

Case1: 75 yr-old woman with hyperfunctioning adenoma in the right thyroid lobe

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75-yr old woman with hyperfunctioning adenoma in the right thyroid lobe, slowly increasing in size over time. On treatment since several years with methimazole 5 mg/day.

Clinical Data

TSH 0.11 μ IU/mL; fT3 and fT4 within normal limits whilst on methimazole



Thyroid US shows a single hypo-isoechoic nodule in the right lobe of thyroid (37×21×28 mm), with regular margins and intranodular and perinodular vascularization on Doppler-US. The remaining thyroid parenchyma is normal.



**Scintigraphy with $^{99m}\text{Tc-O}_4$ (185 MBq i.v.):
Planar imaging 15 min post-injection, with
pin-hole collimator (128×128, zoom 1).**

Scintigraphy shows a bulky nodule in the right lobe of the thyroid exhibiting focal intense accumulation of $^{99m}\text{Tc-O}_4$, with lower uptake in the central area (hot nodule with necrotic phenomena); radiopharmaceutical uptake in the extranodular parenchyma is markedly reduced/absent.



Solitary hyperfunctioning nodule of the thyroid

The patient is good candidate to radioiodine therapy

The therapeutic activity to be administered is calculated based on weight of the nodule (preferably estimated on US data, but scintigraphic evaluation acceptable) and 24-hr uptake of a tracer amount of ^{131}I -iodide (1,85-3,70 MBq)

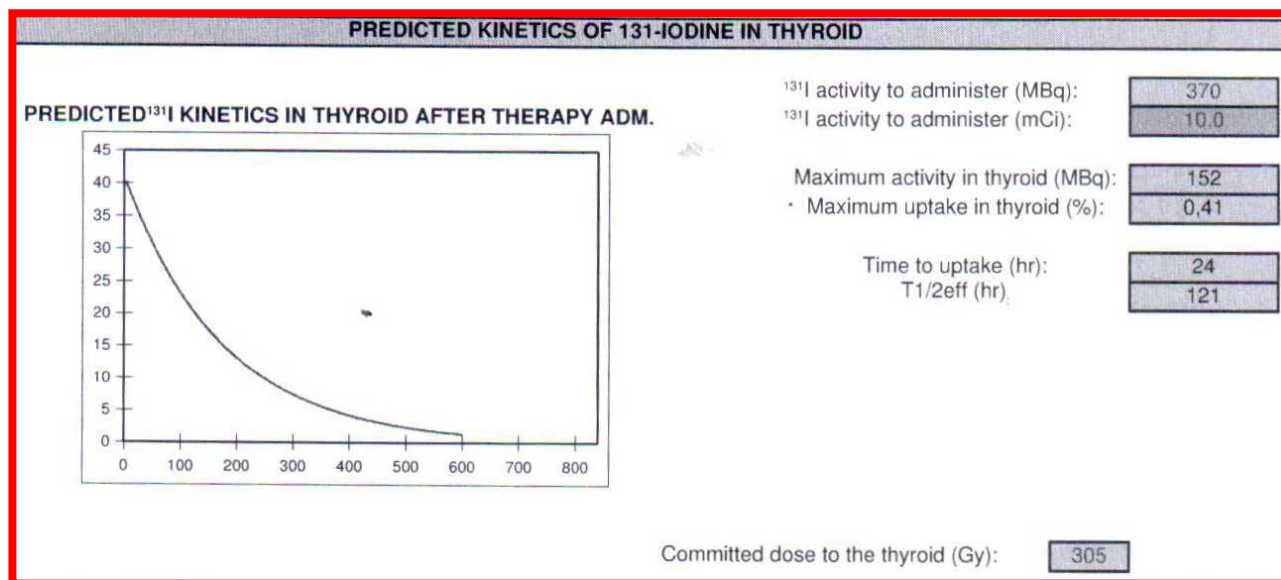
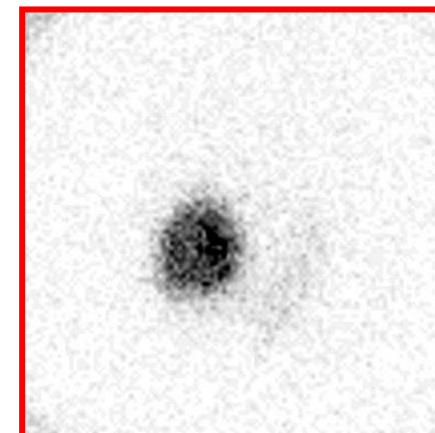
Patient Preparation

Withdrawal of methimazole 2 weeks before therapy (mild clinical signs of hyperthyroidism), and low-iodine diet:

- TSH 0.031 μ IU/mL; fT3 5.54 pg/mL (1.45 - 3.7); fT4 1.1 ng/mL (0.7 - 1.8).**
- Urinary iodine (spot morning sample): 122 μ g/L (<250).**

Nodule volume: 11 mL (evaluated by US).
 24-hr ^{131}I -iodide uptake(1.85 MBq): 41%.

Thyroid scintigraphy 24 hr after 1,85 MBq ^{131}I -iodide (pin-hole collimator)



Predicted ^{131}I activity to deliver a 305 Gy committed dose to the target tissue (nodule): 370 MBq.

Results

Six months after ^{131}I -iodide therapy: complete biochemical and clinical remission of hyperthyroidism:

TSH 0.4 $\mu\text{IU/mL}$; f-T3 2.9 pg/mL (2.1-4.6); fT4 9.6 ng/mL (8.58-18.6).

Discussion (I)

Investigating a thyroid nodule:

- to exclude malignancy;
- thereafter, to define optimal management for any given patient (medical, surgical, radioiodine).

Patient's history (presence of symptoms, prior head/neck radiation exposure, family history of thyroid or endocrine diseases), and clinical examination are crucial in patients with thyroid nodule(s).

Discussion (II)

Investigation of thyroid nodules includes:

1. Assessment of thyroid function (TSH, fT4, fT3).
2. Thyroid auto-antibodies (thyroid peroxidase and antithyroglobulin antibodies are found in Graves' disease or in Hashimoto's thyroiditis; TSH receptor auto-antibodies are detectable in the majority of patients with Graves' disease).

3. Ultrasound investigation and FNAB may demonstrate features suggestive of a malignant nodule (0.2 % malignancy in hot nodules versus 5% in all nodules).

4. When serum TSH is low or suppressed, a thyroid scan is useful to determine if the nodule is a single toxic nodule, part of a toxic multinodular goiter, or a single nodule in a patient with Grave's disease.

Discussion (III)

- CT, magnetic resonance imaging (MRI), and PET scanning are not recommended in the routine workup of thyroid nodules.

Conclusion

- ^{131}I -iodide therapy is a simple and effective way to attain functional ablation of autonomous thyroid adenomas and to induce remission of hyperthyroidism.
- The effectiveness of ^{131}I -therapy in permanently correcting hyperthyroidism from toxic adenoma is up to 82% with a single administration.

Teaching points

- Management of thyroid nodule
- Radioiodine therapy of hyperthyroidism

Reiners C, Schneider P. Radioiodine therapy of thyroid autonomy. *Eur J Nucl Med Mol Imaging*. 2002; 29 (Suppl 2): S471-S478.

Sarkar SD. Benign thyroid disease: what is the role of nuclear medicine? *Semin Nucl Med*. 2006; 36: 185-193.

Filetti S, Durante C, Torlontano M. Nonsurgical approaches to the management of thyroid nodules. *Nat Clin Pract Endocrinol Metab*. 2006; 2: 384-94.

Gharib H, Paini E, Valcavi R, et al. American Association of Clinical Endocrinologists and Associazione Medici Endo-crinologi medical guidelines for clinical practice for the diagnosis and management of thyroid nodules. *Endocr Pract*. 2006; 12: 63-102.

Gharib H, Papini E, Paschke R. Thyroid nodules: a review of current guidelines, practices, and prospects. *Eur J Endocrinol* 2008; 159: 493-505.