. 2). CT scan of the chest demonstrated an anterior mediastinal mass. Serum thyroglobulin determinations were always low due to the presence of high levels of antithyroglobulin antibodies (>30 U/ml). A median sternotomy and surgical excision of the mass was performed. Pathologic examination disclosed hypertrophic thymus without any evidence of thyroid tissue. Currently, the patient is receiving TSH suppressive doses of L-thyroxine.

Received Feb. 14, 1995; revision accepted Nov. 8, 1995.

For correspondence or reprints contact: Lewis E. Braverman, MD, Division of Endocrinology, University of Massachusetts Medical Center, 55 Lake Ave. North, Worcester, MA 01655.



**Patient 2**

**FIGURE 2.** Anterior view of the 116-mCi post-therapy  $^{131}\text{I}$  whole-body scan of Patient 2 who had undergone near total thyroidectomy and bilateral node dissection for papillary thyroid carcinoma. Anterior mediastinal uptake is shown with a black arrow.

## DISCUSSION

Mediastinal  $^{131}\text{I}$  uptake in patients with differentiated thyroid carcinoma does not always represent metastases. Mediastinal uptake of  $^{131}\text{I}$  in a hiatal hernia can mimic recurrence of papillary thyroid carcinoma (6). Over the last decade, several patients with papillary thyroid carcinoma who developed significant uptake in the mediastinum after thyroidectomy and  $^{131}\text{I}$  therapy have been reported (1,2). Interestingly, none of the above reported patients had any clinical or biochemical evidence of recurrent thyroid carcinoma since the majority had low serum thyroglobulin concentrations. This nonmetastatic mediastinal uptake was considered to represent either ectopic thyroid tissue or secretions in the tracheobronchial tree (1,2). Very recently, four young patients who had undergone thyroidectomy for papillary thyroid carcinoma and therapy with high doses of  $^{131}\text{I}$  had significant  $^{131}\text{I}$  mediastinal uptake due to normal thymus tissue. The mediastinal uptake was not present after removal of the entire thymus (3,4).

In this report, we present two young adults who developed significant mediastinal  $^{131}\text{I}$  uptake caused by thymic tissue. Both patients had well-differentiated thyroid carcinoma and received high-dose  $^{131}\text{I}$  therapy following a near total thyroidectomy. The presence of thymic tissue responsible for the mediastinal uptake was established by surgical excision in one patient and by CT-guided fine needle aspiration biopsy in the other. In contrast with previous reports, one of these two patients had follicular thyroid carcinoma associated with mediastinal  $^{131}\text{I}$  uptake caused by thymic tissue.

Accumulation of radioiodine in thymic tissue within the thyroid has been reported in two patients with papillary thyroid carcinoma (5). In rats, the thymus accumulates radioiodine demonstrated by autoradiography (5) and by tissue/blood radioiodine concentration (7). The thyroid and the thymus are embryologically-related organs and thymic ectopy in the thyroid has been reported in diabetic female mice (8) and also in adult humans with Graves' disease (9) and normal thyroids (10). Nevertheless, the explanation for thymic  $^{131}\text{I}$  uptake remains unknown.

Ectopic thyroid tissue in the thymus could explain the  $^{131}\text{I}$  uptake in the mediastinum. Neither normal thyroid tissue nor metastatic foci of thyroid carcinoma was found in either the four patients previously reported or the present two patients. Interestingly, accessory thyroid tissue due to abnormal embryological migration in the anterior mediastinum physically separated from the thyroid gland, which presented as mediastinal uptake of  $^{131}\text{I}$  during a thyroid scan, has been reported (11).

Thymic tissue should be considered in young and perhaps in older patients with papillary or follicular thyroid carcinoma who have been treated with high doses of  $^{131}\text{I}$  and present with post-therapy mediastinal  $^{131}\text{I}$  uptake. To avoid unnecessary surgical intervention or inappropriate further  $^{131}\text{I}$  therapy, patients should be evaluated with serum thyroglobulin concentrations, chest CT scan and CT-guided fine needle aspiration biopsy to confirm the diagnosis of metastatic thyroid carcinoma.

## ACKNOWLEDGMENT

Supported in part by National Institutes of Health grants DK07302 and DK18919.

## REFERENCES

- Ramanna L, Waxman AD, Brachman MB, et al. Correlation of thyroglobulin measurements and radioiodine scans in the follow-up of patients with differentiated thyroid cancer. *Cancer* 1985;55:1525-1529.
- Greenler DP, Klein HA. The scope of false-positive iodine-131 images for thyroid carcinoma. *Clin Nucl Med* 1989;14:111-117.
- Mishigishi T, Mizukami Y, Shuke N, et al. Visualization of the thymus with therapeutic doses of radioiodine in patients with thyroid cancer. *Eur J Nucl Med* 1993;20:75-79.
- Bestagno M, Pagliaini R, Maira G, Pizzocaro C. Mediastinal uptake of  $^{131}\text{I}$  in patients with thyroid cancer: may it be referred to normal thymus? [Abstract]. *Eur J Nucl Med* 1993;20:648.
- Jackson GL, Flickinger FW, Graham WP III, Kennedy TJ. Thymus accumulation of radioactive iodine. *Penn Med* 1979;11:37-38.
- Willis LL, Cowan RJ. Mediastinal uptake of  $^{131}\text{I}$  in a hiatal hernia mimicking recurrence of papillary thyroid carcinoma. *Clin Nucl Med* 1993;18:961-963.
- Goldman M, Bauer SR. A comparative study of iodine uptake by thyroid and thymus glands of male and female Sprague-Dawley rats of different ages. *Acta Endocrin* 1977;85:64-70.
- Many MC, Drexhage Hemmo A, Deneff JF. High frequency of thymic ectopy in thyroids from autoimmune prone nonobese diabetic female mice. *Lab Invest* 1993;69:364-367.
- Mizukami Y, Nonomura A, Michigishi T, Noguchi N, Nakamura S. Ectopic thymic tissue in the thyroid gland. *Endocrine Pathology* 1993;4:162-164.
- LiVolsi VA. Branchial and thymic remnants in the thyroid and cervical region: An explanation for unusual tumors and microscopic curiosities. *Endocrin Pathol* 1993;4:115-119.
- Salvadore M, Gallo A. Accessory thyroid in the anterior mediastinum: a case report. *J Nucl Med* 1975;16:1135-1136.