$^{131}$I treatment for differentiated thyroid carcinoma
Current guidelines

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IAEA-Belnuc Theranostics course
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Before I speak, I have something important to say.

Groucho Marx
131I treatment for differentiated thyroid carcinoma - Scope

- Clinical presentation of DTC
- Staging and risk stratification
- Radioiodine therapy: practical aspects
- Some questions that need an answer
- RAI refractory patients
- Radiation protection issues
Treatment for differentiated thyroid carcinoma

Clinical presentation

- Palpable nodule (including self palpation)
- Rapidly progressive nodule
- Local compression including voice changes
- Neck lymph nodes
- Incidentaloma (CT-scan, PET-scan, carotid US,...)
- Incidentaloma at surgery for benign disease
- Rarely metastases as first presentation
- Rare familial cases (screening)

**Treatment:** total thyroidectomy & $^{131}$I in some cases
Pathological classification of DTC

Staging (AJCC 8th edition revised in 2017*)

* Now T1a (<1 cm) vs T1b (1-2 cm) // T3a (>4 cm) vs T3b (local invasion)

Table 4. TNM Classification System for Differentiated Thyroid Carcinoma

<table>
<thead>
<tr>
<th>Stage</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>Tumor diameter 2 cm or smaller</td>
</tr>
<tr>
<td>T2</td>
<td>Primary tumor diameter &gt;2 to 4 cm</td>
</tr>
<tr>
<td>T3</td>
<td>Primary tumor diameter &gt;4 cm limited to the thyroid or with minimal extrathyroidal extension</td>
</tr>
<tr>
<td>T4a</td>
<td>Tumor of any size extending beyond the thyroid capsule to invade subcutaneous soft tissues, larynx, trachea, esophagus, or recurrent laryngeal nerve</td>
</tr>
<tr>
<td>T4b</td>
<td>Tumor invades prevertebral fascia or encases carotid artery or mediastinal vessels</td>
</tr>
<tr>
<td>TX</td>
<td>Primary tumor size unknown, but without extrathyroidal invasion</td>
</tr>
<tr>
<td>NO</td>
<td>No metastatic nodes</td>
</tr>
<tr>
<td>N1a</td>
<td>Metastases to level VI (pretracheal, paratracheal, and prelaryngeal/Delphian lymph nodes)</td>
</tr>
<tr>
<td>N1b</td>
<td>Metastasis to unilateral, bilateral, contralateral cervical or superior mediastinal nodes</td>
</tr>
<tr>
<td>NX</td>
<td>Nodes not assessed at surgery</td>
</tr>
<tr>
<td>MO</td>
<td>No distant metastases</td>
</tr>
<tr>
<td>M1</td>
<td>Distant metastases</td>
</tr>
<tr>
<td>MX</td>
<td>Distant metastases not assessed</td>
</tr>
</tbody>
</table>
Pathological classification of DTC

New entity: NIFTP

Noninvasive Follicular Thyroid Neoplasm with Papillary-Like Nuclear Features

It is a cancer but must not be (over) treated as a cancer
To the contrary of strictly benign lesions, requires follow-up

Nikiforov et al.
Nomenclature Revision for Encapsulated Follicular Variant of Papillary Thyroid Carcinoma: A Paradigm Shift to Reduce Overtreatment of Indolent Tumors.
Pathological classification of DTC

Additional ‘Staging’ information

- More aggressive sub-types
- Vascular and lymphatic invasion
- Number of LN in N+ patients
- Extracapsular spread in LN
- Size of LN invasion in affected LN
- BRAF V600E mutation and other genetic abnormalities
- Age and potential risk factors
## Risk Stratification of DTC

Need for radioiodine treatment (ATA 2009)

### Table 5: Major Factors Impacting Decision Making in Radioiodine Remnant Ablation

<table>
<thead>
<tr>
<th>Factors</th>
<th>Description</th>
<th>Decreased risk of death</th>
<th>Decreased risk of recurrence</th>
<th>May facilitate initial staging and follow-up</th>
<th>RAI ablation usually recommended</th>
<th>Strength of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>1 cm or less, intrathyroidal or microscopic multifocal</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td>1–2 cm, intrathyroidal</td>
<td>No</td>
<td>Conflicting data</td>
<td>Yes</td>
<td>Selective use</td>
<td>I</td>
</tr>
<tr>
<td>T2</td>
<td>&gt;2–4 cm, intrathyroidal</td>
<td>No</td>
<td>Conflicting data</td>
<td>Yes</td>
<td>Selective use</td>
<td>C</td>
</tr>
<tr>
<td>T3</td>
<td>&gt;4 cm</td>
<td>No</td>
<td>Conflicting data</td>
<td>Yes</td>
<td>Yes</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>&lt;45 years old</td>
<td>No</td>
<td>Conflicting data</td>
<td>Yes</td>
<td>Yes</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>≥45 years old</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>Any size, any age, minimal extrathyroidal extension</td>
<td>No</td>
<td>Inadequate data</td>
<td>Selective use</td>
<td>Selective use</td>
<td>I</td>
</tr>
<tr>
<td>T4</td>
<td>Any size with gross extrathyroidal extension</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>B</td>
</tr>
<tr>
<td>Nx,N0</td>
<td>No metastatic nodes documented</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>I</td>
</tr>
<tr>
<td>N1</td>
<td>&lt;45 years old</td>
<td>No</td>
<td>Conflicting data</td>
<td>Selective use</td>
<td>Selective use</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>&gt;45 years old</td>
<td>Conflicting data</td>
<td>Conflicting data</td>
<td>Selective use</td>
<td>Selective use</td>
<td>C</td>
</tr>
<tr>
<td>M1</td>
<td>Distant metastasis present</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>A</td>
</tr>
</tbody>
</table>
Risk Stratification of DTC

Need for radioiodine treatment
EJE 2006 and EANM 2008

• **Very low risk patients**: T1<1cm, unifocal and intra-thyroid; and N0 (no capsular invasion, no previous irradiation, no unfavourable histology, [tall, columnar and sclerosing]): **No benefits, no indication for I131**

• **High risk patients**: T3-4, N1, M1, persistent disease: treatment with a high activity (3.7 GBq or more) following withdrawal until remission

• **Low risk patients**: the other patients: Benefits of I131 controversial. Ablation may be performed with a low/high activity and following rhTSH/withdrawal
# Risk Stratification of DTC

Need for radioiodine treatment (ATA 2009): But...!

## Table 3. Patients With Persistent Disease at the End of Follow-up

<table>
<thead>
<tr>
<th>Patient</th>
<th>Group</th>
<th>Age at Diagnosis, y</th>
<th>Sex</th>
<th>Histotype</th>
<th>TNM</th>
<th>Stage</th>
<th>De Groot’s Class</th>
<th>Risk Stratification</th>
<th>Basal Tg, ng/mL</th>
<th>rhTSH, Tg, ng/mL</th>
<th>Neck US</th>
<th>Post-therapy</th>
<th>CT Scan</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hypo</td>
<td>55</td>
<td>M</td>
<td>PV F</td>
<td>T3N1M0</td>
<td>III</td>
<td>3</td>
<td>I</td>
<td>&lt;0.5</td>
<td>2.3</td>
<td>Negative</td>
<td>R + LC-LFN</td>
<td>LFN</td>
<td>ND</td>
</tr>
<tr>
<td>2</td>
<td>Hypo</td>
<td>63</td>
<td>M</td>
<td>PVC</td>
<td>T4bN1bM0</td>
<td>IVB</td>
<td>3</td>
<td>H</td>
<td>17.5</td>
<td>4.15</td>
<td>Negative</td>
<td>Negative</td>
<td>LC-LFN</td>
<td>SD</td>
</tr>
<tr>
<td>3</td>
<td>Hypo</td>
<td>35</td>
<td>M</td>
<td>PVC</td>
<td>T4N1bM0</td>
<td>II</td>
<td>3</td>
<td>H</td>
<td>&lt;0.5</td>
<td>1.6</td>
<td>Negative</td>
<td>Negative</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>4</td>
<td>Hypo</td>
<td>38</td>
<td>F</td>
<td>PVC</td>
<td>T4bN1aM0</td>
<td>II</td>
<td>3</td>
<td>H</td>
<td>1.22</td>
<td>2.25</td>
<td>Negative</td>
<td>Negative</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>5</td>
<td>Hypo +</td>
<td>57</td>
<td>M</td>
<td>PV F</td>
<td>T3N1M1</td>
<td>IV C</td>
<td>4</td>
<td>H</td>
<td>1.72</td>
<td>2.9</td>
<td>Negative</td>
<td>Negative</td>
<td>LFN</td>
<td>SD</td>
</tr>
</tbody>
</table>

Molinaro et al., JCEM 2013
Risk of Structural Disease Recurrence
(In patients without structurally identifiable disease after initial therapy)

**High Risk (>20%)**
- pT4
- M1-R1, R2
- Inappropriate post-op Tg

**Intermediate Risk (5%-20%)**
- pT3 N0 Nx
- pT1-3, N1a-N1b
- Aggressive histology or vascular invasion
- RAI uptake outside the thyroid bed

**Low Risk (<5%)**
- pT1-T2 N0/Nx
- No aggressive histology, no vascular invasion

- FTC, extensive vascular invasion (≈ 30-55%)
- pT4a gross ETE (≈ 30-40%)
- pN1 with extranodal extension, >3 LN involved (38%)
- pN1, any LN > 3 cm (≈ 30%)
- BRAF mutated, not intrathyroidal (≈ 10-40%)
- PTC, vascular invasion (≈ 15-30%)
- Clinical N1 (≈20%)
- pN1, > 5 LN involved (≈20%)
- BRAF mutated, intrathyroidal, < 4 cm (≈10%)
- pT3 minor ETE (≈ 3-8%)
- pN1, all LN < 0.2 cm (≈5%)
- pN1, < 5 LN involved (≈5%)
- Intrathyroidal 2-4 cm PTC (≈ 5%)
- Multifocal PMC (≈ 4-6%)
- pN1 with extranodal extension, ≤ 3 LN involved (2%)
- Minimally invasive FTC (≈ 2-3%)
- BRAF wild type, intrathyroidal, < 4 cm (≈ 1-2%)
- BRAF mutated, intrathyroidal unifocal PMC (≈ 1-2%)
- Intrathyroidal, encapsulated, FV-PTC (≈ 1-2%)
- Unifocal PMC (≈ 1-2%)
Risk Stratification of DTC

Very low risk  Low risk  High risk

Low  Intermediate  High risk

Low to intermediate  Intermediate to high

New paradigm (ATA 2015)
Radioiodine therapy for ablation of remnants following thyroidectomy

General recommendations

- Treatment should be given shortly after surgery (<3mo)
- Usual activity: 100 mCi for ablation
- No evidence of usefulness of pre \( R_x^{131}I \) imaging (stunning)
- Higher activities for residual disease, metastases
- Preparation with rh-TSH (2 im) or L-T4 withdrawal (4 weeks)
- Always followed by WBS and suppressive L-T4
  (TSH < 0.1 for 12-24 mo, than < 1)
- Radiation protection issues
Radioiodine therapy in DTC following thyroidectomy

General recommendations

• In metastatic patients, higher activities
• In metastatic patients, L-T4 withdrawal
• Steroids to prevent edema when CNS lesions
• I-131 can be given once in Tg+ pts with negative Dx scan (not more if post-therapy scan remains negative)

• Avoid iodine contamination, low-iodine diet 3-4 weeks
• Good hydration, salivary gland protection (lemon)
• Avoid constipation and vomiting
Standard $^{131}$I activity (100mCi) after L-T4 withdrawal for remnants ablation following thyroidectomy

A myth: the magic bullet
Radioiodine therapy in DTC following thyroidectomy

Questions to be answered – secondary cancer

Increased Risk of Leukemia After Radioactive Iodine Therapy in Patients with Thyroid Cancer: A Nationwide, Population-Based Study in Korea

Gi Hyeon Seo, Yoon Young Cho, Jae Hoon Chung, and Sun Wook Kim
Radioiodine therapy in DTC following thyroidectomy

Questions to be answered – secondary cancer?

Note: relative risk: Low dose < no RAI = moderate dose < very high dose < high dose
Radioiodine therapy in DTC following thyroidectomy

Questions to be answered

- The incidence of DTC has been tripled over the last 40 yr
- The mortality rate remains unchanged
- Most patients have limited disease
- Maybe we overtreat some patients, maybe not...
- Radiation protection issues (e.g. secondary cancer) are raised and relevant

Get rid of L-thyroxin withdrawal
Reduce I131 activities
Rationalize the use of I131 therapy
Radioiodine therapy in DTC following thyroidectomy

Evolution of recommendations

Everything that can guarantee the efficiency of care to DTC patients with less radiation burden is welcome
Use of rh-TSH for ablation of remnants following thyroidectomy

Results

- Randomized, multicentric study, 5 Europe/5 US
- 63 eligible patients (T1: 13 / T2: 44 / T4: 6 / N+: 22)
- Age: 20-68 yr F/M 50/13
- 30 hypothyroid / 33 euthyroid
- 100 mCi I131
- Endpoints: ablation success, dosimetry, QoL

Pacini et al. JCEM, 2006
Use of rh-TSH for ablation of remnants following thyroidectomy

Results

<table>
<thead>
<tr>
<th>Uptake in thyroid bed</th>
<th>Hypothyroid (n = 28), n (%)</th>
<th>Euthyroid (n = 32), n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No visible uptake or uptake &lt;0.1%</td>
<td>28 (100)</td>
<td>32 (100)</td>
</tr>
<tr>
<td>No visible uptake</td>
<td>24 (85.7)</td>
<td>24 (75.0)</td>
</tr>
<tr>
<td>Visible uptake &lt;0.1%</td>
<td>4 (14.3)</td>
<td>8 (25.0)</td>
</tr>
<tr>
<td>Visible uptake &gt;0.1%</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

CI, Confidence interval.

Similar results for thyroglobulin

Pacini et al. JCEM, 2006
Use of rh-TSH for ablation of remnants following thyroidectomy

Results

• 51 pts of Pacini’s series after median FU of 3.7 yr
• Ablation rate equal in both arms (92 vs 90 %)
• Stimulated Tg > 2 in two patients (1rh/1THW)
• 9 recurrences retreated (4rh/5THW), all in remission at FU

Elisei, JCEM 2009
Use of rh-TSH for ablation of remnants following thyroidectomy

Advantages vs L-T4 withdrawal

- No symptoms of hypothyroidism
- No medical contra-indication (exc. hypersensitivity)
- Improved compliance
- Maintained quality of life
- Pharmaco-economic benefit
- Reduction of whole-body dose with I-131
- Less proliferative effect than endogenous TSH
- Few side effects
ESTIMABL: mean change in EQ-5D utility score during post-op RAI treatment

Use of rh-TSH for ablation of remnants following thyroidectomy

Advantages: radiation dose

Remy et al. JNM, 2008

**FIGURE 1.** Cumulated urinary excretion activity: comparison between withdrawal patients (THW) and rhTSH patients.
Use of rh-TSH for ablation of remnants following thyroidectomy

Advantages: radiation dose

Chromosome Translocation Frequency after Radioiodine Thyroid Remnant Ablation: A Comparison between Recombinant Human Thyrotropin Stimulation and Prolonged Levothyroxine Withdrawal

Frigo et al. JCEM 2009
Which $^{131}$I activity to use for ablation following thyroidectomy?

- The universal standard is 100 mCi ($ie. \ 3.700.000.000 \ Bq$)
- 8/10 studies demonstrated equal results with 30 or 50 mCi
- Direct comparative trials between
  - 30 vs 100 mCi
  - and rh-TSH vs withdrawal
    - ESTIMABL (France, 752/684 pts)
    - HILO (UK, 438/421 pts)

Schlumberger et al., Mallick et al., NEJM 2012
Which I-131 activity to use for ablation following thyroidectomy?
Which I-131 activity to use for ablation following thyroidectomy?
Ablation Success with rhTSH vs THW

Success Rates, 6–10 Months After Ablation
(684 evaluable patients)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Success Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thyrogen 30 mCi (n=160/177)</td>
<td>92%</td>
</tr>
<tr>
<td>THW 30 mCi (n=156/170)</td>
<td>91%</td>
</tr>
<tr>
<td>Thyrogen 100 mCi (n=159/171)</td>
<td>93%</td>
</tr>
<tr>
<td>THW 100 mCi (n=156/166)</td>
<td>94%</td>
</tr>
</tbody>
</table>

Which I-131 activity to use for ablation following thyroidectomy?

- rh-TSH and withdrawal preparation gives equal results
- 30 and 100 mCi give equal results
- Limitations: mainly T1-T2*, N0, M0 patients
- Endpoints: clinical results (ablation rate within Y1, recurrences, retreatment), costs, QoLi

*: HILO: ~25% ‘size’ T3
Which I-131 activity to use for ablation following thyroidectomy?

Costs
- Low-dose THW: 776£
- Low-dose rh-TSH: 1.356£
- High-dose THW: 1.056£
- High-dose rh-TSH: 1.582£

Costs of sick-leave and QoL not considered

Mallick et al., NEJM 2012
Which I-131 activity to use for ablation following thyroidectomy?

- **10-yr FU** of 159 patients (T4 withdrawal or rh-TSH)
- 4/115 ablated patients showed recurrence (1 later cured)
- 16/44 non-ablated patients with persistent disease (those with early Tg < 5.4 will be cured)

- In total, 19/159 have persistent disease at 10yr
- Results *seem* similar to standard treatment
- Not randomized, no direct comparison

Molinaro et al. JCEM, 2013
Which I-131 activity to use for ablation following thyroidectomy?

It is premature to drastically change the current empirical activity of ‘100 ‘mCi in all patients.

Several trials have shown promise in low-risk patients; it is obvious that if the radiation burden (to patient, staff and public) can be reduced, it will be a major step forward.
Indications: Post-op RAI administration (ATA 2015)

Ablation

Adjuvant

Cancer treatment

NO RAI

1100 MBq/rhTSH

3700 MBq/rhTSH

3700 MBq/withdrawal

pT1a N0/Nx

pT1b-T2 N0/Nx

pT3>4cm N0/Nx

pT3 ETE N0/Nx

pT1-3 N1a-N1b: according to location, number, size, ECE of N1

pT4 or M1

Courtesy of M. Schlumberger, 2015
**131I treatment for DTC: 2016 proposal**

\( T = \text{rhTSH} \quad W = T_4 \text{ withdrawal} \)

<table>
<thead>
<tr>
<th>Nx (cN0)</th>
<th>N0</th>
<th>N1a-b** ECS-</th>
<th>N1a-b ECS+</th>
</tr>
</thead>
<tbody>
<tr>
<td>pT1a</td>
<td>(-)</td>
<td>(-)</td>
<td>100 T</td>
</tr>
<tr>
<td>pT1b</td>
<td>30 T</td>
<td>30 T</td>
<td>100 T</td>
</tr>
<tr>
<td>pT2</td>
<td>30 T</td>
<td>30 T</td>
<td>100 T</td>
</tr>
<tr>
<td>pT3</td>
<td>100 T</td>
<td>100 T</td>
<td>100 T</td>
</tr>
<tr>
<td>pT4</td>
<td>100 W</td>
<td>100 W</td>
<td>100 W</td>
</tr>
<tr>
<td>M+</td>
<td>100 W</td>
<td>100 W</td>
<td>100 W</td>
</tr>
</tbody>
</table>

*: if no additional risk factors: previous radiation, unfavourable histology, vascular or lymphatic invasion, genetic variants

Any pT: R1 upstaged to T3; R2 upstaged to T4

**: if complete lymphadenectomy and \(< 5 \text{ LN} < 2\text{mm}\), considered as N0
Treatment of DTC
High-risk – RAI *refractory* patients

- **What is a RAI *refractory* patient?**
  - No RAI uptake
  - Disproportionate RAI uptake by comparison with Tg
  - No clinical/radiological response in spite of RAI uptake
  - PET+/RAI- numerous lesions
  - Risks of $^{131}$I Rx outweighs benefits (eg. lung fibrosis)

*: non-responsive, non-avid, refractory, resistant, see Haugen et al. *Endocr Rev*, 2013, 439-455
SELECT: Lenvatinib vs placebo
Progression Free Survival

Median PFS, months (95% CI)

Lenvatinib: 18.3 (15.1, NR)
Placebo: 3.6 (2.2, 3.7)

HR (99% CI): 0.21 (0.14, 0.31)
Log-rank test: $P <0.0001$

Progression events, 41%
Progression events, 86%

ORR: 65%

Number of subjects at risk:

<table>
<thead>
<tr>
<th></th>
<th>Lenvatinib</th>
<th>Placebo</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>261</td>
<td>131</td>
</tr>
<tr>
<td>2</td>
<td>225</td>
<td>71</td>
</tr>
<tr>
<td>4</td>
<td>198</td>
<td>43</td>
</tr>
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<td>6</td>
<td>176</td>
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<td>8</td>
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<td>10</td>
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<td>44</td>
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</tr>
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<td>24</td>
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<td>22</td>
<td>11</td>
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</tr>
<tr>
<td>24</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>26</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

CI, confidence interval; HR, hazard ratio; NR, not reached; PFS, progression-free survival.

Schlumberger M et al., NEJM 2015
High-risk – RAI refractory patients

Ho et al. NEJM, 2013
Radioiodine therapy in DTC

Radiation protection issues for the patient

• Well-balanced indications (justification)

• Prevention of acute side effects (deterministic)
  • Local pain (swelling) – symptomatic R/
  • Nausea – vomiting: Avoid absolutely! – R/ domperidone
  • Sialadenitis: 5-10d, mainly females, dose-dependent
  • Hematologic complications very rare

• Delayed side effects (mainly stochastic)
  • Negligeable: leukemia for high doses, solid cancer unclear, earlier menopause even for low dose (1-2 yr), no effect on fertility and offspring, xerostomia, xerophthalmia, lung fibrosis
Radioiodine therapy in DTC

Radiation protection issues for the patient

• **Patient preparation**
  • Plenty of fluids!
  • Citric acid (lemon, candies,...)
  • Prevention of iodine contamination

• **Contraception: a must!**
  • Treatment during pregnancy is not permitted
  • Conception during 4-6 mo after treatment must be avoided
  • Thorough review of medical history is required
  • Hormonal contraception preferred, otherwise measures x2
  • This also applies to male patients

• **Information about radiation protection**
Radioiodine therapy in DTC

Radiation protection for the family, relatives and public (Belgium)

- **Patient discharge from hospital:**
  - allowed when dose-rate < 20μSv/h at 1 m
  - unless urinary incontinence, mental incapacity, no intention to follow rules, sojourn in hospice, presence of young children, ...than 10μSv

- **External irradiation (gamma 364 keV)**
  - TDS rules

- **Internal (external) contamination**
  - medium energy beta
  - high affinity for the thyroid tissue
Radioiodine therapy in DTC

Radiation protection for the family, relatives and public

- **External irradiation (gamma 364 keV)**
  - **Contact restrictions** (1m / 30’/d) for 100 mCi
    - separate bed rooms
    - refrain from sexual activity, no kiss, hugging OK
    - no unnecessary travel by car and public transport

- Distance x 2, dose /4!!!

- 2 days: adults, children > 6y
- 1w: children <6y, pregnant women, public and work places
Radioiodine therapy in DTC

Radiation protection for the family, relatives and public

- **Internal irradiation (beta)**
  - Contamination: urine >>> saliva, sweat
  - Avoid personal belongings in therapy room (eg. laptop, tablet, jewels, books,...)
  - Hygiene, washing hands, toilets, ...
  - Measures are rather simple and logical

- **Exceptional situation: premature death**
  - Rules for burial/cremation, see FANC (www.fanc.fgov.be/GED/00000000/2900/2941.pdf)
Radioiodine therapy in DTC

Radiation protection – Real life

- Young mother (1 & 2 yr old)
- Old lady (82 yr), fear for secondary cancer
- Old lady (77 yr), cats and dogs...or parrots
- Claustrophobia and being in peace...
Radioiodine therapy in DTC

Radiation protection – *take home message*

- There are **rules and laws** *(vary from country to country)*
- Radiation protection issues are *mainly* for other people
- One must remain realistic
- No-conception is a must *(male and females!)*
- **Face to face information is absolutely necessary**