Radiation Safety Recommendations for Radioiodine Patients

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mSv radiation exposure

What is this?

Kloos RT. Thyroid 2010 21;2:97-99
Kloos RT. Thyroid 2010 21;2:97-99

mSv radiation exposure

half of the people receiving 3500-5000 mSv to the whole body over a few minutes to a few hours die within thirty days
mSv radiation exposure

What is this?
mSv radiation exposure

Greater than 500 mSv is associated with the development of a number of malignancies.

Kloos RT. Thyroid 2010 21;2:97-99
mSv radiation exposure

What is this?

Kloos RT. Thyroid 2010 21;2:97-99
Currently there are no data that unequivocally establish the occurrence of cancer following whole body exposure to below about 100 mSv.
mSv radiation exposure

What is this?

Kloos RT. Thyroid 2010 21;2:97-99
Living in high levels of background radiation (>10 mSv/yr) such as Denver, CO has shown no adverse biological effects.
mSv radiation exposure

What are these?

Radiation Exposure

100
50
10
5
3.6
3
1
The average yearly radiation exposure from natural sources to a person in the US is 3 mSv. Man-made sources contribute another 0.6 mSv/yr.
mSv radiation exposure

What is this?
The NRC permits facilities to release an I-131 treated patient from their control if the total effective dose equivalent to any other individual from them is not likely to exceed 5 mSv.
licensee must provide the released individual, or guardian, with written instructions to maintain doses to others ALARA if the total effective dose equivalent to another is likely to exceed 1 mSv.
Harm from therapeutic radioiodine given to others

• What are the two situations when therapeutic radioiodine given to a patient is known or suspected to harm another person?

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Harm from therapeutic radioiodine given to others

• Fetuses whose mothers are treated with radioiodine after approximately 10-12 weeks of pregnancy are at high risk of iatrogenic hypothyroidism.

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Harm from therapeutic radioiodine given to others

- Unpublished report of childhood hypothyroidism ascribed to radioiodine ingestion from breastfeeding.

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Harm from therapeutic radioiodine given to others

• Given the known concentration of radioiodine in breast milk and documented uptake in the thyroids of newborns nursing from mothers given diagnostic activities of radioiodine, the discontinuation of lactation before radioiodine therapy and avoidance of breastfeeding after radioiodine treatment appear justified.

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Harm from therapeutic radioiodine given to others

• Putting aside these special circumstances of pregnancy and lactation, the amount of harm that a radioiodine-treated patient could inflict upon another person while following common sense instructions appears to be low.

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Radiation exposure for “caregivers” during outpatient I-131

- 27 radiation doses were given.
- The person likely to receive the highest exposure (caregiver), was electronically monitored hourly for 1 week.
- 25/27 doses were 100 mCi (others were 150 and 200 mCi).
- Patients were screened and educated. 2 patients thought unlikely to follow instructions were excluded.

Radiation exposure for “caregivers” during outpatient I-131

- Average caregiver penetrating dose was 0.098 mSv, and the maximum was 0.283 mSv.
- This maximum value is $<1/3$ of 1 mSv and $<1/17^{th}$ of 5 mSv limits.
- $1/3$ of the dose was received during the drive home from the hospital.
  - [Consider advising patient to drive themselves if not hypothyroid and emotionally prepared.]
Typical caregiver penetrating dose profile

Resumption of shared bed 2\textsuperscript{nd} night after I-131 administration. Seen in 4/27 caregivers.

Average penetrating dose rate for 27 caregivers

Average penetrating dose rate for 27 caregivers

Function of drive home duration

Average penetrating dose rate for 27 caregivers

Function of I-131 clearance from the patient

Average penetrating dose rate for 27 caregivers

Function of I-131 home contamination

Average penetrating dose rate for 27 caregivers

What are these two lines?

Average penetrating dose rate for 27 caregivers

0.63 uSv/hr Athens to New York flight

Average penetrating dose rate for 27 caregivers

0.3 μSv/hr Seattle to Portland flight

Radiation Safety in the Treatment of Patients with Thyroid Diseases by Radioiodine $^{131}$I: Practice Recommendations of the American Thyroid Association

The American Thyroid Association Taskforce on Radioiodine Safety


Free PDF document from thyroid.org
### Precaution Requirements After Treatments with $^{131}$I

#### 2A-1. Hyperthyroidism [Assumes 50% uptake by thyroid, with effective $T_{1/2}$ of about 5 days (12)]

<table>
<thead>
<tr>
<th>mCi (MBq) administered</th>
<th>10 (370)</th>
<th>15 (555)</th>
<th>20 (740)</th>
<th>30 (1110)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nighttime restrictions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleep in a separate (6-feet separation) bed from adults for days shown.</td>
<td>3</td>
<td>6</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>Sleep in a separate bed from pregnant partners, infant, or child for days shown.</td>
<td>15</td>
<td>18</td>
<td>20</td>
<td>23</td>
</tr>
<tr>
<td>Daytime restrictions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>You may return to work after days shown.</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Maximize your distance (6 feet) from children and pregnant women for days shown.</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Avoid extended time in public places for days shown.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

Examples should be modified to meet local and specific patient needs. These examples are based on dose rate of 0.17 mrem h$^{-1}$ mCi$^{-1}$ at 1 m (16,17), 500 mrem per year for family member and caregiver, 100 mrem for pregnant women, children, and the public, and Occupancy Factors for adults of 0.25 except for sleeping 0.33. Resumption of sleeping with a partner assumes a distance of 0.3 m (7).
**Precaution Requirements After Treatments with $^{131}$I**

2A-2. Thyroid carcinoma/remnant ablation [Assumes that disappearance of $^{131}$I is biexponential with early effective $T_{1/2}$ of about 0.76 days, and 2% uptake in remnant with effective $T_{1/2}$ of about 7.3 days (7). Consider formal dosimetry (18) for larger administered doses given to patients with functioning carcinoma. $^{131}$I kinetics in euthyroid patients stimulated by recombinant human thyrotropin may differ from those used here (11)].

<table>
<thead>
<tr>
<th>$mCi$ (MBq) administered</th>
<th>50 (1850)</th>
<th>100 (3700)</th>
<th>150 (5550)</th>
<th>200 (7400)</th>
</tr>
</thead>
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<tr>
<td>Nighttime restrictions</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Sleep in a separate (6-feet separation) bed from adults for days shown</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Sleep in a separate bed from pregnant partners, infant, or child for days shown</td>
<td>6</td>
<td>13</td>
<td>18</td>
<td>21</td>
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### Precaution Requirements After Treatments with $^{131}$I

#### 2B-1. Hyperthyroidism

<table>
<thead>
<tr>
<th>Travel time (hours) without exceeding regulatory dose limit</th>
<th>10 (370)</th>
<th>15 (555)</th>
<th>20 (740)</th>
<th>30 (1110)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day (24-h cycles) 0 (beginning with treatment)</td>
<td>5.9</td>
<td>3.9</td>
<td>2.9</td>
<td>2.0</td>
</tr>
<tr>
<td>Day (24-h cycles) 1</td>
<td>9.2</td>
<td>6.1</td>
<td>4.6</td>
<td>3.1</td>
</tr>
<tr>
<td>Day (24-h cycles) 2</td>
<td>13.0</td>
<td>8.7</td>
<td>6.5</td>
<td>4.3</td>
</tr>
<tr>
<td>Day (24-h cycles) 3</td>
<td>–</td>
<td>10.6</td>
<td>8.0</td>
<td>5.3</td>
</tr>
</tbody>
</table>

Examples should be modified to meet local and specific patient needs. These examples are based on dose rate of 0.17 mrem h$^{-1}$ mCi$^{-1}$ at 1 m (16.17), 500 mrem per year for family member and caregiver, 100 mrem for pregnant women, children, and the public, and Occupancy Factors for adults of 0.25 except for sleeping 0.33. Resumption of sleeping with a partner assumes a distance of 0.3 m (7).
### Precaution Requirements After Treatments with $^{131}$I

#### 2B-2. Thyroid carcinoma/remnant ablation

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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day (24-h cycles) 0 (beginning with treatment)</td>
<td>1.2</td>
<td>0.6</td>
<td>0.4</td>
<td>0.3</td>
</tr>
<tr>
<td>Day (24-h cycles) 1</td>
<td>3.0</td>
<td>1.5</td>
<td>1.0</td>
<td>0.8</td>
</tr>
<tr>
<td>Day (24-h cycles) 2</td>
<td>7.2</td>
<td>3.8</td>
<td>2.5</td>
<td>1.9</td>
</tr>
<tr>
<td>Day (24-h cycles) 3</td>
<td>15.0</td>
<td>7.5</td>
<td>5.0</td>
<td>3.8</td>
</tr>
<tr>
<td>Day (24-h cycles) 4</td>
<td>–</td>
<td>15.0</td>
<td>10.0</td>
<td>7.5</td>
</tr>
</tbody>
</table>

Examples should be modified to meet local and specific patient needs. These examples are based on dose rate of 0.17 mrem h$^{-1}$ mCi$^{-1}$ at 1 m (16,17), 500 mrem per year for family member and caregiver, 100 mrem for pregnant women, children, and the public, and Occupancy Factors for adults of 0.25 except for sleeping 0.33. Resumption of sleeping with a partner assumes a distance of 0.3 m (7).
Eligibility Assessment Checklist

Absolute contraindications to $^{131}$I therapy (Pregnancy and Breastfeeding)

1. Determine absence of pregnancy by:
   ___ Pregnancy test within 72 hours prior to treatment, or
   ___ Historical evidence of hysterectomy, or
   ___ No menses for ≥2 years and >48 years old, or
   ___ Other incontrovertible evidence for absence of pregnancy.

2. Determine absence of lactation and/or breastfeeding:
   ___ By interview and/or clinical examination, or
   ___ If uncertain and treatment is needed urgently, recommend $^{123}$I scan to assess breast concentration of radiiodine.

REMEMBER, Breastfeeding or pumping must not be resumed after $^{131}$I therapy.

Consider Inpatient $^{131}$I therapy and Consult RSO When

1. Proposed $^{131}$I dose is
   ___ ≥200 mCi (7400 MBq) or
   ___ TEDE, despite written instructions, is likely to exceed, 0.5 rem (5 mSv) to an adult family member or caregiver, or to exceed 0.1 rem (1 mSv) to a pregnant woman, child or a member of the general public.

2. The patient is unable to comply with oral and written instructions and therefore will require special planning because of:
   ___ Incontinence issues;
   ___ Requires help with devices such as Foley catheters, peritoneal dialysis equipment, feeding tubes, etc.;
   ___ Cognitive/psychiatric limitations;
   ___ Travel/housing limitations;
   ___ Other limitations (name).

Sisson et al. Thyroid 2011;21:335-346
Eligibility Assessment Checklist

Information Gathering for Radiation Safety Precaution Planning

**Travel**: To home on the day of treatment or subsequently:

- __Patient will drive alone and is competent to do so._
  - __Patient plans to use private car with a driver, or taxi, or car service. The patient must sit alone in a back seat >3 feet from the driver. If travel requires taxi or duration is over 2 hours, consult RSO._
  - __Patient is limited to travel by bus, train, subway, ferry, or other public conveyance. This option requires a calculation of TEDE for other individuals and approval by the RSO (see Tables 2B-1 and 2B-2)._  

**Home**: Living arrangements (relationship, age and gender of each household member)

For all household members, patient must be able to stay >6 feet away most of the time (care givers may approach 3 feet up to 25% of the time.)

Special Household Situations. Check all that apply; provide appropriate information and make an alternate arrangement:

- __Household member is pregnant, and the patient cannot stay at least 6 feet away all of the time._
- __Household member(s) are under the age of 16, and the patient can’t stay at least 6 feet away all of the time._
- __Patient is responsible for the care of an infant or young child._
- __There is not sufficient space to maintain >6 feet distance from others._
- __Patient unable to sleep alone during nighttime restricted period._  
  (Consult RSO and/or consider admission.)
- __Patient must share a bathroom with others. (Special home arrangements: Emphasize instructions in Table 4, Step 4, General Recommendations)._  

**Work/School**: Employment or school status, including required activities, environment, contacts with co-workers or fellow students, and arrangements to commute to work/school. From all co-workers or classmates patient must be able to maintain at least 6 feet distance at all times except for momentary encounters.

Special Work/School Situations:

- __Associated with children <16 years of age. If patient cannot stay >6 feet away, delay return to work._
- __Associated with pregnant women. If patient cannot stay >6 feet away, delay return to work._
- __Food preparation for others. Get special instructions from RSO/Radioiodine Treatment Team._
- __Commuting to work or school._
- __Car pooling or public transportation for periods of daytime restriction: make alternate arrangement or obtain special instructions from RSO._
Safety Instructions for Patients

Step 1: Talk with your doctor or a member of the Radioiodine Treatment Team about why treated women must
   ○ Avoid pregnancy for a period of time and
   ○ Not breastfeed.
When treated men can consider fathering a child.
Who will give you the radioiodine therapy, and where and when this will happen.

Hotel/motel accommodations. A stay in a hotel or motel is not recommended after treatment with $^{131}$I.

Sisson et al. Thyroid 2011;21:335-346
Safety Instructions for Patients

Step 2: Make preparations before treatment and talk with your doctor or a member of the Radioiodine Treatment Team about the following specific items:

Obtaining

- Wipes and/or toilet paper that can be flushed down the toilet;
- Disposable gloves if others will be helping to take care of you;
- Heavy duty (doubled if possible), leak proof, specified plastic trash bags for tissues, paper towels and other things that may be contaminated and trashed;

For your travel:

- If you are well enough, it is best to drive yourself;
- If you ride with someone else, confirm she is not pregnant, and maintain a distance of >3 feet (use the back seat on opposite side of the driver);
- When and where you can take necessary trips;
- When it is safe to use public transportation;

For home:

- Living or working with a pregnant woman;
- Associations with children;
- Inability to control your urine or bowels;
- Using special medical equipment, such as catheters, ostomy bags, or anything that could be contaminated by your body fluids;
- Getting sick easily (throw up or get woozy);
- Not being able to go directly home; arrangements must be made through your treatment team; hotel and motel stays are not recommended.

Sisson et al. Thyroid 2011;21:335-346
Safety Instructions for Patients

Step 4. Recommendations for after therapy

At home
Specific recommendations. Ask your doctor for the number of days to:

- Sleep alone in a bed that is >6 feet away from another person, and, if possible, use a separate bedroom or sleeping room all by yourself;
- Not kiss anyone;
- Not have sexual activity.
- Move your bowels every day and use a laxative if you need help;
- Empty your bladder (urinate) every hour or so during the day of, and day after your radioiodine treatment; follow your doctor's advice on how much to drink;
- Use wipes (preferably flushable) to clean the toilet seat after use; men should sit down to urinate and use wipes to remove splatter of urine; wipe yourself dry after urinating so that you do not drip;
- For a phone you share with others, after use, wipe off the mouthpiece, or, while using, cover the phone with a plastic bag that, after use, is placed in specified plastic trash bag.

General Recommendations especially for patients sharing a bathroom

- Flush the toilet after each time you use it; flush toilet paper and wipes;
- Always wash your hands well after using the toilet;
- Rinse the sink and wash your hands after brushing your teeth to wash away the saliva (spit);
- Do not share your toothbrush, razor, face cloth, towel, food or drinks, spoons, forks, glasses and dishes;
- Shower every day for at least the first 2 days after your treatment;
- Do not cook for other people. If cooking is necessary, use plastic gloves and dispose of in the specified plastic trash bag;
- Wash your dishes in a dishwasher or by hand; it is better not to use disposable (throw away) dishes which must be put into a specified plastic trash bag;

- Try to flush any tissues or any other items that contain anything from your body, such as blood, down the toilet; items that cannot be flushed, such as menstrual pads, bandages, paper/plastic dishes, spoons and forks and paper towels should be put in the specified plastic trash bag;
- Wash your underwear, pajamas, sheets and any clothes that contain sweat, blood or urine by themselves; use a standard washing machine; you do not need to use bleach and do not need extra rinses;
- Have any one who helps you clean up vomit, blood, urine, or stool wear plastic gloves; the gloves should then be put in the specified trash plastic bag.
Trash Recommendations
○ Keep the specified plastic trash bags separate from other trash; keep the bags away from children and animals;
○ A member of your Radioiodine Treatment Team will tell you how and when to get rid of the specified plastic trash bag; you may be asked to bring the bag back to your treatment facility, or, after 80 days, the bag may be removed as other trash bags.

Pets
○ Usually pets will not receive enough radiation to harm them. But do not sleep with pets (ask your doctor for how long) since your saliva, perspiration or other secretions may be carried away by the pet.

Outside the Home. Ask Your Doctor or a member of the Radioiodine Treatment Team when:
○ It will be safe to eat out, go shopping and attend events such as religious services, parties and movies;
○ You will be able to return to work and to care for or teach others;
○ It would be safe to donate blood;
○ Special or longer distance travel is possible; (Note: For up to 3 months or more following radioiodine treatment you may set off radiation detectors at: national borders, airports, bus and train stations, tunnels, bridges, trash collection sites and even your place of employment); a member of your Radioiodine Treatment Team will issue you a letter or card describing the therapy and the phone number of a person knowledgeable about your treatment (usually at the treating facility) in case local law enforcement agents need to check on this information; you should keep the letter or card containing the information with you whenever you are traveling for at least 3 months.

Emergency Care
○ You will get an information card or letter at the time of your treatment that will show the date, type and amount of radioiodine that you were treated with; carry this card with you at all times for at least 3 months following your treatment;
○ If you are in a traffic accident or any other medical emergency during the first week after your treatment, you should show this card to the medical people to let them know about the date and dose of your radioiodine treatment.
The OSU Thyroid Cancer Unit

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