



Radioactive Iodine Ablation Treatment (RAI)

RAI (I-131) treatment may be given after a total thyroidectomy (TT) to eliminate (ablate) thyroid cells, normal and cancer cells. The dosage of RAI is given in millicuries. The dosage of RAI determines the length of isolation required.

Requirements for Successful RAI

1) Increase your TSH level

Your TSH level (thyroid-stimulating hormone, or thyrotropin) must be well above 30 mIU/L (**Figure 1**). This removes the TSH suppression and “turns on” the thyroid cells. There are two ways to increase TSH levels.

- a. **Withdrawal from Thyroid Hormone medications.** This could take 3-6 weeks to achieve > 30 mIU/L TSH levels. Some doctors prescribe cytomel (T3) to help wean from the thyroid medications. However cytomel will need to be discontinued at least 2 weeks prior to RAI.
 - i. Removal of thyroid hormones results in hypothyroidism.
 - ii. Symptoms include fatigue, weight gain, puffiness, constipation, muscle aches, brain fog, depression, dry skin, brittle hair and nails.
 - iii. Not all individuals will experience all these symptoms and some may not experience any symptoms.
 - iv. Typically an individual can resume thyroid medications 24 hours after RAI.
- b. **Thyrogen® Shots.** This is an injection of man-made TSH (recombinant human TSH) that will rapidly increase TSH levels. Individuals can stay on their thyroid medications. Note – some doctors prefer to do a hybrid approach wherein they used Thyrogen shots and remove thyroid hormone medications for days rather than weeks.
 - i. Most individuals will experience no side effects.
 - ii. Side effects generally are fatigue.
 - iii. **Table 1** has a list of side effects observed in The LID Life Community (LLC) from RAI, thyrogen, and thyroid medication withdrawal.
 - iv. TSH will rapidly decline once Thyrogen leaves your body in a few days,

*note – both methods of increasing TSH have comparable success rates for RAI ablation.

2) Low Iodine Diet

- a. 2 week diet that improves the efficacy of RAI by removing dietary iodine from the diet (**Figure 2**). For more information the **LLC LID guidelines** provide in depth information about the diet.
- b. Removal of sea salt, soy (except soy lecithin and soybean oil, red dye #3, anything from the sea, dairy, among others.

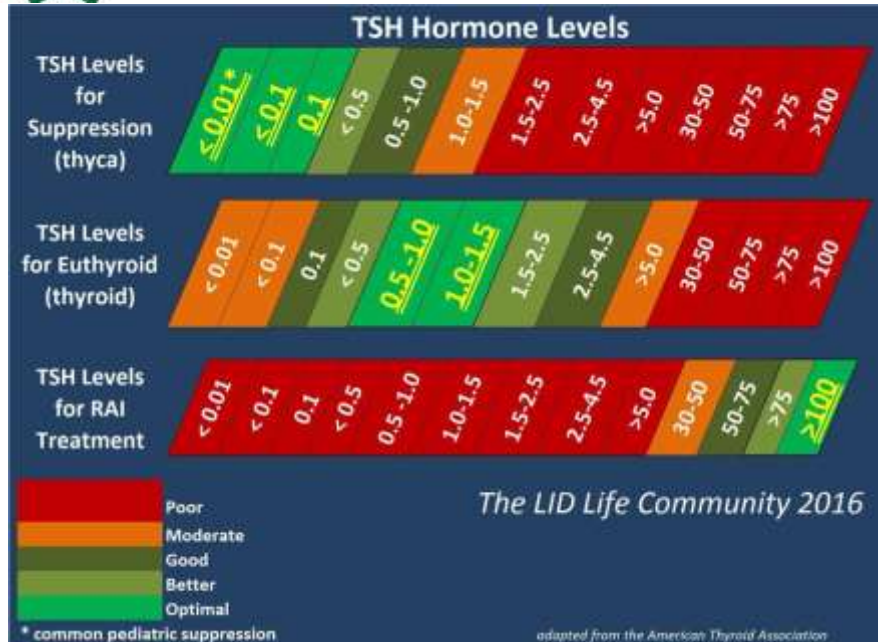


Figure 1: TSH levels for suppression of thyroid cancer (top row), wherein <0.1 mIU/L TSH is the target level according to the American Thyroid Association. The middle row is TSH levels for individuals that do not have thyroid cancer and have a thyroid. No suppression is required for individuals without thyroid cancer. The bottom row is TSH levels for preparation of RAI. TSH needs to be >30 mIU/L for RAI to be taken into the thyroid cells.

After RAI

1) Water

- Drink enough water to urinate at least once an hour during awake times.
- If needed, use laxatives to defecate at least once per day.
- Do NOT drink distilled water as it can upset the stomach and increase the risk for hyponatremia.

2) LID needs to continue for a minimum of 24 hours after RAI.

- Check with your doctor for their specific requirements.
- Do NOT introduce dietary iodine directly after RAI.

3) Start using sour candy or food to stimulate saliva production 24 hrs after RAI

- Early use of sour candy can lead to hastening RAI into the salivary glands.
- Some doctors prescribe Medrol Steroid packs to avoid salivary gland inflammation.
- Some doctors have prescribed Salagen to stimulate saliva production.
- Warm compresses and massage helps relieve salivary gland pain.

4) Nausea

- Use gingerale to help alleviate.
- Some doctors prescribe Zofran for nausea.
- Sometimes the sudden return to dairy after LID causes upset stomach.

5) Hygiene

- Use soft toothbrushes. Use gentle toothpaste. No toothpastes with alcohols or whiteners
- Brush teeth and floss at least 3 times per day. Mouthwashes. Use alcohol-free.
- Shower every day. The more a person sweats, the more showers need to be taken per day.
- Wash hands after using restroom. Flush twice.



- e. Avoid baby shampoo as it dries out hair. Hair stylists recommend a gentle shampoo, such as Paul Mitchell Shampoo One or Original Awapuhi shampoo. Talk to your hairstylist to see which gentle shampoo is best for your hair. To decrease products during isolation, conditioner can be used as a conditioner, a leave-in conditioner, and shaving lotion.
- f. Some members use hotel soap and travel containers for their products.
- g. If you decide to not wash your hair every day, make sure you wash it before WBS to avoid a false image due to RAI in your hair from sweating.

6) Thyroid Medications (for those on the withdrawal method) resumed 24-48 hours after RAI.

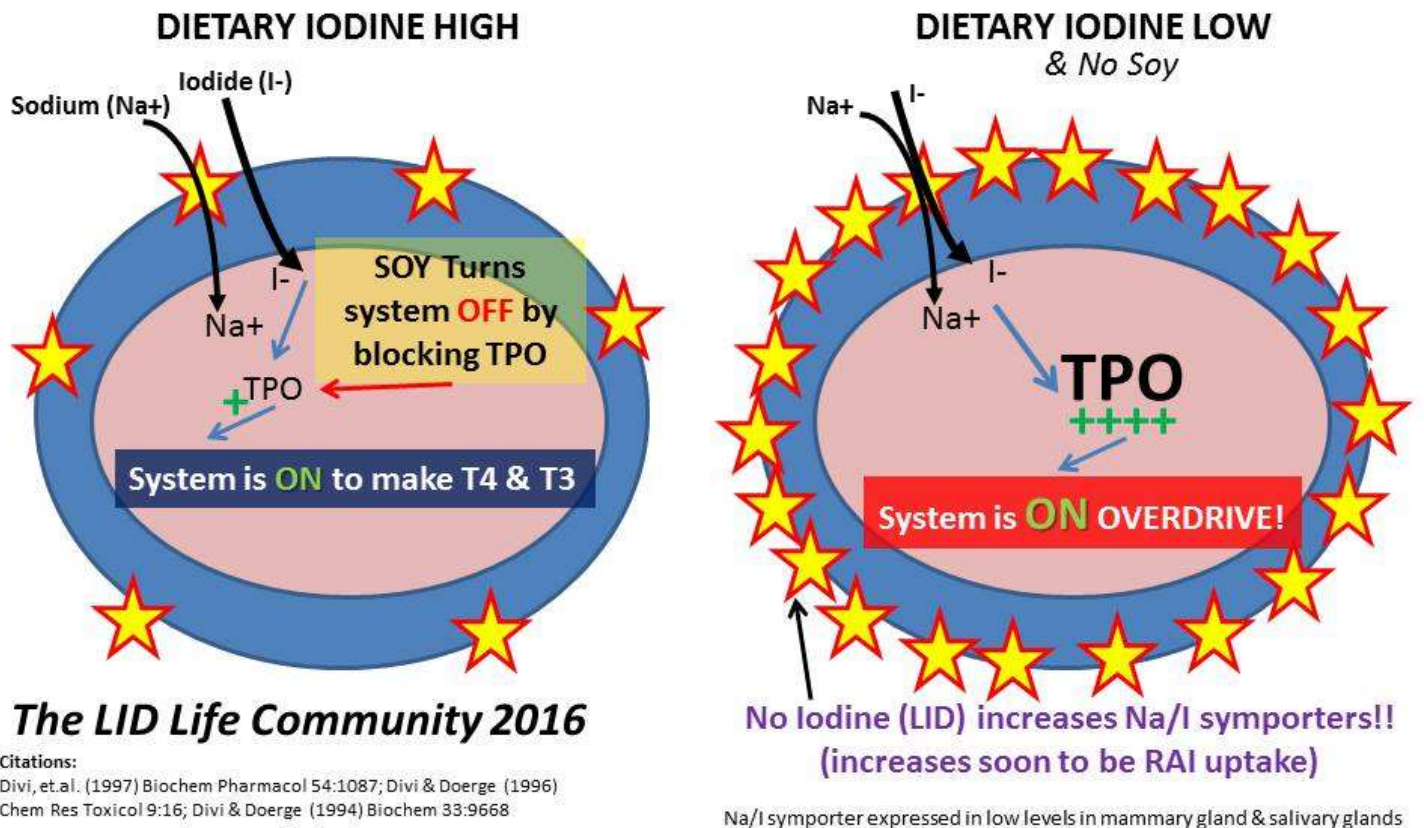


Figure 2. The effects of low iodine diet and lack of soy on thyroid cell function.



Isolation

1) Times depend on RAI concentration

- If you know your uptake is less than 2%, use the American Thyroid Association isolation guidelines (**Figure 3**).
- If you know your uptake is around 5%, use the LLC isolation guidelines (**Figure 4**).
- If you do NOT know your uptake, use the LLC isolation guidelines.

2) Geiger Counter

- If you have young children, it is advisable to get a Geiger counter reading to determine how much radioactivity you are emitting.
- You must know the units use for the Geiger counter to determine if you are at background radiation levels (**Figure 5**).

3) 6 feet bubble

- Stay 6 feet (2 meters) away from everyone (including pets) until you are released from isolation (**Figure 6**).
- Many individuals isolate in a bedroom with an attached bathroom to reduce possible radioactive contamination to other areas of their home.
- Do not use public transportation or hotels during your isolation.
 - If someone is driving you home (especially if individual is hypothyroid), sit in the back seat on the opposite of the driver.
 - Many people put a sheet over the seat for the individual to sit on.

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)]

	mCi (MBq) administered			
	50 (1850)	100 (3700)	150 (5550)	200 (7400)
Nighttime restrictions	Days/24-h cycles			
Sleep in a separate (6-feet separation) bed from adults for days shown.	1	1	2	4
Sleep in a separate bed from pregnant partners, infant, or child for days shown.	6	13	18	21
Daytime restrictions				
You may return to work after days shown.	1	1	1	1
Maximize your distance (6 feet) from children and pregnant women for days shown.	1	1	1	1
Avoid extended time in public places for days shown.	1	1	1	1

Figure 3. The American Thyroid Association's guideline for isolation with 2% thyroid uptake.



RAI dose and suggested isolation times

** these are suggested because there are numerous factors that individualize it (age, kidney function, amount of residual tissue, flushing, etc).*

If you have young children, we HIGHLY suggest you get a reading by a Geiger counter at your whole body scan.

TALK TO YOUR DR TO SEE WHERE YOU FALL ON THE SCALE. This table is based on 5% thyroid uptake

RAI DOSE (mci)	Day 1 RAI level (based on 90% excreted)	Day 2 RAI levels (based on 95 % excreted)	DAY 3 RAI level (based on 98% excreted)	No isolation	overnight isolation	Isolation from adults	Isolation from children/ pregnant women	RAI DOSE (mci)	RAI DOSE (MBq)	RAI DOSE (GBq)
1.5	0.15	0.075	0.03	x				1.5	55.5	0.06
3	0.3	0.15	0.06	x				3	111	0.11
5	0.5	0.25	0.1		x			5	185	0.19
10	1	0.5	0.2		x			10	370	0.37
20	2	1	0.4		x			20	740	0.74
30	3	1.5	0.6			2 days	3 days	30	1110	1.11
40	4	2	0.8			2.5 days	3 days	40	1480	1.48
50	5	2.5	1			2.5 days	3 days	50	1850	1.85
60	6	3	1.2			3 days	5 days	60	2220	2.22
70	7	3.5	1.4			3 days	6 days	70	2590	2.59
80	8	4	1.6			4 days	7 days	80	2960	2.96
90	9	4.5	1.8			5 days	8 days	90	3330	3.33
100	10	5	2			6 days	8 days	100	3700	3.7
110	11	5.5	2.2			7 days	10 days	110	4070	4.07
120	12	6	2.4			7 days	11 days	120	4440	4.44
130	13	6.5	2.6			8 days	12 days	130	4810	4.81
140	14	7	2.8			8 days	13 days	140	5180	5.18
150	15	7.5	3			8 days	14 days	150	5550	5.55
160	16	8	3.2			9 days	14 days	160	5920	5.92
170	17	8.5	3.4			10 days	15 days	170	6290	6.29
180	18	9	3.6			11 days	16 days	180	6660	6.66
190	19	9.5	3.8			12 days	16 days	190	7030	7.03
200	20	10	4			13 days	16.5 days	200	7400	7.4

* 1.5 is needed to be released from adult isolation

*1 is needed to be released from children and pregnant women isolation

The LID Life Community 2016

Figure 4. Isolation guidelines based on 5% thyroid uptake.



Geiger Counter Numbers		The LID Life Community 2016			
Source	uSv	mSv	nSv	cpm	mrem (mR/hr)
background (non-RAI radiation levels)	0.2-0.625	0.0002-0.000625	200-625	25-75	0.02-0.0625
banana (radiation that a banana emits)	0.1	0.0001	100.00	12	0.01
chest x-ray (radiation from procedure)	100	0.1	100,000.00		10
dental x-ray (radiation from procedure)	90	0.09	90,000.00		9
mammogram (radiation from procedure)	700	0.7	700,000.00		70
flight from LA to NY (radiation from flying)	15	0.015	15,000		1.5

Minimum Geiger counter numbers to leave the 6 ft bubble

*** around adults: at the 3 foot distance < background readings

*** children (especially infants): at the neck distance < background readings

Figure 5. Geiger counter numbers for background radiation. Background radiation is radiation from sources such as the sun. First step is to determine the units. USA units are generally mrem (mR/hr). Canada and Europe units are generally uSv. Many people that use a Geiger counter at home use CPM units. Once you know the units, go to the yellow line and find the number listed under your Geiger Counter's units. This number is the background the number. To break isolation, your radiation number should be near this number. The other lines show radiation levels for bananas, medical procedures, and even flights in the different units.

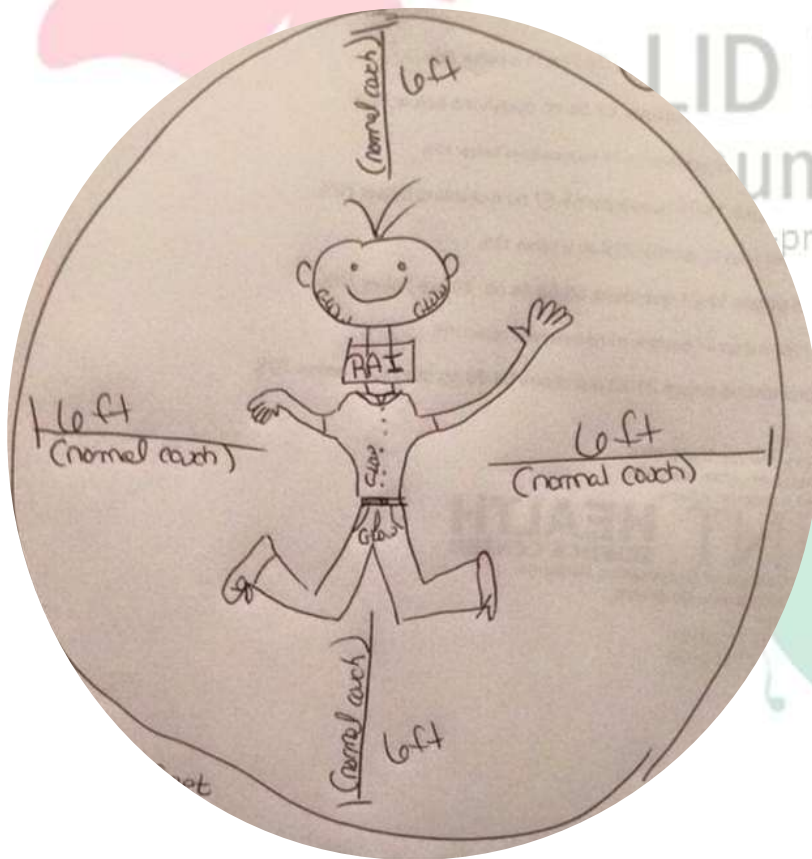


Figure 6. Ray RAI. This is "Ray" and he has a 6 foot glow circle around him, due to Ray temporarily putting out "X-rays" during his isolation. The X-rays do not leave anything bad behind when the glow circle leaves an area. This means that when Ray is near something but does not touch it, it is not contaminated. Ray does have sweaty hands and touched a dresser. He will need to wipe down that area he touched with non-bleach cleaner, such as Lysol or soap & water, at the end of isolation. Ray does have areas that show up in his WBS that are glow areas but not RAI uptake areas. Ray is excreting RAI and it shows in his bladder, GI, and his salivary glands. However, Ray is drinking enough water to pee once an hour and is flushing the RAI from his system.



Whole Body Scan (WBS) after RAI

- 1) 2-10 days after RAI depending on the RAI dose
- 2) Scan takes ~ 30 minutes -2 hours
- 3) Request a Geiger Counter scan at your WBS
 - a. This gives your individual radioactivity level that you can compare against background radiation levels (**Figure 5**).
 - b. Very important if you have children or pregnant women near you
- 4) Generally the scan occurs at a hospital or nuclear medicine facility
 - a. You will remain fully clothed. May want to dress warmly as the room may be cold (**Figure 7**).
 - b. Most individuals will show residual tissue on their first WBS because it is very difficult to surgically remove all thyroid tissue. This is generally referred to as “normal uptake in the neck.” The scan may also show uptake in the GI system, bladder, and salivary glands.
 - c. The scan provides information if there are any other areas of the body that has thyroid cells or cancer.
 - d. WBS results may be provided at the time of the scan, a few days after the scan, or at your next doctor appointment.

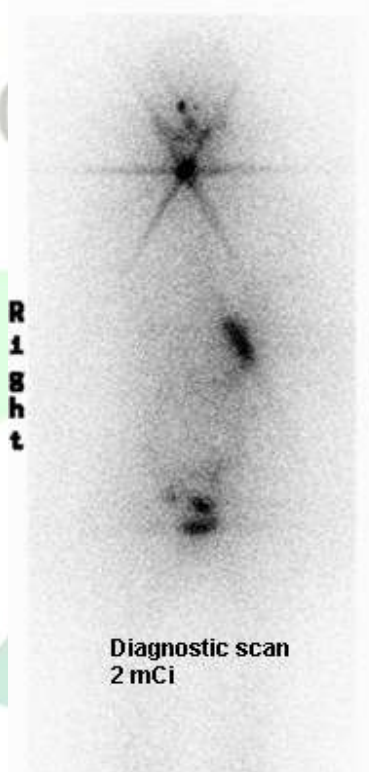


Figure 7. Whole Body Scan. A. This machine is open on all sides. A box moves up and down your body taking photos. **B. Sample WBS image.** The star shape is remnant thyroid tissue. The spot above it is salivary gland uptake. The black spot in the middle is GI system uptake, and the bottom black spot is bladder uptake. Please relieve yourself prior to WBS to remove background uptake from excrement.



1) Sleep separate & use separate utensils until end of isolation

2) CPAP machines

- Soap and water can be used to clean the machine, hoses, and mask.
- If you do not want to clean the hose and mask, save your old hoses and masks for use during isolation.
- Please wash anything prior to discarding it.

3) Tracer dose followed by WBS for RAI determination

- Small amount of RAI (<5 mci) may be used to determine treatment RAI doses. Usually called a pre-scan.
- For individuals that are borderline (low Tg or low risk), a tracer dose may be used to determine if treatment RAI is necessary.

4) Dental Care

- Some doctors recommend getting a dental cleaning prior to RAI.
- Wait at least 3 weeks after RAI to go to the dentist.
- Use soft toothbrushes. Use gentle toothpaste. No toothpastes with alcohols or whiteners.
- Brush teeth and floss at least 3 times per day. Mouthwashes. Use alcohol-free.

5) Pets

- Treat pets as children.
- Multiple veterinarians have stated that pets should be outside the 6 ft isolation bubble.
- Study found RAI exposure to pets ~0.02-1.1 mSv (20-1100 uSv or 2-110 mrem) from their owners that underwent I-131 (116 mci) and were released from isolation after 2 days. RAI exposure was measured 24 hrs/day for 10 days. For comparison a chest x-ray for a pet is ~0.39 mSv (390 uSv or 39 mrem) per view.
<http://jama.jamanetwork.com/article.aspx?articleid=192644>.
- Dogs and cats groom themselves a LOT. If you pet them while being under isolation and some of the RAI in your perspiration was transferred to their coat, you have now set up your pet to have their thyroids destroyed along with yours as they have now ingested your RAI.
- Treat older pets the way you would older people. Would you hug your grandparent?

6) Cleaning

- Wash linens and used clothing twice in the washing machine.
- Clean areas that you may have touched with soap and water. Pay extra precaution to your sink where you brushed your teeth. Saliva is 7-100 times more radioactive than urine.
- Store trash to decay the radiation
- If unable to store trash, diminish trash.
 - Use flushable wipes rather than paper towels or facial tissues
 - Do not eat food that cannot be disposed by the garbage disposal
- Rinse sink and shower thoroughly (**Figure 8**)
- You can use a dishwasher to clean your plates and utensils. No need to run it multiple times.
- Maid service: NOT until you have cleaned these areas yourself.

7) I-123 RAI Isotope

- For non-treatment RAI, such as for yearly scans or pre-scans, I-123 RAI may be used instead of I131.
- I-123 is harmless to thyroid cells. No isolation is required after exposure to I-123.
- Because of the expense, this isotope may not be always used for diagnostic scans.



I am lazy, so I covered stuff to decrease my cleaning burden
(This is NOT required)



I plastic wrapped my faucets, handles, switches



I covered my husband's vanity. I put tape down to remind me of where I wanted to not go



I wore slippers to protect my carpet (also threw down a sheet on my carpet). Electronics are in a baggie. Light switch covered with plastic.

Cleaning Products

- Lysol (no-bleach) wipes
- Water
- Soap
- Baby Wipes



- Washed clothes & linens 2X
- Items that did not fit in the washer easily, I put in the garage for 80 days
- I kept my trash in the garage for 80 days (not all places require this)

Figure 8. Isolation cleanup. To decrease my cleaning burden after isolation, I did cover some areas of my

8) Tracer dose versus treatment dose.

- Tracer dose is <5 mCi of RAI. Generally either I-123 or I-131 is used. However, if I-131 is used, overnight isolation may be required depending on the dose. WBS is usually 1-2 days after tracer dose.
- Treatment doses of RAI are >30 mCi and are always I-131, resulting in isolation requirements. WBS usually occurs 7-10 days after RAI.
- Treatment doses are based on risk (low-high), size of the tumor, lymph node involvement, metastasis to lungs or bone, variants, mutations, and age/gender.

9) Water Softener salt:

Thank you for contacting Morton Salt, and for your interest in our products. Morton® Water Softening products are not iodized.

We hope you find this information helpful. Should you have additional questions or comments, feel free to contact us via our toll-free number [\(800\) 725-8847](tel:8007258847), Monday through Friday 8:30 a.m. - 4:30 p.m. CST, or via our website at www.mortonsalt.com. Again, thank you for contacting Morton Salt.



10) **Breastfeeding**

- a. Do not do RAI if you are breastfeeding
- b. Wait until 6 weeks at a minimum after breastfeeding for RAI
- c. 3 months after breastfeeding is preferable.

11) **Sexual Relations**

- a. Wait until you are completely out of isolation
- b. It is advisable to practice safe sex for a couple of weeks after isolation.
- c. Since saliva is the most radioactive body fluid, it is advisable to wait 3 weeks after RAI for kissing.

12) **Abbreviations**

THYCA - thyroid cancer
WBS - whole body scan
RAI (131) - radioactive iodine
RAI (123) - Tracer dose
TG - Thyroglobulin
TT - total thyroidectomy
LID - low iodine diet
HCC - hurthle cell carcinoma
PC - papillary carcinoma
FC - follicular carcinoma
FNA - fine needle aspiration
TSH - thyroid stimulating hormone
T4 - thyroxine storage thyroid hormone
T3 - liothyronine active thyroid hormone
ENDO - endocrinologist

VIT - vitamin
LEVO - levothyroxine
MRI - magnetic resonance imaging
CT - cat scan
MCI - millicurie
METS - metastasis
ISO - isolation
NED - No evidence of disease
DX - Diagnosis
NDT - natural desiccated thyroid
PET - Position emission tomography
LLC – LID Life Community
FNB - fine needle biopsy
Rx- prescription
Sx - surgery
Dx – diagnosis
Tx - treatment

13) **Future pregnancy**

- a. Wait 6-12 months before pregnancy in women
- b. Women may have temporary irregular periods after RAI
- c. RAI at high concentrations may affect sperm count.

14) **Inconsistencies**

- a. There are broad inconsistencies from doctor to doctor, facility to facility, state to state, country to country.
- b. We do not promote one place over the other. We only promote the accepted science.

15) **Hotels**

- a. We do not encourage hotels because it is a public health concern (**Figure 9**).
- b. If you have no other choice than to use a hotel, please follow these recommendations.
 - i. Talk to hotel management and ask for a corner room
 - ii. Place the DO NOT DISTURB sign on the door to protect hotel staff.
 - iii. Sleep with your head at the foot of the bed to create 6 feet from the wall.
 - iv. Bring your own food or order room service with the food requested to be left outside the door.
 - v. If order room service, use gloves and wash the dishes and anything you touched in the sink. Once the dishes and tray are clean from your contamination, they can be left outside the door.



- vi. Bring your own linens, pillows, towels, and a beach towel to place under your sheet. These items will be taken with you when you leave.
- vii. Bring cleaning supplies to clean the room. Remember to scrub the toilet and shower.
- viii. Use slippers to walk on the floor
- ix. Bring your own utensils. Use a straw.
- x. Follow directions for how to have no trash at the end of isolation (Cleaning in the FAQs).
- xi. All waste is to be bagged and taken with you at the end of your stay.
- xii. Put baggies on remotes and door knobs
- xiii. INSTEAD OF YOU ISOLATING AT A HOTEL, SEND YOUR FAMILY THERE FOR A VACATION WHILE YOU ISOLATE AT HOME

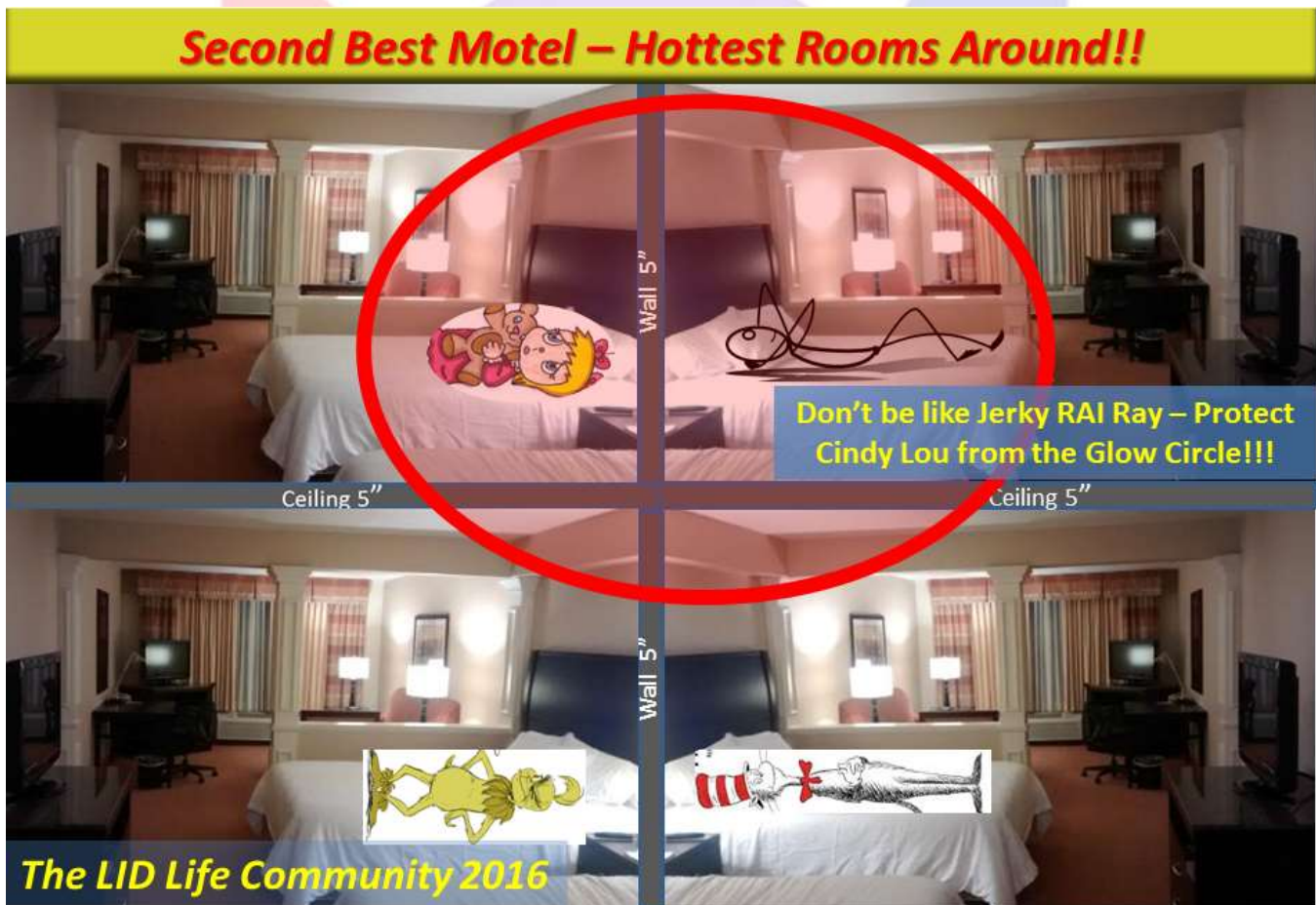


Figure 9. Hotel. Even though RAI contamination is only from body fluids, the gamma waves that an individual with RAI (I-131) is emitting will go through walls (6 feet) to harm anyone within 6 feet.



TABLE 1

SIDE EFFECTS SEEN IN THE LID LIFE COMMUNITY

Side effect	Common?	Rare?	Cause-off thyroid meds	Cause - LID	Cause-RAI	Cause - thyrogen	Cause - other	Possible remedy
anxiety	x		x	x- trying to find foods is trying	x- it's scary	x- it's scary	LID, RAI, Isolation and clean up are scary. It is also possible that your thyroid medication is high, resulting in hyper symptoms	thyroid med adjusting, de-stressing, Xanax, baths, getting out of isolation and cleanup
body aches	x (not for LID and RAI, but for hypo)		x				it could also be adrenaline let-down from the stress of thyca treatment	thyroid med adjusting, de-stressing, Epsom salt baths, magnesium, potassium
brittle nails	x (not for LID and RAI, but for hypo)		x					thyroid med adjusting, including biotin, de-stressing
confusion/brain fog/ hallucinations/ cognitive issues	x not for LID & RAI, but for hypo)	x	x					going back on thyroid meds. It may take a couple of weeks to get back to normal



constipation	x (not for LID and RAI, but for hypo)	x	x - usually this is the cause	x - change of diet, not common	x - rare		taking pain meds	drink, return of thyroid meds, laxatives
depression	x		x	x	x	x	stress, adrenaline, isolation, meds off,	meds adjusted, returning to normal life. Getting an antidepressant may help
diarrhea		x		x - change of diet, not common			It could also be doing a dairy splurge after LID	hard to do but return to dairy slowly
dry eyes		x			x			drink and use eye drops, artificial tears, medrol steroid pack
dry mouth	x				x		not drinking enough - pinch top of your hand to see if dehydrated . If it tents up, drink up	drink, xylimelts, if salivary glands are swollen, do as suggested above, act/biotene dry mouth products



fatigue	x		x		x	x	it could also be adrenaline let-down from the stress of thyca treatment	sleep, resuming thyroid meds
frustration	x		x	x	x	x	This could be due to exhaustion from thyca treatment (diagnosis, TT, LID, & RAI) can wear you down and make you frustrated and short-tempered.	Finishing the treatment. Getting back on thyroid meds. A break from being poked & prodded. Sleep. De-stress
hair loss	x (not for LID and RAI, but for hypo)		x				it could also be adrenaline let-down from the stress of thyca treatment	thyroid med adjusting, including biotin, de-stressing
headache	x		x			x	your immune system may be compromised due to high stress, so this could also be a sinus infection, etc	thyroid meds starting again, time, sleep, ibuprofen, Tylenol, etc
heart palpitations		x					thyroid meds high, stress, adrenaline	med adjustment, de-stressing



insomnia	x (not for LID and RAI, but for hypo)		x				it could also be adrenaline let-down from the stress of thyca treatment	thyroid meds starting again, time, sleep, letting your body finally adjust to de-stressing after everything you have gone through. I am a big proponent of Epsom salt baths to help with this
light-headedness		x	x- usually this is the cause				your immune system may be compromised due to high stress, so this could also be a sinus infection, it can also be a symptom of low blood pressure from off meds, your salt/water balance off (especially if drinking distilled water)	thyroid meds starting again, time, sleep, stand up/bend down slowly
loss of taste (metallic taste)	x				x			time



moodiness/emotional mess	x		x	x - trying to find foods is frustrating	x - stress	x - stress and for some that are sensitive to high TSH even on thyroid meds (rare)	it could also be adrenaline let-down from the stress of thyca treatment	thyroid meds starting again, time, sleep, etc
mouth sores		x					too many sour candies. If you are prone to cold sores during periods of high stress, you may end up with one	Switch to a different type of sour or skip sour and use something that makes you salivate (gum). Water and go on a low acid diet to let your tongue heal. Magic mouthwash helps



nausea	x				x	x	many times it only happens for a few hours on a single day, if at all, your salt/water balance off (especially if drinking distilled water)	ginger ale, Zofran
Nose dry/ bloody nose		x			x		your immune system may be compromis ed due to high stress, so this could also be a sinus infection, etc	nasal sprays, ointments, humidifier, lysine, ayr gel, nasogel
salivary gland pain	x				x		your immune system may be compromis ed due to high stress, so this could also be a sinus infection, etc	sour candies, something to make you salivate (only start 24 hrs after RAI), ibuprofen, Tylenol, Medrol steroid pack, warm compresses, WATER,



Swelling (neck, body)		x	x					talk to your dr. If it is due to being off meds, they need to know
swollen puffy eyes	x (not for LID and RAI, but for hypo)		x				salt/water balance off from drinking distilled water	thyroid med adjusting, check your water mineral balance.
tongue pain		x					too many sour candies.	Switch to a different type of sour or skip sours and use something that makes you salivate (gum). Water and go on a low acid diet to let your tongue heal. Magic mouthwash helps
upset stomach	x		x	x - change of diet	x - the fluid flushing can upset stomachs		drinking distilled water, going on a NO Salt diet	drink tap or spring water, ginger ale, slowly introduce dairy at end of LID
weight gain/loss	x		x	x			stress can affect weight gain or loss	resume thyroid meds, de-stressing, returning to normal diet



11)

Citations

<https://www.aace.com/syllabus/tampa-thyroid-cancer/presentations/8-WARTOFSKY-AACE-Thyroid-Cancer-january-2015.pdf>

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