Radionuclide examinations of the thyroid gland

Radionuclide examinations and therapies for thyroid pathology have historically been among the first applications of nuclear medicine. Before the examination itself, its informative value must be considered. The necessary **knowledge of the history, physical examination, and laboratory values** specific for the thyroid gland pathology, such as levels of thyroxine and thyroglobulin.

Accumulation test

The patient is given **radioactive ^{131}iodine**, most often orally in the form of capsules. After its absorption from the intestine, iodine ions are taken up by differentiated thyroid structures , both physiological and pathological (tumors and their metastases). However, this does not apply to the medullary part of the thyroid gland.

The output of the test is the measurement of radioactivity over the thyroid gland in 24 hours and a comparison with the activity of the administered radiopharmaceutical. The results may be skewed by some drugs that contain iodine, resulting in saturation of uptake mechanisms and less accumulation of radioiodine.

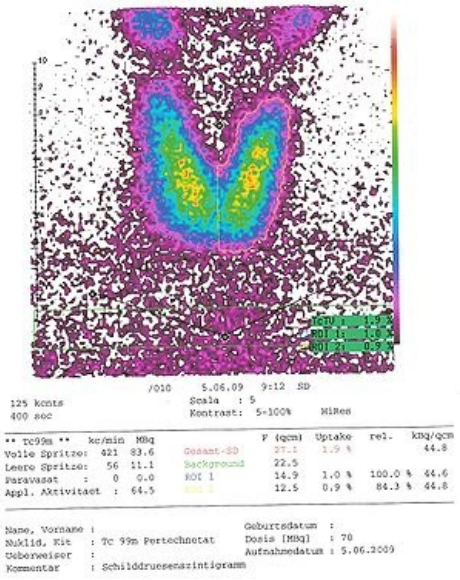
Werner suppression test

After several days of administration of triiodothyronine, **down-regulation** of thyroid metabolism and reduction of radioiodine accumulation below 50% is achieved . Tumors and other pathological lesions do not respond to regulatory mechanisms and their uptake is not significantly reduced.

Accumulation tests are no longer routinely performed, they have been replaced by scintigraphic methods.

Scintigraphic examination

Uptake of various radiopharmaceuticals shows the **distribution** and **degree** of thyroid tissue function. We can monitor the **follicular** or **medullary component** , depending on the radiopharmaceutical we use.



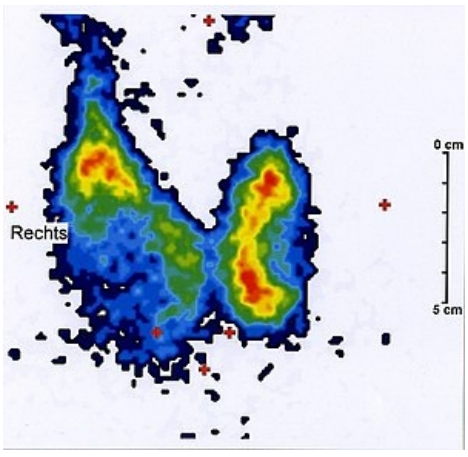
Thyroid scintigraphy

Radiopharmaceuticals

$^{99m}TcO_4^-$ (pertechnate, pertechnetate) is the most commonly used radiopharmaceutical in the form of sodium salt, it replaces ^{131}I, as it is a pure γ emitter with low energy and short half-life, ie it represents less radiation exposure for the organism. It is subject to the same metabolic pathways as iodine. Its disadvantage is the physiological uptake in other tissues (stomach, salivary glands, ...).

^{131}I and **^{123}I** show higher specificity. But it means a higher burden.

^{99m}Tc-DMSA (dimercaptosuccinic acid) and **^{99m}Tc-pentetreotid** are suitable radiopharmaceuticals for thyroid marrow examination and monitoring of C-cell pathologies (especially tumors).



Thyroid scintigraphy (cold deposit on the right)

Evaluation of results

Healthy tissue absorbs the radiopharmaceutical (iodine, pertechnetate) homogeneously. Pathological processes are manifested on the scintigram by a change in the accumulation of the radiopharmaceutical.

- **Homogeneous reduction** - hypothyroidism in Hashimoto's thyroiditis, scarring, sometimes the result of inappropriately strong radiotherapy;
- **Homogeneous increase** - hyperthyroidism (← pituitary adenomas), Graves-Basedow disease ...;
- **" Cold nodules "** - part of the tissue is taken up by the radiopharmaceutical less or not at all. These are cysts, scars, dysfunctional adenomas or undifferentiated carcinomas;
- **" Hot nodes "** - increased uptake of radiopharmaceuticals show Thyroid tumors , hyperfunctional adenomas.

Radionuclide examinations are seldom diagnostic in themselves. However, they play an important role in **differential diagnosis** , **preoperative preparation** and **monitoring of therapeutic processes** .

Links

Related articles

- Thyroid Tumors
- Examination of thyroid function

References

- KUPKA, Karel – KUBINYI, Jozef – ŠÁMAL, Martin, et al. *Nukleární medicína.* 1. edition. vydavatel, 2007. 185 pp. ISBN 978-80-903584-9-2.