Radionuclide therapy

The administration of open radionuclides for therapeutical purposes. The radiopharmaceuticals get **right to the cells** to be destroyed, and act there locally.

Generally beta- (rarely alpha-) radiating nuclides are used, as beta radiation reaches only a small neighborhood of its source.

Most common aims of radionuclide therapy:

- ***Intracavital therapy***
- ***Radioimmunotherapy***
- ***Pain-killing therapy of bone metastases***
- ***Radioiodine therapy of hyperthyreosis***
- ***Radioiodine therapy of thyroid carcinoma and its metastases***

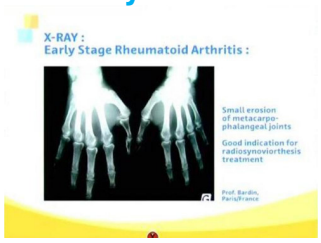
Intracavital therapy

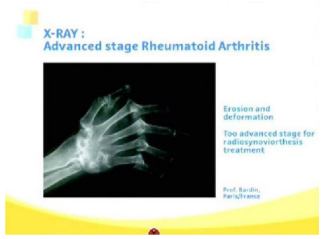
The injection of radionuclides right into some body cavities (that is not through the bloodstream or lymphatic drains).

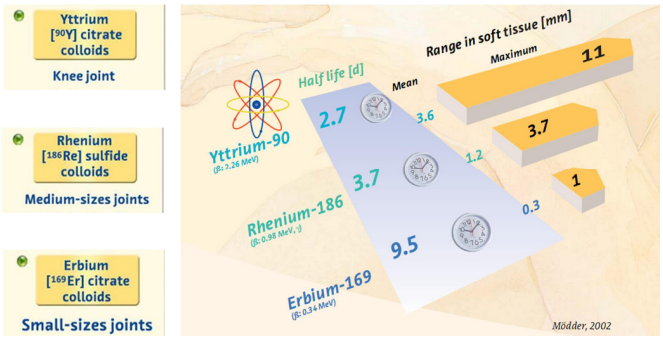
- ***Synovium***
  Indication: Chronic synovitis
  Mechanism: Irradiating the cells of the synovial membrane decreases fluid production.
- ***Pleura***
- ***Peritoneum***
- ***Intrathecal therapy***
- ***Cysts***

Colloidal radiopharmaceuticals are administered,
labeled by: ^{186}Rhenium, ^{169}Erbium, ^{90}Yttrium, ^{32}Phosphor, ^{198}Gold

Radiosynoviorthesis







Contraindications*

- Absolute: Pregnancy, lactation
- Relative: in well founded exception to be used for children and adolescents (instable and divisioned joints)

Radioimmunotherapy:

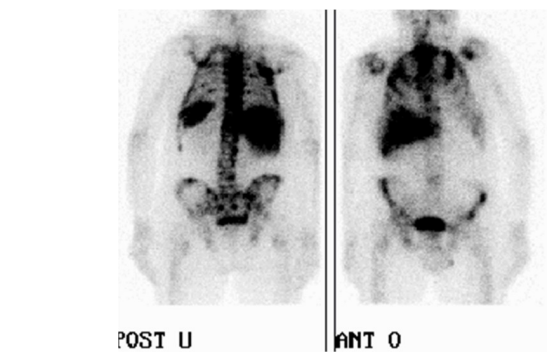
with labeled (monoclonal) antibodies, against various tumor-antigens

- Administration: Generally i.v.
  peritoneum: intraperitoneal infusion
- Radionuclide: Iodine-131
  Lutetium-177
- ***Problems:***
- Bonds to and mostly effects the surface of the tumor
- Short period
- HAMA („human anti-mouse antibody") is produced ⇒ not repeatable.

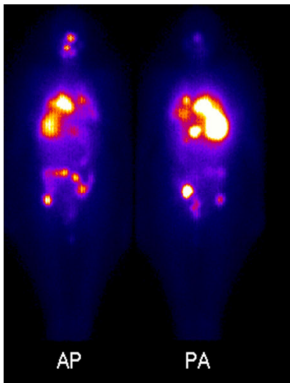
Pain-killing therapy of bone metastases

Radionuclide	$T_{1/2}$ (days)	Energy
^{89}Sr	50.5	1.49 MeV
^{186}Re	3.78	1.07
^{90}Y	2.67	2.28
^{153}Sm	1.95	0.81

Pain-killing therapy of bone metastases :Sm-153-Multibone



Radioiodine therapy of thyroid carcinoma and its metastases



Palliative therapy of bone metastases

- Rhenium-186 HEDP
- Strontium-89 Metastron
- Yttrium-90 „Multibone”

Dose calculation schemes

Method:	Thyr. size	Max. uptake	Elimination
Fixed dose			
For unit mass			
Absorbed dose			

„The aim of treatment with ^{131}I is to achieve a **nonhyperthyroid** status”

„The **individual calculation** approach seems advisable in patients <45 years of age, and especially in children in whom radioiodine therapy is under consideration”

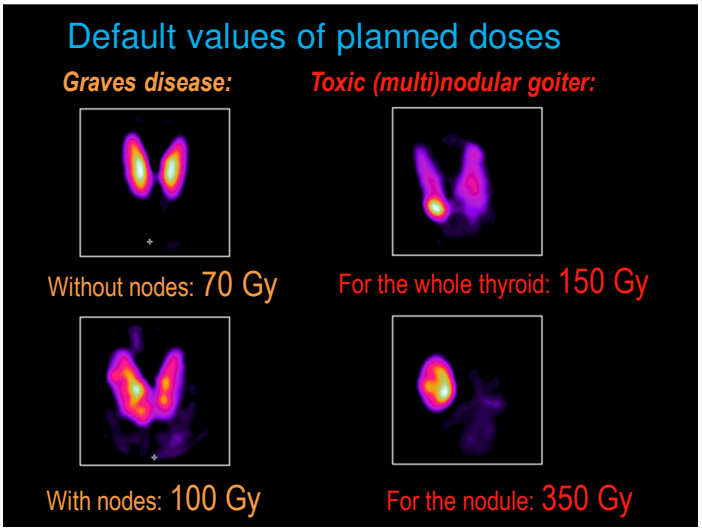
(EANM Guideline)

Calculation of radioiodine activity for the therapy of hyperthyreosis

$$ACTIVITY = DOSE * \frac{1}{T_{eff} * U_{max}} * MASS * 25 \frac{MBq * day * \%}{g * Gy}$$

iodine storage — th. size — constant

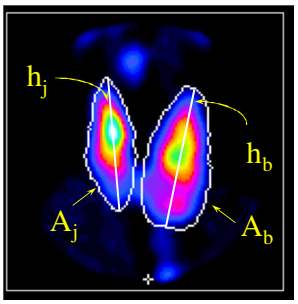
Default values of planned doses



Mass estimation: lobes separately

$$m = (h_b * A_b + h_j * A_j) * 0.4$$

$$\frac{absz(h_b - h_j)}{h_b + h_j} \geq 0.2$$



Mass estimation: node only

$$m = 0.436 * A^{1.5}$$

Volume estimation with ultrasound

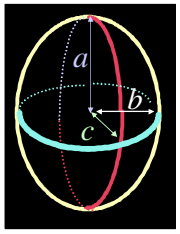
(a) Supposing ellipsoid

$$V = k * a * b * c$$

where exactly: $k = \pi/6 = 0.524$

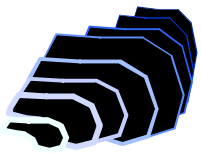
approximation: $k \approx 0.5$

$c = b$ or $c = 0.8 * b$

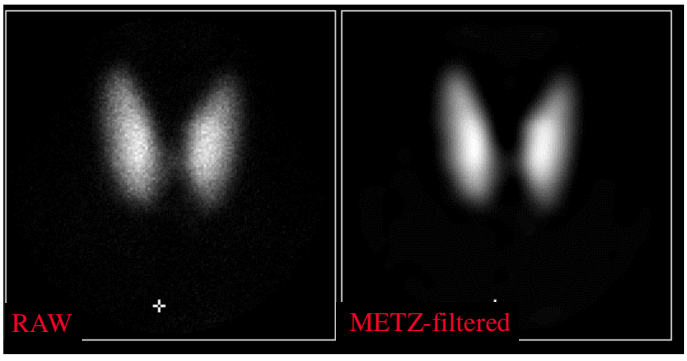


(b) Summing slice areas

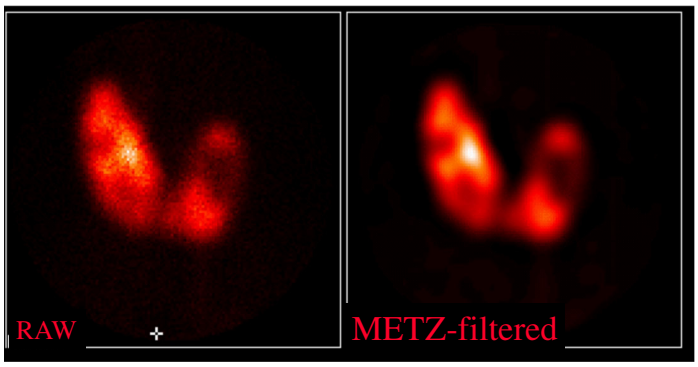
$$V = \sum_i A_i * \Delta h_i$$



Restoration filter on normal image



Restoration filter on abnormal image



Excel sheet for the calculations

DE OEC Nukleáris Medicina Tanszék

Hyperthyreosis radiojód-terápiája — Dátum: 2005.04.18

Beteg neve:
Beküldő: — Orvos:
TAJ: — Született:

Diagnózis Toxikus göb

Méretbecslés Csak göbre **22.8 g**

Jobb lebeny hossza:	3.9 cm		
Bal lebeny hossza:	3.9 cm		
Jobb lebeny területe:	3.9 cm2		
Bal lebeny területe:	20.9 cm2		
Pajzsmirigy területe:	cm2	Összes beütés:	77
Göb területe:	14 cm2	Göb beütés:	66
Térfogat:	cm3		

Jódfelvétel:

24 h:	77 %	
Később:	42 %	☐ Csak 7 napos felvételből számoljunk
Időpontja:	7 nap	

Számolt aktivitás:	817.1 MBq	Standard dózis:	350 Gy
Kért aktivitás:	MBq	Kért dózis:	Gy
Beadandó aktivitás:	**817 MBq**	**Dózis:**	**350 Gy (göbre)**

Számolta:

Aláírás:

endocrinológus szakorvos — nukl.med. szakorvos