

Marked Thyroid Uptake of Thallium-201 in Patients with Goiter: Case Report

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Marked thyroid uptake of thallium-201 was observed in four patients with goiter, namely one case each of hyperthyroidism, primary hypothyroidism due to chronic thyroiditis, chronic thyroiditis in the mild hypothyroid state, and nontoxic nodular goiter.

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Thallium-201 seems potentially useful clinically and has been used for myocardial imaging (1), renal medullary imaging (2), and tumor detection (3,4). Recently Atkins et al. reported that the thyroid uptake of Tl-201 in patients without thyroid dysfunction was only 0.2% of the injected dose (5), but there are no reports on the thyroid uptake of Tl-201 in patients with thyroid diseases. Previously we observed thyroid uptake of 1.18% of the injected dose of Tl-201 in a hyperthyroid patient with angina pectoris after sudden withdrawal of propranolol. The cases reported in this paper were examined to obtain information on thyroid uptake of Tl-201 in patients with thyroid disease.

Thallium-201 chloride was used and its radioisotope 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 μ g/ml, and Cu^{2+} < 2 μ g/ml. Its spectrum and biologic behavior 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 and thyroid uptake. The instrument was a gamma camera with a 10,000-hole parallel collimator for thyroid imaging and a videotape recorder-playback system. Collimator-to-patient distance was 6 cm. Thyroid uptake of Tl-201 was determined from the stored data.

CASE REPORTS

Case 1 is a 35-year-old man who had received antithyroid drug therapy 6 yr previously for hyperthyroidism with periodic paralysis. His chief com-

plaints were palpitation, tachycardia, finger tremor, and muscle weakness. His thyroid function tests were as follows: T_3 -resin uptake 44.7% (normal 12.3-39.2%), T_3 789 ng/dl (normal 100-200), T_4 18.7 μ g/dl (normal 5.0-14.0), and 24-hr I-131 uptake 82.9% (normal 10-40%). His thyroid gland was diffusely enlarged and was estimated to weigh 62 g. Scintigraphy was performed using Tl-201 before treatment for recurrent hyperthyroidism with periodic paralysis, and the net thyroid uptake of Tl-201 was calculated as 1.13% of the injected dose.

Case 2 is a 31-year-old woman who was admitted with chief complaints of soft diffuse goiter of about 45 g in weight, and general fatigue. Results of thyroid function tests were as follows: T_3 -resin uptake 18.7%, T_3 107 ng/dl, T_4 4.9 μ g/dl, TSH 81.6 μ U/ml (normal < 10 μ U/ml), and antithyroid antibody titer 1:10⁸ (normal < 1:10²). A diagnosis of primary hypothyroidism due to chronic thyroiditis was made, and thyroid imaging was performed using Tl-201 before replacement therapy. The net thyroid uptake of Tl-201 was calculated as 1.10% of the injected dose, no significant uptake.

Case 3 is a 55-year-old woman who has had diffuse hard goiter for 4 yr. She was admitted to the hospital with essential hypertension. Results of thyroid function tests were as follows: T_3 -resin uptake 28.1%, T_3 102 ng/dl, T_4 4.2 μ g/dl, TSH 19 μ U/ml, and antithyroid antibody titer 1:10⁴. A diagnosis of

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chronic thyroiditis was made and thyroid imaging was performed using Tl-201. The net thyroid uptake of Tl-201 was calculated as 1.07% of the injected dose.

Case 4 is a 72-year-old woman with a hard nodule (3.5 × 4.5 cm) in the right thyroid lobe. Her thyroid function tests were as follows: T₃-resin uptake 33.4%, T₃ 114 ng/dl, T₄ 7.4 μg/dl, TSH 2.5 μU/ml, antithyroid antibody titer 1:10², and 24-hr I-131 uptake 24.2%. Thyroid scintigraphy using I-131 showed a cold nodule in the right lobe. Thallium-201 imaging was performed and net thyroid uptake of Tl-201 was calculated as 2.11% of the injected dose.

DISCUSSION

The use of radioactive thallium in nuclear medicine was first suggested by Kawana et al. (6), and recently Tl-201 has been found useful for various diagnostic purposes (1-4). The distributions of thallium in animals and humans have been reported by several authors (7-11), but there are no reports of the presence of thallium in the thyroid gland. Recently Atkins et al. reported that the thyroid uptake of Tl-201 in patients without thyroid diseases was 0.2% of the injected dose (5). Previously we carried out myocardial imaging using Tl-201 chloride in 40 patients without thyroid diseases, and thyroid uptake was only 0.14 ± 0.05% of the injected dose. In the present experiments, however, intense thyroid uptake of Tl-201 chloride was observed in patients with goiter.

Thallium, a metallic element in group IIIA of the periodic table, has biologic properties like those of potassium. It can replace potassium in activation of pyruvate kinase (11), and in the Na-K ATPase system (12). Several authors have reported the effects of thyroid hormone on potassium metabolism in thyroid diseases (13-15). The effect of potassium on the thyroid gland of patients with thyroid diseases, however, is unknown, and the mechanism of marked thyroid uptake of Tl-201 chloride in our cases is also obscure.

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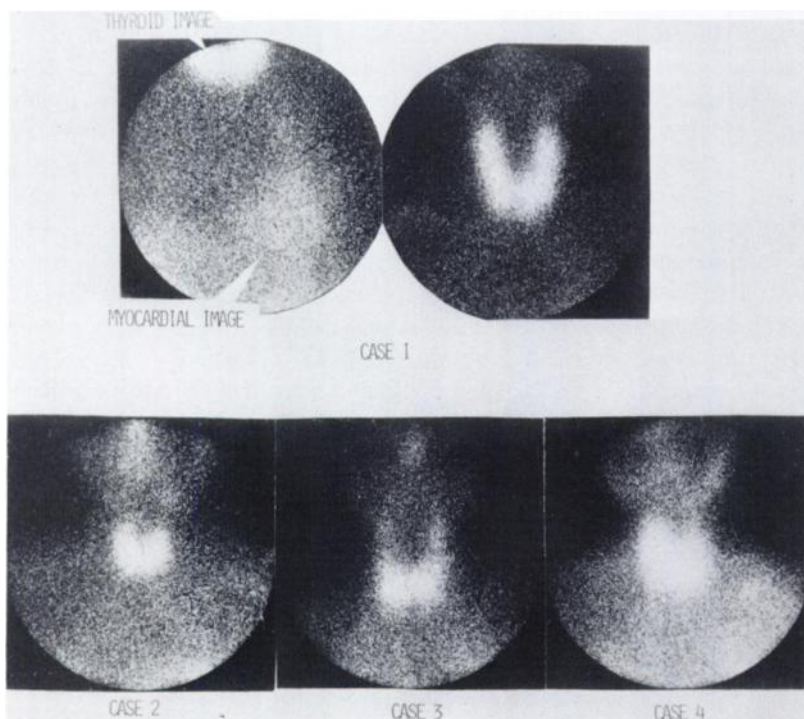


FIG. 1. Thyroid images in patients with goiter. Case 1: hyperthyroidism with periodic paralysis; Case 2: hypothyroidism due to chronic thyroiditis; Case 3: chronic thyroiditis in the mild hypothyroid state; Case 4: nontoxic nodular goiter.

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