Unusual Scintigraphic Findings in a Thyroid Adenoma

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Thallium imaging is increasingly being used to evaluate the thyroid. Uptake patterns of ^{201}Tl in benign and malignant thyroid nodules have been described. Thallium localizes all thyroid tissue with possibly different rates of washout in benign and malignant nodules. This case demonstrates a follicular adenoma presenting ^{123}I as a clinically palpable nodule with nonvisualization of the remainder of the thyroid gland consistent with the diagnosis of an autonomously hyperfunctioning module. Subsequent thallium scanning revealed a complete reversal of tracer distribution with lack of uptake of ^{201}Tl in the nodule while the rest of the gland showed normal thallium accumulation. Surgical excision of the nodule demonstrated follicular adenoma.

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Autonomously functioning thyroid nodules are most commonly adenomatous nodules and are very rarely carcinomas (*1,2*). However, functioning thyroid nodules are almost always benign (*3*). Recent reports have described uptake characteristics of ^{201}Tl in thyroid nodules in an effort to distinguish between benign and malignant nodules (*4–6*). From these reports, it is apparent that all thyroid nodules show early accumulation of thallium, although the rate of tracer washout varies in the delayed images. We present an unusual case with discordance of ^{123}I and ^{201}Tl images of the thyroid nodule.

CASE REPORT

A 63-yr-old male was evaluated for fatigue and weight loss. His physical exam was unremarkable except for a 2-cm right-sided thyroid nodule. His thyroid function tests revealed a normal T4, slightly elevated T3 and a low TSH. Fine needle aspiration biopsy (FNAB) of the nodule was suspicious for a Hurthle cell neoplasm. Both ^{123}I and ^{201}Tl scintigraphy were performed because of the suspicion of a malignant nodule as indicated by FNAB. The ^{123}I thyroid scan revealed uniform tracer uptake in the nodule. The rest of the gland was not visualized, indicating suppression of normal thyroid tissue (Fig. 1) consistent with the diagnosis of an autonomous nodule. Imaging with ^{201}Tl was performed 15–20 min following administration of 2 mCi of ^{201}Tl. Anterior image of the thyroid was obtained using a pinhole collimator for 50,000 counts. The scan revealed lack of tracer uptake in the region of the nodule, while the surrounding thyroid tissue not visualized on ^{123}I scintigraphy showed good tracer uptake (Fig. 2). Since both lobes of the thyroid were visualized on the thallium study, the nodule was localized at the inferior pole of the right lobe. The patient underwent surgical excision of the nodule. Microscopic examination of the nodule revealed a benign follicular adenoma with extensive cystic degeneration (Fig. 3).

DISCUSSION

This case illustrates the complex relationship between histology and functional images. Thallium is known to accumulate in normal thyroid tissue as well as thyroid neoplasms (*4–9*). Several other tumors also have been shown to accumulate thallium (*10–12*). Several mechanisms influence thallium uptake by neoplastic tissue, including tissue perfusion, sodium-potassium ATP-ase transport mechanism and tissue viability (*13–15*). This differs from the mechanism of iodine uptake by the thyroid which includes TSH-dependent, active, iodide transport across the cell membrane and subsequent organification.

In this patient, the ^{123}I thyroid scan indicated a functioning thyroid nodule. Early thallium accumulation in this area would have been expected but was not observed. In fact, the hyperfunctioning nodule localized less ^{201}Tl than the surrounding, metabolically suppressed thyroid. Although the lack of such uptake in this instance is initially puzzling, histopathologic examination of the nodule showing extensive cystic degeneration explains the paucity of thallium uptake in the nodule (i.e., the thallium image reflects overall viable tissue distribution in the gland and the density of the viable tissue is considerably less in the nodule in comparison with the surrounding normal tissue). Also, the presence of necrosis has been explained as a possible explanation for poor thallium concentration which could be due to nonfunctioning ATP-ase cell membrane pump activity (*14,15*). The iodine image by contrast reflects the degree of active iodine incorporation. The activity of the iodide transport mechanism in the thyroidal cells is dependent on circulating

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FIGURE 1. Iodine-123 thyroid scan shows uptake in the right-sided thyroid nodule with lack of uptake in the remainder of the gland. Arrows point to sternal notch and right side markers.

TSH levels. Low TSH levels such as in this patient would minimize transport across normal thyroid tissue, with little or no effect on the autonomous nodule and might thus enable the nodule to accumulate much higher concentrations of radioiodine than adjacent normal thyroid tissue to mask the presence of degenerating, nonviable tissue within the nodule.

This case illustrates the potential complexity which may be encountered in imaging thyroid nodules with thallium or dual-isotope imaging when there are different physiologic pathways involved in tracer binding.

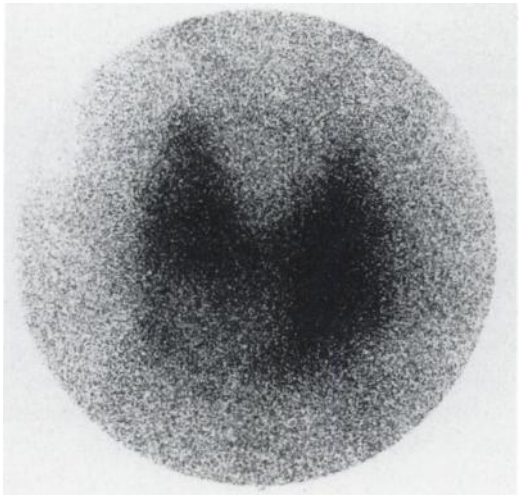

FIGURE 2. Thallium-201 scan of the thyroid shows decreased uptake in the nodule and normal uptake in the remainder of the gland.

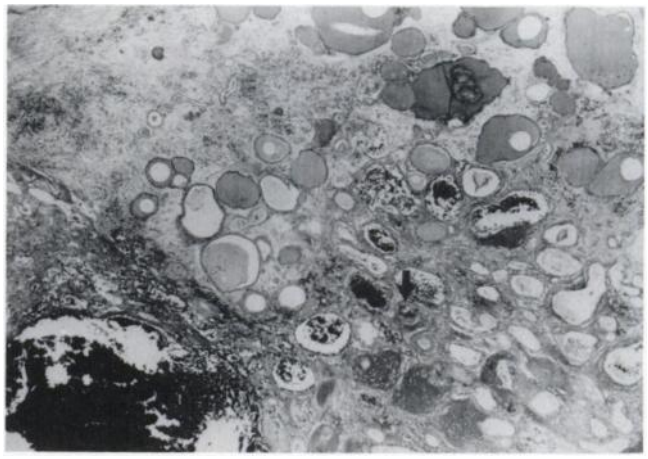

FIGURE 3. Histology of the resected thyroid nodule demonstrates degeneration and necrosis (arrow).

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