

FIG. 3. Photograph of assembled unit.

eter. I is the lamp (12 V, 30 W). Part (CN) is an aluminum tube and cone, sealed into the chamber directly below the lamp, polished on the inside, and sealed at its lower end with a Plexiglas window. It provides illumination for checking of the aerosol. Part (6) connects the chamber to the inhalation side of inhalation-exhalation nose cup (I-E), whose exhalation side leads to a 75-liter leak-proof bag made of thin plastic.

Figure 3 shows a photograph of the unit that is in routine use in our Research Center.

There have been three changes since the earlier description (1,2). The first is the addition of the access-and-viewing window, which is essential during assembly and for visual monitoring of the aerosol generation. The second is the provision of the accessory illuminating lamp and cone. The third change is the removal of the vacuum relief valve, which used to let room air into the chamber during inhalation, thereby partially diluting the aerosol concentration in the chamber. We noted that the efficiency of delivery to the lung improved by 5 to 10% after this modification, with no added respiratory discomfort.

In normal operation, it is recommended that the patient should continue to inhale for two additional minutes after complete nebulization of the radioactivity, to take advantage of aerosol remaining in the chamber.

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#### REFERENCES

1. KOTRAPPA P, RAGHUNATH B, SUBRAHMANYAM PSS, et al: Scintiphotography of lungs with dry aerosol—generation and delivery system: Concise communication. *J Nucl Med* 18: 1082-1085, 1977

2. RAIKAR UR, GANATRA RD, RAGHUNATH B: Dry aerosol delivery system compared to ultrasonic nebulizer. *J Nucl Med* 19: 1088-1089 1978

### Thyroid Carcinoma in an Autonomously Functioning Nodule

Evidence for the very rare occurrence of carcinoma within autonomous hyperactive thyroid nodules can be obtained from review of the literature, which includes only ten such cases (1). Of these ten patients, eight were thyrotoxic and two euthyroid. In eight instances the carcinoma was papillary, whereas in the remaining two patients it was either follicular (2) or mixed papillary and follicular (3).

A 19-year-old white female presented late in 1974 with a 6-week history of a lump in her neck. Physical examination revealed no abnormality except for a 4- by 2-cm firm, mobile, nontender nodule in the left lobe of the thyroid gland. The 24-hr I-131 uptake was 17%, with a  $T_3$  of 23.9 and  $T_4$  7.6  $\mu\text{g}/100$  ml. On I-131 scan, most of the radioactivity showed up in the nodule in the left lobe of the thyroid, while the remainder of the gland showed decreased uptake (Fig. 1, left).

In an attempt to suppress this nodule, the patient was placed on L-thyroxine\* 0.2 mg daily for 6 weeks. Repeat 24-hr I-131 uptake was 12% and scintigraphy showed persistence of activity in the nodule, with total suppression of the remainder of the gland, indicating that the nodule was functioning autonomously (Fig. 1, right).

Since the patient was euthyroid and essentially asymptomatic, she was given no specific treatment but was instructed to return for followup at 6-mo intervals. At the first 6-mo followup, she was still asymptomatic and euthyroid, with no appreciable change in  $T_3$  and  $T_4$  values. By the end of one yr, the only difference noticed on repeat photoscanning was some increase in the size of the nodule, which measured 4  $\times$  3 cm. Accordingly, surgical removal of the nodule was advised.

In December 1975, a left total lobectomy with removal of the isthmus and part of the right lobe was uneventfully accomplished. Histological examination revealed a Grade I mixed papillary and follicular adenocarcinoma measuring 4  $\times$  3.5  $\times$  4 cm, with colloid production in approximately 50% of the tumor. The remainder of the thyroid showed no abnormalities.

Postoperatively, the patient did well and was placed on 0.2 mg Synthroid daily. She was last seen in January 1977, and had no specific complaints.

On the basis of the widely accepted criteria that were clearly re-emphasized by Hamburg (4), the presented case should be considered an autonomously functioning thyroid nodule. His-

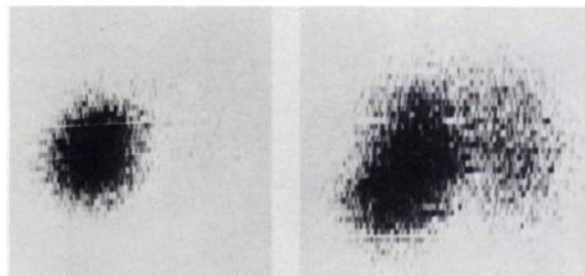


FIG. 1. Iodine-131 thyroid scintiscans showing (left) nodule in left lobe with increased activity, partially suppressing rest of gland, and (right) after 6 weeks of Synthroid, when all activity appeared in nodule of left lobe, with total suppression of remainder of gland.

tological examination of this nodule revealed a Grade I mixed papillary and follicular adenocarcinoma.

The extreme rarity of such a case can be clearly seen from review of the literature, which includes ten cases of thyroid carcinoma within an autonomous nodule. On the functional level, eight of the ten reported patients were thyrotoxic, the other two being euthyroid. In this respect, our patient was euthyroid in spite of the size of the nodule ( $4 \times 3.5 \times 4$  cm). Histologically, such carcinomas have been papillary in eight instances (1), follicular in one case (2), and mixed in another (3). In the present case the tumor proved to be mixed papillary and follicular adenocarcinoma. Lastly, in most of the previously reported cases, the malignant region was small (not exceeding 1 cm in diameter) and was embedded in a hyperfunctioning adenoma (4-7). By autoradiography, Becker et al. (5) demonstrated absence of uptake in the tumor tissue with high uptake in the adjacent hyperplastic thyroid parenchyma. In contrast, our patient proved to have a rather large adenocarcinoma ( $4 \times 3.5 \times 4$ ) with colloid production in approximately 50% of the tumor. This indicates activity of the tumor tissue since it has been shown that the relative ability of various types of thyroid carcinoma to concentrate radioiodine is paralleled by the amount of colloid in the particular cell type (8,9). A similar case of functioning primary thyroid carcinoma proven by autoradiography has been reported previously by Ghose et al. (2).

The present case strongly supports the impression, which has rather limited acceptance, that the presence of an autonomous hyperfunctioning thyroid nodule by scintigraphy should not suffice to rule out the possibility of thyroid malignancy.

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## FOOTNOTE

\* Synthroid, Flint Laboratories, Morton Grove, IL.

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## REFERENCES

1. LAMBERG BA, MÄKINEN J, MURTOOMAA M: Papillary thyroid carcinoma in a toxic adenoma. *Nuklearmedizin* 15: 138-141, 1976
2. GHOSE MK, GENUTH SM, ABELLERA RM, et al: Functioning primary thyroid carcinoma and metastases producing hyperthyroidism. *J Clin Endocrinol Metab* 33: 639-646, 1971
3. SUSSMAN L, LIBRIK L, CLAYTON GW: Hyperthyroidism attributable to a hyperfunctioning thyroid carcinoma. *J Pediatr* 72: 208-213, 1968
4. HAMBURGER JJ: Solitary autonomously functioning thyroid lesions. Diagnosis, clinical features and pathogenetic considerations. *Am J Med* 58: 740-748, 1975
5. BECKER FO, ECONOMOU PG, SCHWARTZ TB: The occurrence of carcinoma in "hot" thyroid nodules. *Ann Int Med* 58: 877-882, 1963
6. MOLNAR GD, CHILDS DS, WOOLNER LB: Histologic evidence of malignancy in a thyroid gland bearing a "hot" nodule. *J Clin Endocrinol Metab* 18: 1132-1134, 1958
7. MEADOWS PM: Scintillation scanning in the management of the clinically single thyroid nodule. *JAMA* 177: 229-234, 1961
8. FITZGERALD PJ, FOOTE FW, JR: The function of various types of thyroid carcinoma as revealed by the radioautographic demonstration of radioactive iodine ( $I^{131}$ ). *J Clin Endocrinol* 9: 1153-1170, 1949
9. BLACK BM, WOOLNER LB, BLACKBURN CM: The uptake of radioactive iodine by carcinoma of the thyroid gland: A study of 128 cases. *J Clin Endocrinol Metab* 13: 1378-1390, 1953