

Hypothyroidism presenting as a hot pertechnetate nodule

Sami BOUGHATTAS,* Nadia ARIFA,** Maha KACEM,*** Kaouther CHATTI,*
Nabiha RIAHI,**** Habib HASSINE* and Habib ESSABBAH*

**Department of Nuclear Medicine, Sahloul's Hospital, Sousse, Tunisia*

***Department of Radiology, Sahloul's Hospital, Sousse, Tunisia*

****Department of Endocrinology, Monastir's Hospital, Tunisia*

*****Department of Internal Medicine, Moknine's Hospital, Tunisia*

The authors report an uncommon finding of hot nodule on Tc-99m sodium pertechnetate thyroid scan in three patients with hypothyroidism. Data indicate that hypothyroidism is secondary to Hashimoto's disease (HD). There was a concordant aspect on I-131 scan in two; a nodular discrepancy (cold nodule with I-131) was associated with the highest microsomal antibodies titer. The findings of thyroid scan and ultrasonographic findings indicate that hot nodules may be observed either on initial or advanced stages of HD. Color flow Doppler sonography, showed an absence of internal increase of vascularization. These data suggest that the observed hot nodules correspond to localized hyperplasia of the less diseased portions secondary to chronic stimulation by TSH.

Key words: radionuclide imaging, thyroiditis, autoimmune, hypothyroidism, nodule

INTRODUCTION

HASHIMOTO'S DISEASE (HD) is a common autoimmune thyroid disorder characterized by a great variability in scan appearance¹; we report an unusual finding of hot nodule in three patients with hypothyroidism.

CASE REPORTS

Three cases of hot Tc-99m pertechnetate thyroid nodules in patients with primary hypothyroidism were observed during a 2-yr period, from October 2000 through September 2002; they were three women aged between 28 and 55 yr. Medical histories were unremarkable, without previous thyroid surgery or irradiation, iodine excess, painful goiter or post-partum period. The nodule was on the right side in all cases; hypothyroidism was overt in two, and mild in one.

Serum level of TSH ranged from 8 to 47 $\mu\text{UI/ml}$ (normal range: 0.25–4.5) and T_4 from 6.1 to 7.9 pg/ml (normal range: 7–19). Antimicrosomal antibodies (M-Ab) were measured by the tanned red cell hemagglutination technique, and were positive in one; antithyroglobulin antibodies were negative in all.

All patients underwent thyroid scan, for a palpable thyroid nodule, with both Tc-99m sodium pertechnetate and I-131 (Figs. 1 to 3). Thyroid scans were performed on L-thyroxine therapy in two; in one case T_4 -therapy was withdrawal during 4 weeks because a very low thyroid uptake during replacement (Fig. 2). Thyroid scintigrams were acquired with 74 MBq of Tc-99m pertechnetate. A complementary scan with I-131 (1 MBq) was realized in all patients; I-131 scintigram is generally acquired the same day (4–6 hours); if a discrepancy occurs between these radiotracers, a further image is acquired at the conventional delay of 24-hours. Scan findings were discordant in one (Fig. 1), and concordant in two (Figs. 2 and 3). In one case the remaining thyroid tissue was plainly visualized (Fig. 1), and in two the hot nodule was the only area of uptake (Figs. 2 and 3).

Ultrasound scanning was performed by ATL 5000 HDI color-Doppler system with a 7.5 MHz linear scanner; data were collected that measured concerned thyroid glands

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For reprint contact: Sami Boughattas, Associate Professor, Department of Nuclear Medicine, Sahloul's Hospital, 4054, Sousse, TUNISIA.

E-mail: BOUGHATTASSAMI@netscape.net

and nodules, and echogenicity was compared with the sternomastoid muscle. The nodules were isoechoic in one and hypoechoic in two; the largest diameter varied be-

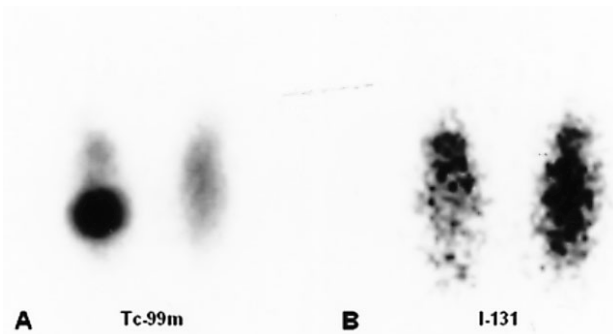


Fig. 1 A 44-year-old woman with overt hypothyroidism. Thyroid scan with Tc-99m pertechnetate showed hot nodule on the right base (A); this nodule was manifestly cold with I-131 (B).

tween 15 and 23 mm. The remaining tissue was hypoechoic in all cases and atrophic in two. Color flow Doppler sonography showed absence of internal increase of vascularization even with low frequency impulsion repetition (Fig. 4).

Fine needle aspiration cytology of the thyroid nodule was performed in two cases and revealed normal vesicular cells; in one case several lymphocytes were present.

The overall characteristics of patients are presented in Table 1.

DISCUSSION

We report herein three cases of functional nodules in a context of hypothyroidism. Such observations are very rare in the medical literature, the functional nodules being generally discovered during the etiological investigation of thyrotoxicosis.

Although M-Abs were negative in the second and third cases, Hashimoto's disease (HD) remains the most prob-

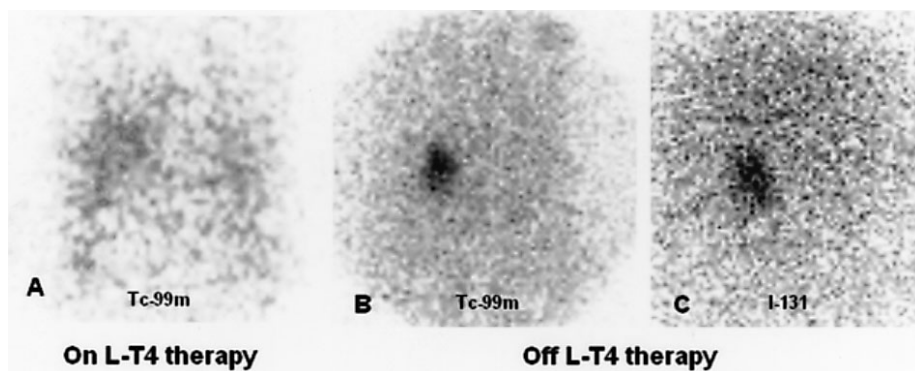


Fig. 2 A 50-year-old woman with overt hypothyroidism. Thyroid pertechnetate scan obtained on T₄-therapy showed a very low uptake. After T₄-therapy withdrawal, thyroid scans with both pertechnetate and I-131 showed that the uptake was limited to a right hot nodule.

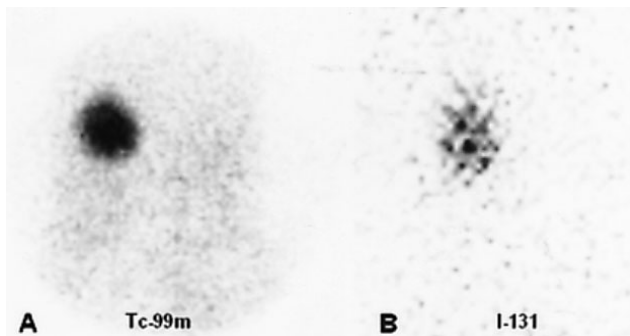


Fig. 3 A 55-year-old woman with mild hypothyroidism. Thyroid scans showed concordant hot nodule on the upper right pole without uptake in the remaining tissue.

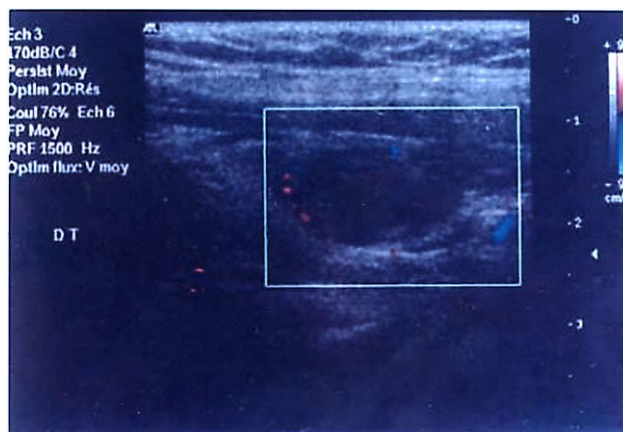


Fig. 4 Color flow Doppler sonography of the thyroid nodule (case 2) showed absence of intranodular hypervascularization with a peripheral rim of increased blood flow.

Table 1 Characteristics of the three patients with hypothyroidism and hot nodule

	Age (yr)	Initial thyroid tests		M-Ab	Thyroid scan		US		CFDS	FNAC
		FT ₄ (pg/ml)	TSH (μ UI/ml)		Tc-99m	I-131	Nodule	Remaining tissue		
1	44	7.9	28.5	1/25600	Hot	Cold	Isoechoic, 15 mm	Hypoechoic, normal volume	Absence of nodular hypervascularization	Benign
2	50	Not done	47	Negative	Hot*	Hot	Hypoechoic, 23 mm	Atrophic, hypoechoic	Absence of nodular hypervascularization	Not performed
3	55	6.1	8.6	Negative	Hot	Hot	Hypoechoic, 21 mm	Atrophic, hypoechoic	Absence of nodular hypervascularization	Benign; presence of lymphocytes

*Pertechnetate scan under L-T₄ showed very low uptake.

able etiology despite the negativity of M-Ab, according, essentially, to the ultrasonographic aspect with atrophic aspect and diffuse reduction in thyroid echogenicity, which constitutes a valid predictor of autoimmune thyroid disease.² Furthermore, no particular findings on cases histories, clinical exams and biological data indicate other possible causes of hypothyroidism.

In HD, thyroid scan may be of particular value especially in the case of a solitary or a dominant thyroid mass with incomplete regression on suppressive therapy suggesting cancer or lymphoma.³ These nodules are usually cold and correspond to severely diseased portions by the destructive and fibrotic process⁴; in some cases, multiple areas of decreased uptake are noted and the scan feature is similar to that of a multinodular goiter.⁵ Exceptionally thyroid scan reveals that the nodule is functional.⁶⁻¹¹ According to the aspect of the surrounding tissue on thyroid scan and ultrasonography, two forms were recognized, i.e. early stage of HD and advanced destructive process. In the first, the surrounding tissue was plainly visualized; in this form follicular cells destruction and fibrosis are slight and left sufficiently normal thyroid tissue, inefficient hormone production is caused mainly by abnormalities of iodine metabolism rather than a destructive process.⁴ In the second form, there was a severe diminished uptake of the remaining thyroid tissue, the functional nodules being the solely areas of uptake.³ So, it appears that the association of HD with hot nodule may be observed either on the early stage of disease or at advanced stage.

The finding of hot nodule in HD underlines the great variability of thyroid scan in this pathology that is called the great mimic¹; this aspect is surprising because of the destructive nature of this disease. The eventuality of autonomous adenoma without sufficient hormone production to overcome hypothyroidism is implausible. Despite the unsuppressed nodule uptake on T₄-therapy (in two cases), it's possible that doses of thyroxine are insufficient to induce TSH suppression. In the reports of Mousavi⁹ and Hoogenberg,¹² most nodules regressed in

patients followed up on adequate thyroid hormone replacement. The most stringent argument against autonomy is the pattern of nodules on color flow Doppler sonography, with absence of intranodular vascularity; indeed a normal or low internal hypervascularization permits to exclude autonomous adenoma with very high predictive value.¹³ This means that hot spots of free technetium did not indicate increased blood flow; as proposed by others, we think that chronic stimulation by TSH or other thyroid autoantibodies contributes to both nodular growth and to the increased ability of nodular tissue to concentrate isotopes.^{9,14} Although the autoimmune process is diffuse, the severity of the disease may vary into the thyroid gland, as suggests the heterogeneity of thyroid abnormalities on pathology¹⁴ or on thyroid scan.^{3,15}

The observed discrepancy in the second case indicates organification defect.¹⁶ Some stages of HD are functionally characterized by an organification defect with large intrathyroid inorganic iodide pool, which can be discharged during perchlorate test. Fluorescent scan study indicates that most patients with HD have decreased stable iodine store on the thyroid gland.¹⁷ Interestingly this discrepancy was associated with the highest titer of M-Ab; in the report of Boi,¹⁰ a similar association was observed with an M-Ab titer of 1/102400. Although *in-vivo* assays showed that M-Ab reach its antigen only with difficulties,¹⁸ the reported scans discrepancies suggest a causal relationship between M-Ab and organification abnormalities in rare cases.

These cases illustrate the great variability of thyroid scan in HD and outline the pathogenetic complexity of this disease. In case of nodular discrepancy, the possibility of HD should be considered.

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