

Nuclear medicine in endocrinology

Nuclear medicine in endocrinology

- Thyroid gland: anatomy, function, inflammation, tumor dignity
- Parathyroid gland: localisation
- Adrenal cortex: function
- Adrenal medulla: localisation

2011

Thyroid (Practice)

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Thyroid scintigraphy

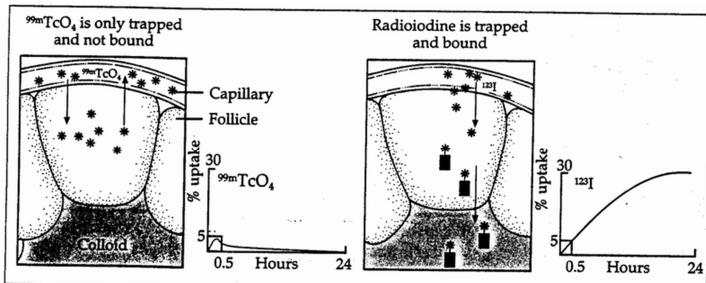
Isotope	Source	$T_{1/2}$	Energy (keV)	Use	Comment
^{99m}Tc	Generator	6 h	140	Thyroid imaging	-daily routine -cheap -low dose
^{123}I	Cyclotron	13.3 h	159	Thyroid imaging	-best -expensive -poorly available
^{131}I	Reactor	8.1 days	$\gamma: 364$ $\beta: 606$	-Thyroid imaging -uptake -therapy	-high dose - β -emission

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Thyroid (Practice)

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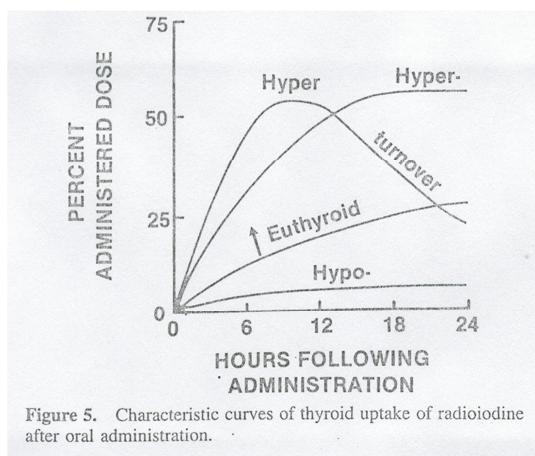
Uptake of different isotopes into thyroid cell



Thyroid (Practice)

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Thyroid uptake



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Thyroid (Practice)

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Thyroid scintigraphy - indications

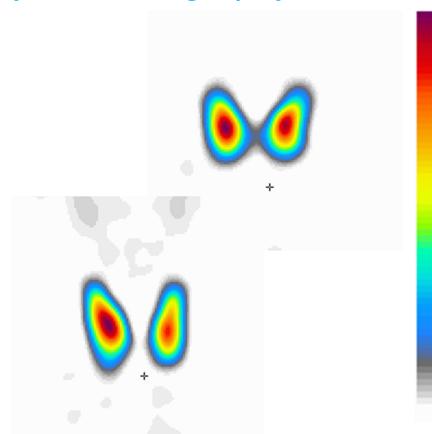
- goiter
- hyperthyroidism
 - Graves disease
 - autonomous adenoma
 - subacute thyroiditis (deQuervain)
- (Hypothyroidism ?)
- palpable nodule in the neck: function?
- evaluation of substernal mass
- postoperative search for functioning metastases

Thyroid (Practice)

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Normal thyroid scintigraphy

- normal size
- homogenous appearance
- sharply defined borders
- straight or convex lateral margins



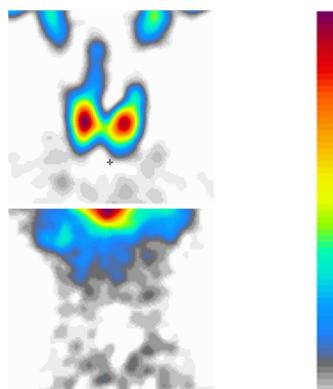
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Thyroid (Practice)

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Normal variants

- ductus thyreoglossus remnant
- sublingual thyroid
- congenital absence of one lobe

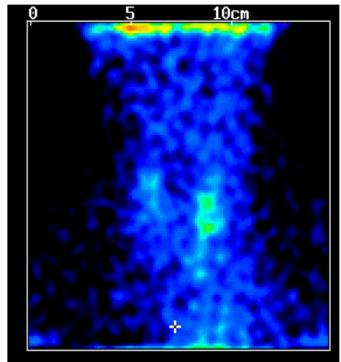


Thyroid (Practice)

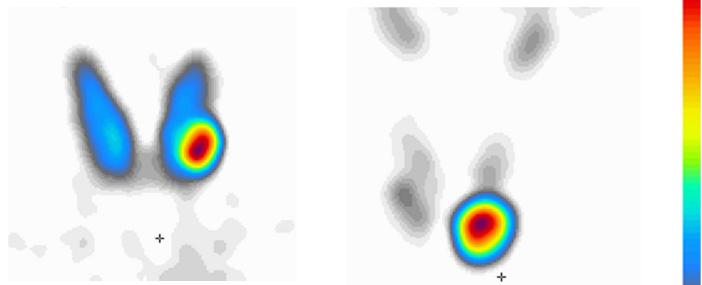
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Non-visualizing thyroid

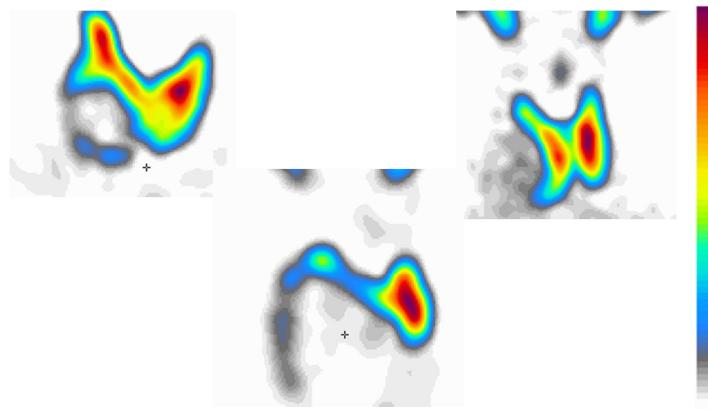
- low thyroid uptake
- thyroiditis
- suppressing or antithyroid medication
- surgical or radioiodine ablation



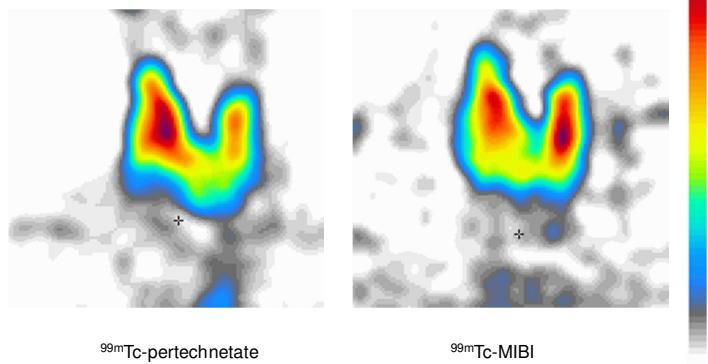
Nodules – hot nodules



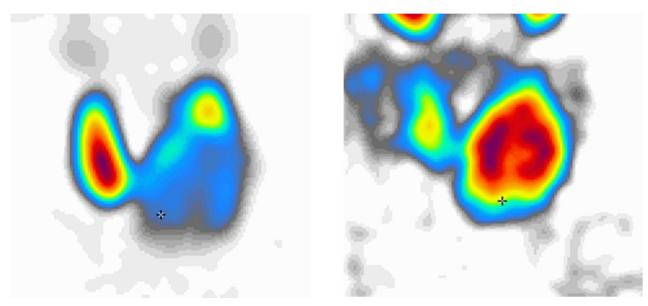
Nodules – cold nodules



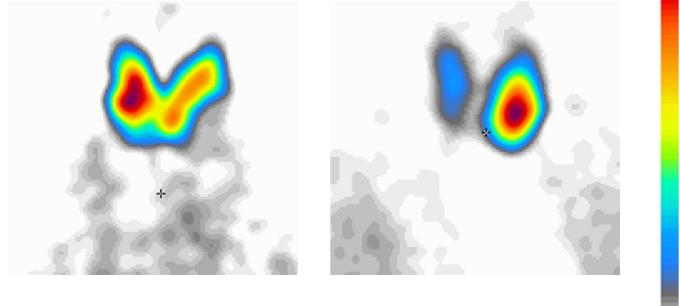
Nodules – cold nodules



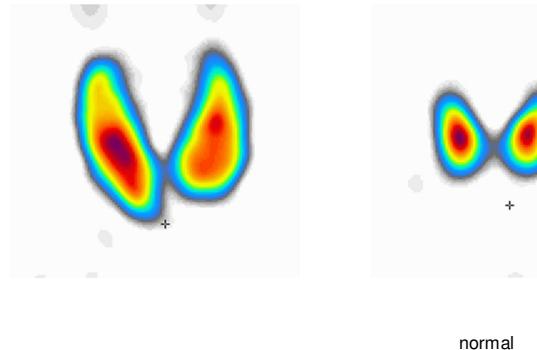
Nodules – cold nodules



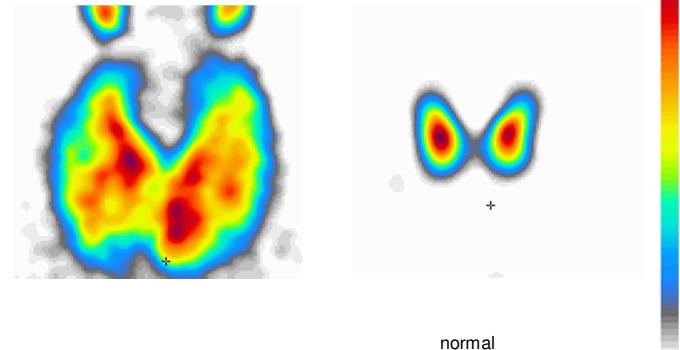
Nodules – cold nodules



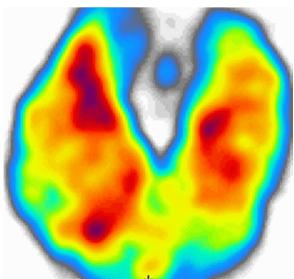
Goiter – diffuse goiter



Goiter – nodular goiter



Goiter – nodular goiter

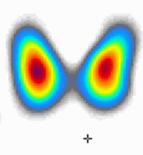


normal

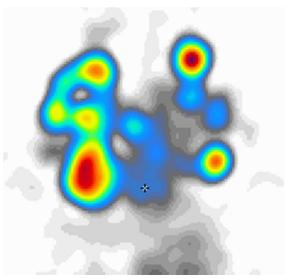
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Thyroid (Practice)

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normal



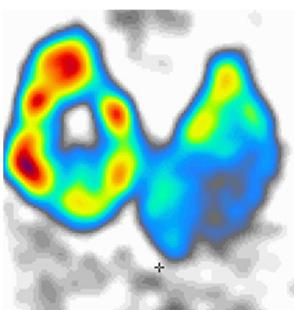
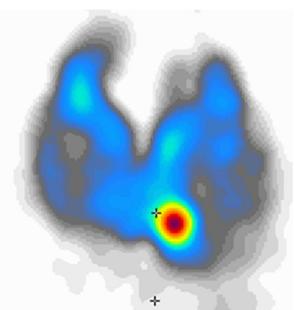
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Thyroid (Practice)

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normal

Goiter – nodular goiter + nodule



After radio-iodine therapy

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Thyroid (Practice)

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normal

Radioiodine therapy of thyroid

- ^{131}I -NaI: β -emission: 606 keV
 γ -emission: 364 keV
 - penetrance in soft tissues: 0.5-0.9 mm
- Indications
 - hyperthyroidism (diffuse: Graves, focal: autonomous adenoma)
 - goiter mass reduction
 - differentiated thyroid cancer
 - tumor remnant ablation after surgery
 - tumor recurrence, metastasis elimination
- Activity to administer (dosage)
 - benign thyroid diseases: calculation (estimated mass, absorption dose in Gy, maximal uptake, effective half-life) – 200-1000 MBq
 - cancer: 3700 MBq (100 mCi) or higher

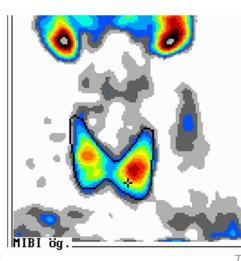
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Thyroid (Practice)

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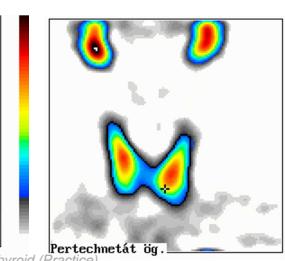
Parathyroid scintigraphy

- Purpose: localisation of parathyroid adenoma (in case of hyperparathyroidism)
- $^{99\text{m}}\text{Tc}$ -MIBI: accumulates in thyroid and parathyroid
- Techniques:
 - $^{99\text{m}}\text{Tc}$ -MIBI washout
 - $^{99\text{m}}\text{Tc}$ -MIBI - $^{99\text{m}}\text{Tc}$ -pertechnetate subtraction



MIBI ög.

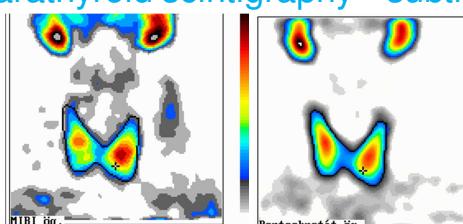
Thyroid (Practice)



Pertechnetát ög.

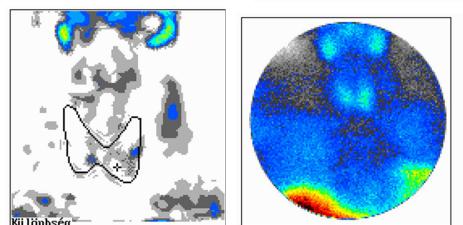
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Parathyroid scintigraphy - subtraction



MIBI ög.

Pertechnetát ög.

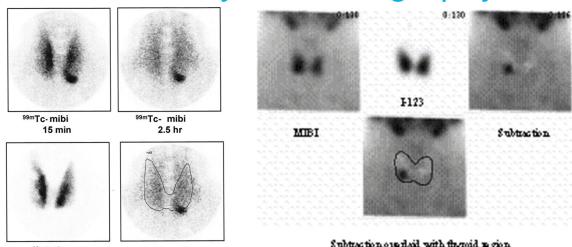


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Thyroid (Practice)

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Parathyroid scintigraphy

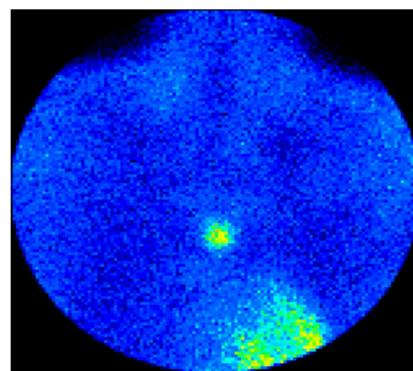


Subtraction result with thyroid region

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Parathyroid scintigraphy – washout (mediastinal localisation)



anterior mediastinal view

Thyroid (Practice)

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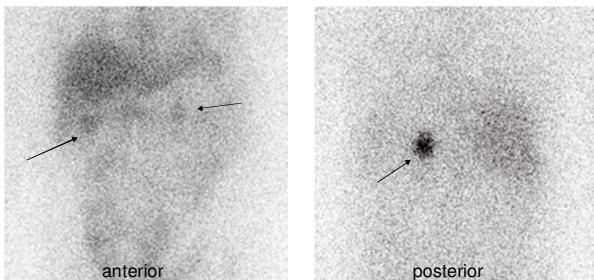
Adrenocortical scintigraphy

- Radiopharmaceutical:
 - ^{75}Se -Cholesterol/Scintadren
 - ^{131}I -Iodocholesterol /NP59
- Indications
 - localisation of hormon overproduction
 - hypercortisolism: Cushing's syndrome
 - hyperaldosteronism: Conn's syndrome
 - adrenal hyperandrogenism
 - „incidentalomas”
 - benign adenoma vs. metastasis

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Thyroid (Practice)

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Thyroid (Practice)

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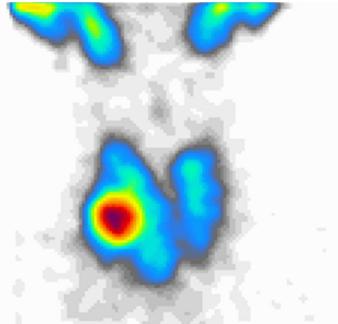
Adrenomedullar scintigraphy

- Radiopharmaceutical:
 - MIBG (metaiodobenzylguanidine)
 - uptake by chatecholemin producing cells: sympathoadrenal system
 - labeled with
 - ^{123}I : diagnosis (γ -emission)
 - ^{131}I : therapy (β -emission)
- Indications:
 - pheochromocytoma
 - neuroendocrine tumors: paraganglioma, neuroblastoma, ganglioneuroma, etc.

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Thyroid (Practice)

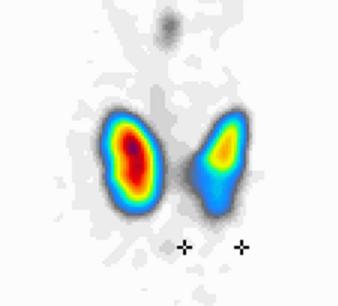
27



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Thyroid (Practice)

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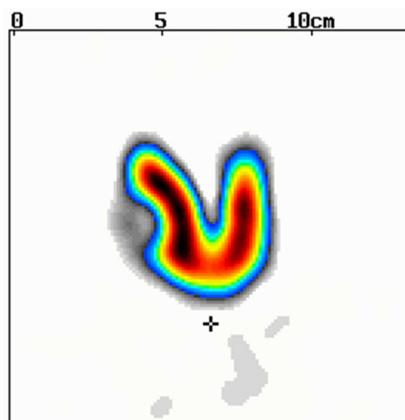


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Thyroid (Practice)

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Thyroid #1

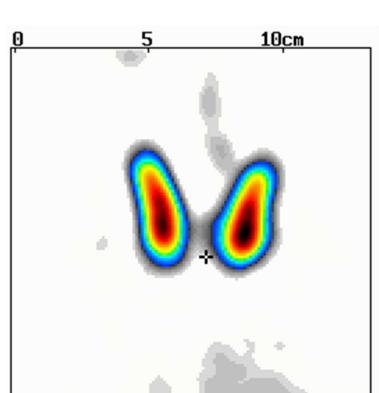


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Thyroid (Practice)

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Thyroid #2

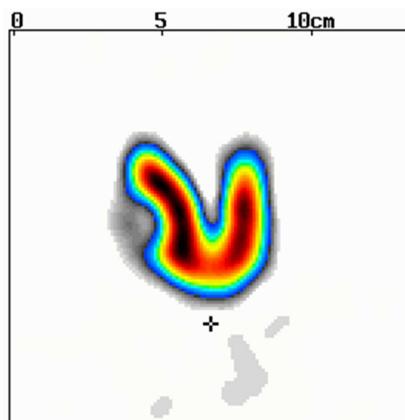


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Thyroid (Practice)

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Thyroid #3

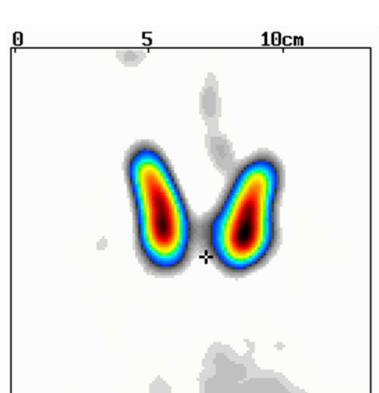


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Thyroid (Practice)

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Thyroid #4

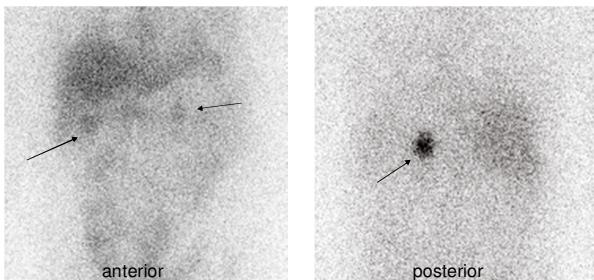


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Thyroid (Practice)

32

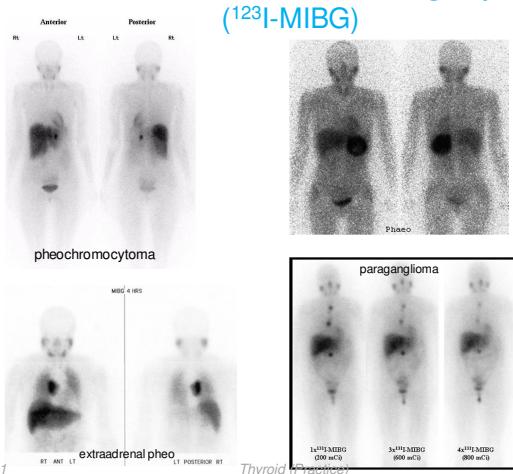
Adrenocortical scintigraphy (NP59)



Thyroid (Practice)

26

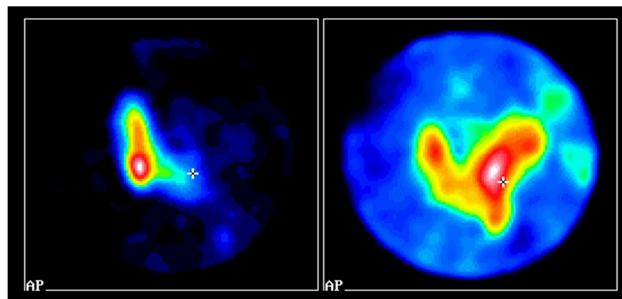
Adrenomedullar scintigraphy (^{123}I -MIBG)



Thyroid (Practice)

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Thyroid #5

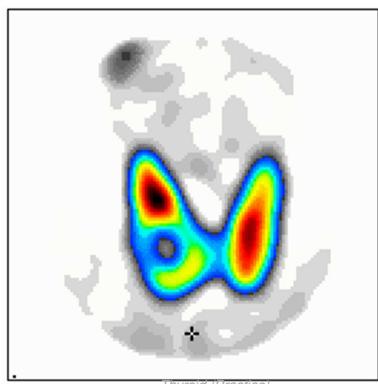


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Thyroid (Practice)

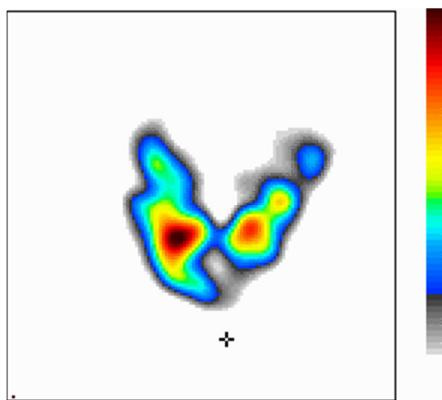
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Thyroid #6



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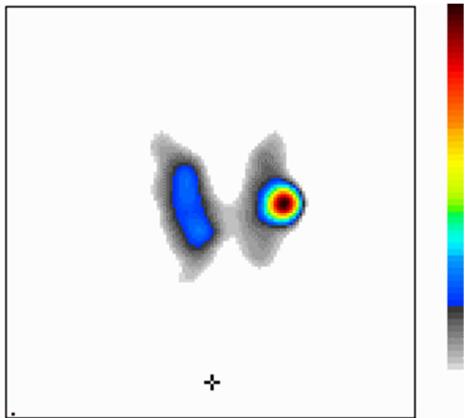
Thyroid #7



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Thyroid #8



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