

Scintigrams of the Thyroid Gland

The Diagnosis of Morphologic Abnormalities with I^{131}

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THE USE of a directional scintillation counter to detect the presence of I^{131} in the thyroid gland and to produce a visual representation of the gland—a "scintigram"—for the study of certain morphological characteristics has been presented in previous reports.^{3, 6} It is the purpose of this paper to give the indications for a scintigram and its clinical applications.

METHOD

The directional scintillation counter is designed for localization and therefore has a much narrower field than the scintillation counter used for uptake studies. Thus larger amounts of I^{131} in the thyroid gland—60 to 80 microcuries—are desirable for the production of a scintigram. For this purpose a dose of 100 to 300 microcuries of carrier-free I^{131} , the amount depending upon the avidity of the gland for the substance, is administered orally in a capsule.⁸ This dose is comparable to those previously considered to be in the tracer range.

The scintigram is done 24 to 48 hours after administration of the radioiodine; for hyperthyroid patients 24 hours is preferable. The patient is immobilized in a comfortable position and the scanning tube is run over the neck or other area where functioning tissue is thought to be present. The scaling circuit can be adjusted so that the printing relay will record every second, fourth, eighth, sixteenth, thirty-second or sixty-fourth count. Thus areas containing I^{131} can be recorded at centers about a millimeter apart, while wider spacing occurs where no iodine is accumulated (Figure 1).

INDICATIONS

Outlining the thyroid gland has become a routine procedure in Wadsworth General Hospital and is used, only on the recommendation of the hospital's

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• *Functioning thyroid tissue containing sufficient radioiodine can be visualized by scanning the gland with a directional scintillation counter.⁴ This visual representation of the gland is called a "scintigram." Scintigrams have been invaluable in the detection and study of both "toxic" and non-functioning nodules, diffuse enlargement in hyperthyroidism and the subsequent reduction in gland size after treatment, carcinoma, and aberrant thyroid tissue.*

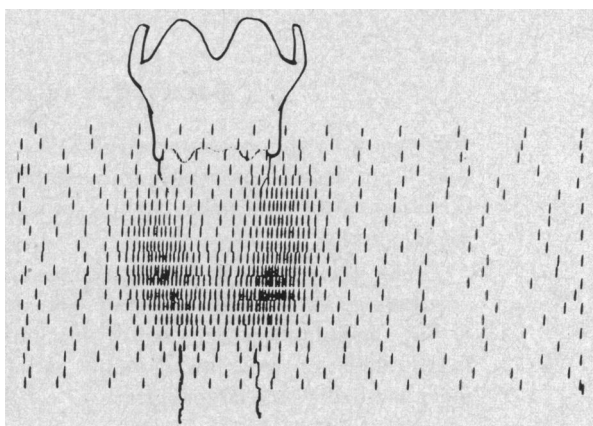


Figure 1.—Scintigram of a latex model of a normal human thyroid gland. The trachea and larynx are sketched in diagrammatically.

radioisotope committee, for obtaining diagnostic information in the following conditions:

1. *Hyperthyroidism*

The differentiation of diffuse enlargement from "toxic" nodules cannot always be solved by palpation. It is well known that patients with "toxic" nodules who are clinically hyperthyroid may have a normal uptake of I^{131} . "Toxic" nodules appear as dense areas on the scintigram (Figure 2), while the remainder of the gland often is not apparent because of suppression of function.⁵

Diffusely enlarged glands (Figure 3) can be visualized and the correct weight of the gland can be

estimated by the formula of Allen and Goodwin.¹ The validity of this formula has been further confirmed by recent and as yet unpublished observations on thyroid glands which were removed shortly after scintigrams had been made. The same method of estimation may be used to determine shrinkage of a diffusely enlarged gland following therapy with I^{131} , and also to determine the amount of thyroid tissue remaining in patients who have recurrence of hyperthyroidism following partial thyroidectomy (Figure 4).

2. Simple goiter

This may include substernal extension of the thyroid gland (Figure 5).

3. Solitary or multiple nodules

While in many cases only a solitary nodule (Figure 6) is palpable, the presence of more than one "non-functioning" area can be demonstrated by outlining. Because solitary nodules, particularly the "non-functioning" which do not accumulate I^{131} ,

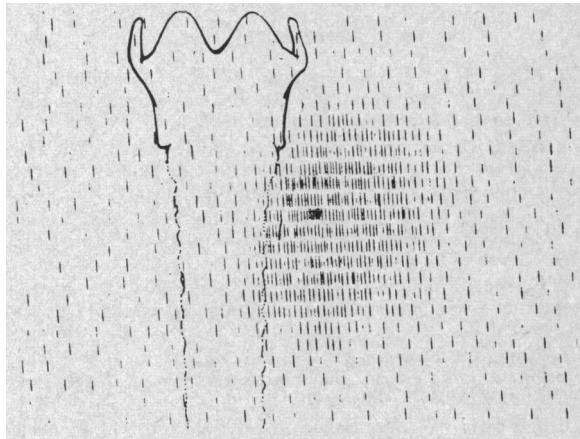


Figure 2.—Scintigram of "toxic" thyroid adenoma in a patient with hyperthyroidism. Note suppression of I^{131} accumulation in the remainder of the thyroid gland.

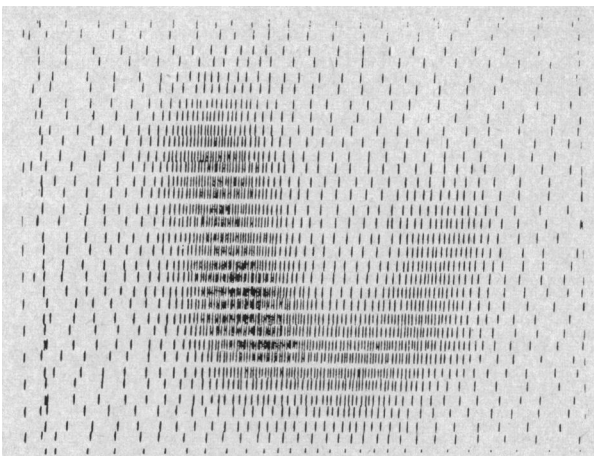


Figure 3.—Scintigram of a diffusely enlarged thyroid gland in a patient with hyperthyroidism.

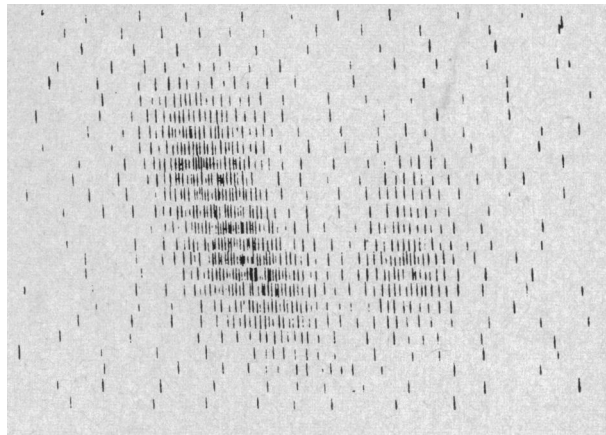


Figure 4.—Scintigram of the thyroid gland of a patient with recurrent hyperthyroidism in whom most of the left lobe had been removed previously.

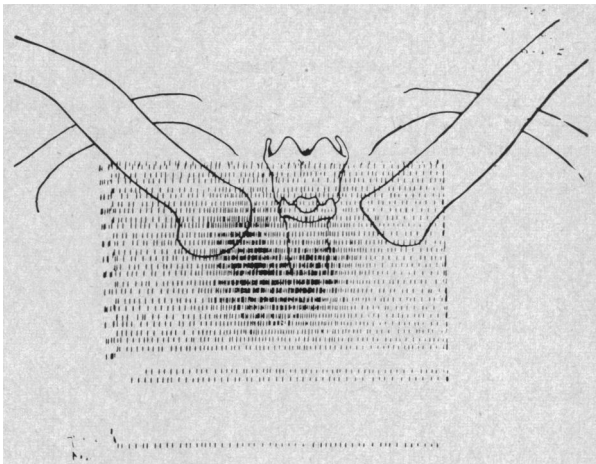
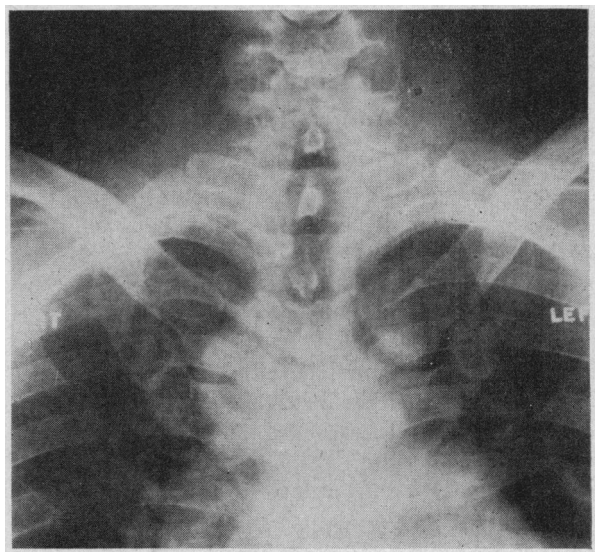


Figure 5.—Upper, note the superior mediastinal mass. Lower, scintigram of the superior mediastinal mass with clavicles, first ribs, larynx and trachea sketched in diagrammatically.

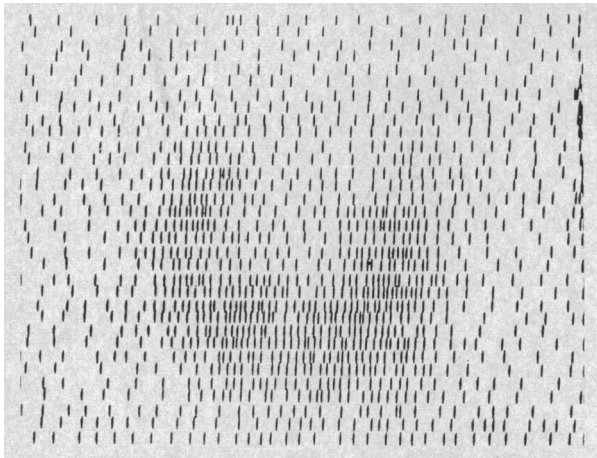


Figure 6.—Scintigram of the thyroid gland of a patient with a “non-functioning” adenoma arising from the right lobe of the thyroid and displacing this lobe posteriorly and upwards.

are, it is believed, more frequently associated with carcinoma of the thyroid gland, the demonstration of these nodules is extremely important.

4. Carcinoma of thyroid gland

Only about one in seven carcinomas of the thyroid gland accumulates radioiodine, but where the primary lesion is susceptible, metastases which accumulate radioiodine may likewise be studied by the scintigram. In many cases after removal of a cancerous thyroid gland the metastases which previously did not accumulate radioiodine do so. Sometimes this action in the metastases can also be stimulated by the administration of thiouracil and thyroid stimulating hormone (TSH). Under all these conditions the outlining procedure is very helpful.

5. Aberrant thyroid tissue

Figure 7 illustrates the use of the scintigram to demonstrate this condition.

ACKNOWLEDGMENT

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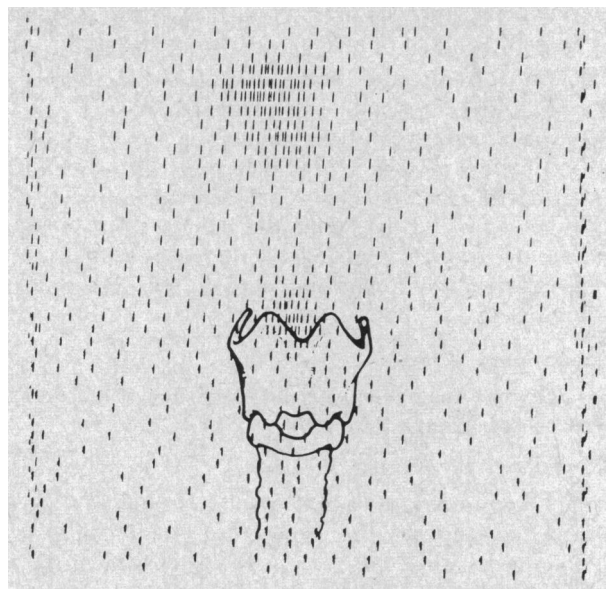


Figure 7.—Scintigram of sublingual and prelaryngeal thyroid tissue in a patient who had had thyroidectomy for non-toxic goiter several years before.

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