

# 9 YEAR-OLD GIRL WITH THYROID NODULE

ENDORAMA

APRIL 12, 2012

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# HPI

- **9 yo Mexican-American girl presents with L neck nodule found incidentally during routine check-up**
- **No improvement in 1 week**
- **No radiation exposure**
- **ROS**
  - Increased appetite x 2 weeks
  - Slight increased hair shedding
  - Occasional constipation for years
  - Denies fatigue, diarrhea, palpitations, wt change, heat/cold intolerance

# HISTORY

## Past Medical Hx

- Born in Mexico, full-term, C-section
- Recurrent strep tonsillitis
- T&A 1 yr ago

## Meds

- None

## Fam Hx

- No thyroid CA, +T2DM in maternal fam, MGGF & MGGF w/ colon CA

## Social Hx

- Lives w/ parents, 14 mo sister

# PHYSICAL EXAM

T 96.2 HR 86 BP 115/84 Ht: 131.7 cm (50%ile) Wt: 36.9 kg (80%ile)  
BMI 21.3 kg/m<sup>2</sup> (97%ile)

Gen: well-nourished

HEENT: PERRLA, EOMI, MMM

Neck: **firm nodule on medial L thyroid lobe, raises w/ swallowing & firm, fixed superio-lateral L nodule both 1.8 x 2 cm and non-tender**

Chest/Resp: CTAB, Tanner 1 breasts

CV: RRR, no murmurs, 2+ pulses

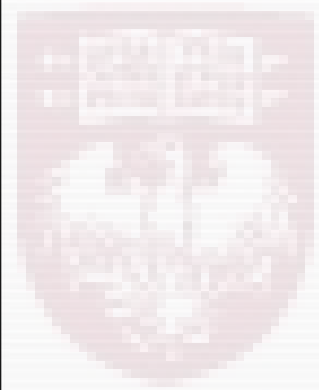
Abdom: soft, NTND, no masses

GU: Tanner 2 sparse vellus hair on mons

MSK: nl strength x 4, no joint swelling

Neuro: CN II-XII intact, symm, brisk patellar reflexes

Skin: nl pigmentation



THE UNIVERSITY OF  
**WHAT NEXT?**  
CHICAGO  
MEDICINE

# American Thyroid Association 2006: Management Guidelines for Patients with Thyroid Nodules and Differentiated Thyroid Cancer

- Thyroid nodule incidence 1-1.5% peds vs 4-6% adults
- Malignancy rate in nodules 5% in adults, reports of 20-40% in children

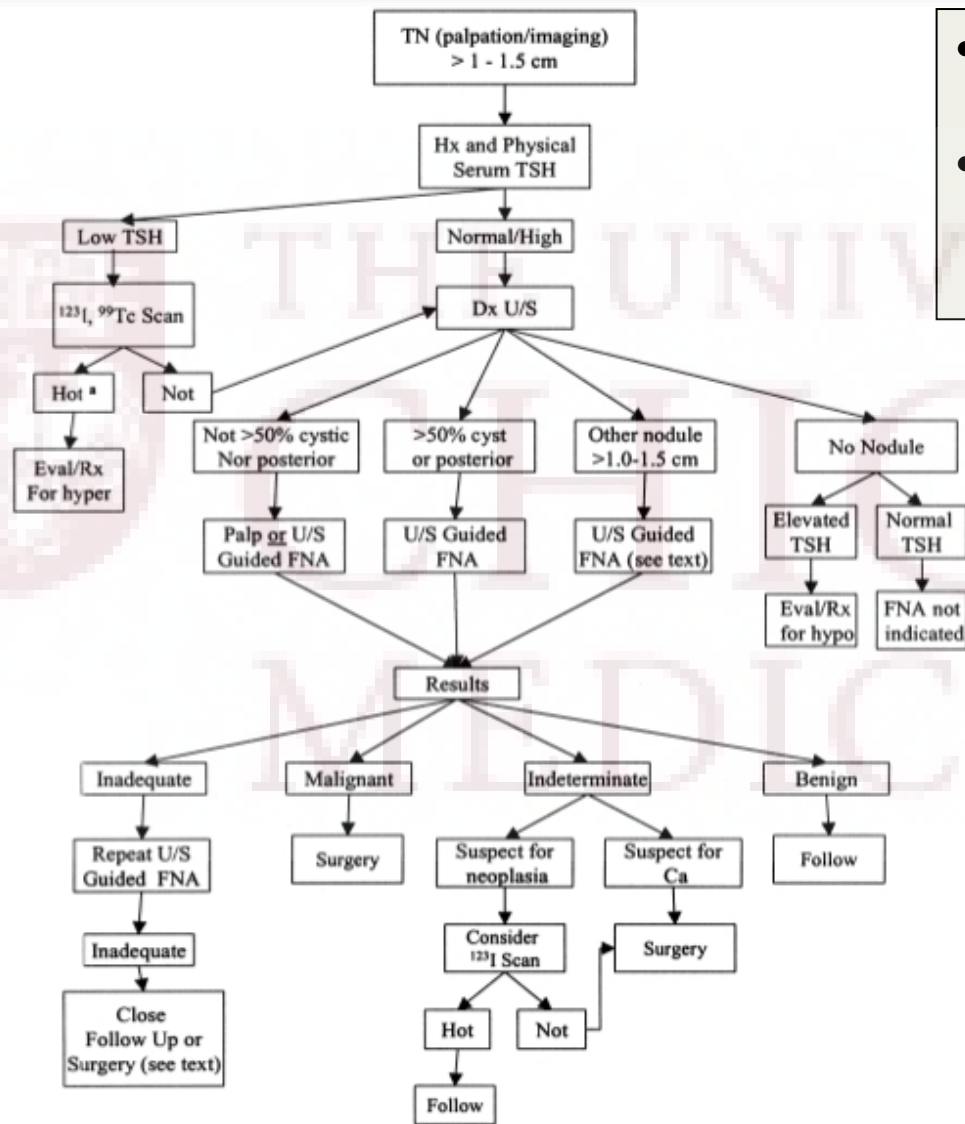


FIG. 1. Algorithm for the evaluation of patients with one or more thyroid nodules. \*If the scan does not show uniform distribution of tracer activity, ultrasound may be considered to assess for the presence of a cystic component

# INITIAL EVALUATION

## PMD eval:

### •CT neck w/ contrast

- L cervical LAD of L jugulodigastric and supraclavicular areas
- Ill-defined hypodense mass measuring 1.8 x 1.5 x 2.2 cm on L thyroid lobe
- R lobe enhanced homogenously, nl thymus

### •Referred to ENT

- FNA → Papillary Thyroid Carcinoma

### •Referred to Peds Endo

- TSH 3.13 mcU/mL, fT4 1.28 ng/dL, TT4 9.3 mcg/dL
- Thyroglobulin Ab >10,240 TPO Ab 20,480

# FEATURES OF PTC

|                            | ADULTS  | CHILDREN   |
|----------------------------|---|--|
| Risk Factors               | Head/neck irradiation, female gender, pubertal, Coexisting thyroid disease, Iodine def. |  |
| Pathogenesis               | Mutations in <i>RET</i> gene, <i>BRAF</i> , <i>TRK</i>                                  | TRK rearrangements are rare  |
| Prevalence                 | PTC 70-80% of all thyroid CA  | PTC + follicular variant 90% of all thyroid CA   |
| Presentation               | -Asymptomatic or painful w/ obstructive sx  | -Asymptomatic<br>-70% w/ extensive nodal involvement at diagnosis                          |
| Morbidity/<br>Mortality    | Age > 40y have significantly higher mortality from PTC 30 y post-op                     | -Death infrequent (1-2 per 150-200)<br>-usu >25 yrs after dx from non-thyroid malignancies |
| Recurrence/<br>Progression | Mets 6.6% (Mayo 1988)<br>Mets/Rekurs in neck, bone, brain, lungs                        | Met rate 6.9% (Mayo 1988)<br>Mets/Rekurs in Met to neck > lungs                            |



# FEATURES OF PTC

## Factors influencing disease progression

- **Large tumor size (> 4 cm)**
- **Multifocality**
- **Nodal disease**
  - Associated with disease progression and lung mets
- **Less than total thyroidectomy**
- **Age at diagnosis (<15 years, especially < 10 years)**
- **T4 N1 disease**

# PTC MANAGEMENT: SURGERY

- **Total or near-total thyroidectomy**
- **Complications: similar to adults w/ transient or permanent hypoparathyroidism, bleeding, nerve damage**

## OUR PATIENT

- **Total thyroidectomy w/ left level 2-4 neck dissection & bilateral paratracheal lymph node dissection**
- **Intraoperatively**
  - Tense adenopathy at levels 2-4
  - Extra-thyroid extension of mass into the strap muscle
  - All 4 parathyroid glands left behind

# POST-OP COURSE

- Developed chyle leak POD 1 → repair of thoracic duct injury
- Transient hypoparathyroidism; Ca nadir 6.4 mg/dL
- Pathology
  - 3.4 cm tumor c/w papillary thyroid carcinoma on a background of chronic lymphocytic thyroiditis, + margins
  - 18 + lymph nodes
  - Staging: pT3(R1), N1b, MX

TABLE 2. TNM CLASSIFICATION SYSTEM FOR DIFFERENTIATED THYROID CARCINOMA

| Definition      |  |                                       |
|-----------------|--|---------------------------------------|
| T1              | Tumor diameter 2 cm or smaller   |                                       |
| T2              | Primary tumor diameter > 2 to 4 cm   |                                       |
| T3              | Primary tumor diameter > 4 cm limited to the thyroid or with minimal extrathyroidal extension  |                                       |
| T4 <sub>a</sub> | Tumor of any size extending beyond the thyroid capsule to invade subcutaneous soft tissues, larynx, trachea, esophagus, or recurrent laryngeal nerve |                                       |
| T4 <sub>b</sub> | Tumor invades prevertebral fascia or encases carotid artery or mediastinal vessels   |                                       |
| TX              | Primary tumor size unknown, but without extrathyroidal invasion  |                                       |
| NO              | No metastatic nodes  |                                       |
| N1 <sub>a</sub> | Metastases to level VI (pretracheal, paratracheal, and prelaryngeal/Delphian lymph nodes)  |                                       |
| N1 <sub>b</sub> | Metastasis to unilateral, bilateral, contralateral cervical or superior mediastinal node metastases  |                                       |
| NX              | Nodes not assessed at surgery  |                                       |
| MO              | No distant metastases  |                                       |
| M1              | Distant metastases   |                                       |
| MX              | Distant metastases not assessed  |                                       |
| Stages          | <i>Patient age &lt; 45 years</i>   | <i>Patient aged 45 years or older</i> |
| Stage I         | Any T, any N, MO   | T1, NO, MO                            |
| Stage II        | Any T, any N, M1   | T2, NO, MO                            |

# POST-OP EVALUATION

- **1 week post-op: TSH 82 on Synthroid 75mcg/day → increased to 112 mcg**
- **Urine iodine 532 ug/L (28-544)**
- **CT scan chest wo contrast**
  - 6-7 noncalcified nodules in R lung, 14-15 in L lung, largest 4 mm
- **Referred for radioactive iodine treatment**

# RAI TREATMENT

- **RAI is now generally reserved for high risk pts**
- **Hay et al, 2010: Mayo study of 215 pts age 3-20y median f/u of 29 yrs**
  - Local & regional recurrence rate higher in those w/ unilateral thyroidectomy 1940-1969; recurrence rate did not improved with RRA from 1950-2008
  - Recurrence rate w/ bilat thyroidectomy 16%
  - All-causes mortality did not exceed expectation in 1<sup>st</sup> 30 yrs, years 30-50y significantly increased (68%) due non-thyroidal malignancies
  - Report no significant improvement in nodal mets w/ RAI

# RAI PREPARATION

## Similar to adults

### •TSH stimulation (>30 mcU/L)

- rhTSH (Thyrogen): Children have similar mean TSH as adults using non-weight-adjusted injections (Iorcansky, JCEM 2005)
- LT4 withdrawal ± T3: Children achieve adequate hyperthyrotropinemia w/in 14 days (W Kuijt, S Huang JCEM 2005)-3wks in adults

### •Low Iodine diet: <50 mcg/day x 2 weeks

## Low-Iodine Diet Guidelines — Summary

ThyCa: Thyroid Cancer Survivors' Association, Inc.<sup>SM</sup>  
For details, & the ThyCa **Free downloadable Low-Iodine Cookbook** with over 340 delicious recipes, visit [www.thyca.org](http://www.thyca.org)

### Key Points

- This is a Low-Iodine Diet, NOT a No-Iodine Diet or an Iodine-Free Diet. The goal is under 50 mcg iodine per day.
- The diet is for a short time period, usually for the 2 weeks (14 days) before a radioactive iodine scan or treatment.
- Avoid foods high in iodine (over 20 mcg per serving). Eat any foods low in iodine (up to 5 mcg per serving). Limit the quantity of foods moderate in iodine (5 to 20 mcg per serving).
- Read the ingredient lists on labels of packaged foods. Check with your physician about medications you're taking.

### Not Allowed—

#### Avoid These Foods and Ingredients

- Iodized salt, sea salt, and any foods containing iodized salt and sea salt.
- Seafood and sea products (fish, shellfish, seaweed, seaweed tablets, carrageenan, agar-agar, alginate, nori and other sea-based foods or ingredients).
- Dairy products of any kind (milk, cheese, yogurt, butter, ice cream).
- Egg yolks or whole eggs or foods containing whole eggs.
- Bakery products containing iodine/iodate dough conditioners or high-iodine ingredients. Low-iodine homemade and commercial baked goods are fine.
- Red Dye #3. (E127 in the United Kingdom)
- Most Chocolate (due to milk content). Cocoa powder and some dark chocolates are allowed.
- Some molasses (if sulfured, such as blackstrap molasses). Unsulfured molasses, which is more common, is okay. Sulfur is a term used on labels and does not relate to iodine.
- Soybeans and soybean products such as tofu, TVP, soy milk, soy sauce. The NIH diet says to avoid some other beans: red kidney beans, lima beans, navy beans, pinto beans, and cowpeas.
- On some diets, rhubarb and potato skins (inside of the potato is fine).
- Iodine-containing vitamins and food supplements.
- If you're taking a medication containing iodine, check with your physician.

### Allowed Foods and Ingredients

- Fruits except rhubarb and maraschino cherries (with Red Dye #3 or E127 in the United Kingdom).
- Vegetables: preferably raw or frozen without salt, except soybeans and (according to NIH diet) a few other beans.
- Unsalted nuts and unsalted nut butters.
- Whites of eggs.
- Fresh meats up to 6 ounces a day.
- Grain and cereal products up to 4 servings per day, provided they have no high-iodine ingredients.
- Pasta, provided it has no high-iodine ingredients.
- Sugar, jelly, jam, honey, maple syrup.
- Black pepper, fresh or dried herbs and spices.
- Oils. All vegetable oils, including soy oil.
- Sodas (except with Red Dye #3 or E127 in the UK), cola, diet cola, non-instant coffee, non-instant tea, beer, wine, other alcoholic beverages, lemonade, fruit juices.
- **Read the ingredient list on all packaged foods.**

### Easy Snacks for Home, Work, or Travel

- Fresh fruit or juice
- Dried fruits such as raisins
- Fresh raw vegetables
- Applesauce
- Popcorn
- Unsalted nuts
- Sodas other than those with Red Dye #3 (E127 in the UK)
- Fruit juice
- Unsalted peanut butter or other nut butters (great with apple slices, carrot sticks, crackers, and rice cakes)
- Unsalted Matzo crackers and other unsalted crackers
- Homemade low-iodine bread or muffins

### Easy Quick Meals

- Oatmeal toppings-cinnamon, honey, applesauce, maple syrup and walnuts, fruit
- Grilled fresh meat, vegetables, fresh fruit or baked apple
- Salad topped with grilled chicken or beef, oil and vinegar dressing
- "Sandwich" with Matzo crackers, plain peanut butter, jelly

Our thanks to ThyCa's medical advisors and conference speakers for information and support.

*Disclaimer: This information is intended for educational purposes only. It is not intended, nor should it be interpreted, as medical advice or directions of any kind. Any person viewing this information is strongly advised to consult their own medical doctor(s) for all matters involving their health and medical care.*

# RAI CONT'D

**Pretreatment scan:  $^{131}\text{I}$  (adults 2-5mCi) or  $^{123}\text{I}$  1-3mCi in pts suspected to have mets**

## **Dosage:**

- Remnant ablation
  - Adults-30-100mCi
  - Controversial in children-newer studies prefer conservative approach
- Pulmonary micromets:
  - Adults-empirically 100-300 mCi or by dosimetry
  - Peds-few studies, dosage varies 150mCi/1.73 m<sup>2</sup>; but if based on 70kg adult, use 50-60mCi

## **Complications:**

- Sialadenitis: sour candy, cholinergic agents, hydration post treatment
- Nasolacrimal damage
- Secondary Malignancies

APPENDIX C

Patient Instructions: Outpatient High Dose Therapy with I-131

1. Sleep alone for 6 days with 7 foot separation. After the 6 days remove all bed linens and wash separately. Follow washings with an extra rinse.
2. **Do not return to work for 3 days. If working closely with children or pregnant women do not return to work for 6 days.**
3. Keep other family members informed.
4. Use a separate bath, if possible. If it is not possible to use a separate bath, clean toilet seat and/or sink with detergent after each use.
5. Keep the toilet especially clean by flushing three times after use. Men should sit during urination. Wash your hands thoroughly after using toilet. Maintain proper personal hygiene to minimize potential for contamination.
6. Use separate personal items such as towels, wash cloths, toothbrushes, etc.
7. Avoid prolonged contact with other people. Maintain a prudent distance from your spouse or primary caregiver as much as possible (e.g. > 1 meter or approximately 3.3 feet). Maintain a greater distance from other people as much as possible (e.g. > 2 meters or approximately 6.6 feet).
8. **Avoid being in the room with pregnant women or children under the age of 18 years for 6 days.**
9. For the first six (6) day do not hug, kiss, or have sexual intercourse with your partner.
10. Avoid activities/areas which may produce excessive sweating.
11. If you are preparing food, wear plastic gloves.
12. Do not share food.
13. Use paper plates and plastic utensils and cups.
14. Collect laundry in a separate basket/bag and wash separately. Follow washings with an extra rinse.
15. Retain wastes (dressings, paper goods, etc.) believed to be contaminated for one week before

Instructions for Outpatient Release:

1. Terminate any breast-feeding for this infant or child.
2. Go straight home after the procedure.
3. Female patients of childbearing age should not become pregnant for six (6) months to one year\* after I-131 therapy and male patients should not father a child for first two (2) months after I-131 therapy. (\*Discuss with your doctor)
4. In case of emergency or if you have any questions, call \_\_\_\_\_ at \_\_\_\_\_.

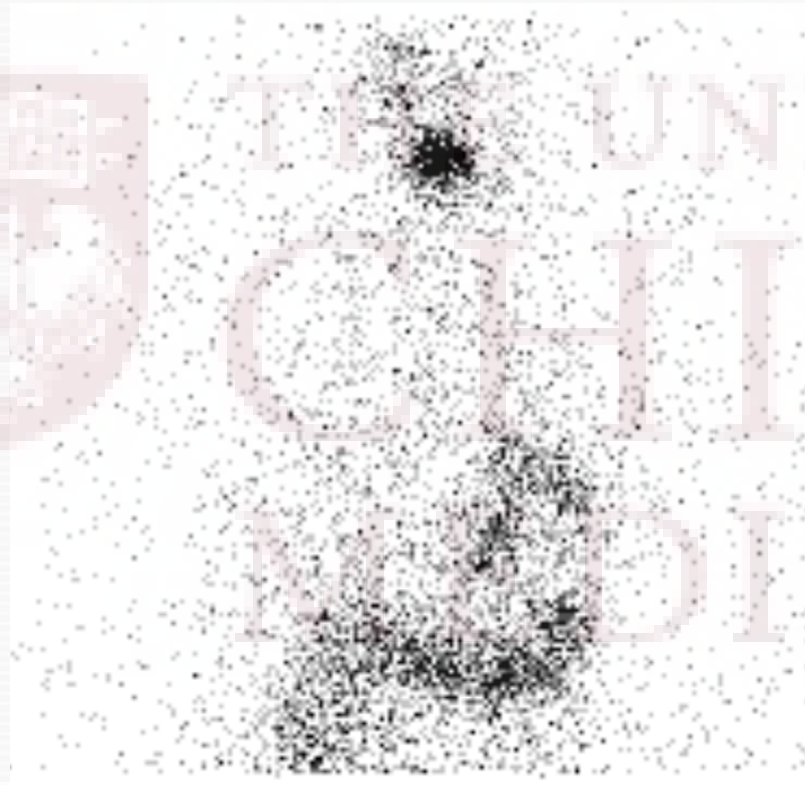
transportation.  
to and from doctor/hospital.  
th you after release from the Medical Center

In addition to the above instructions, follow the instructions below for the number of days corresponding to the activity administered unless specified differently below:

| √                        | Administered Activity in millicuries (mCi) | Number of Days to Follow Instructions |
|--------------------------|--|---------------------------------------|
| <input type="checkbox"/> | Less than 100 mCi                          | 4 days                                |
| <input type="checkbox"/> | 100 to 150 mCi                             | 5 days                                |
| <input type="checkbox"/> | Greater than 150 mCi                       | 6 days                                |



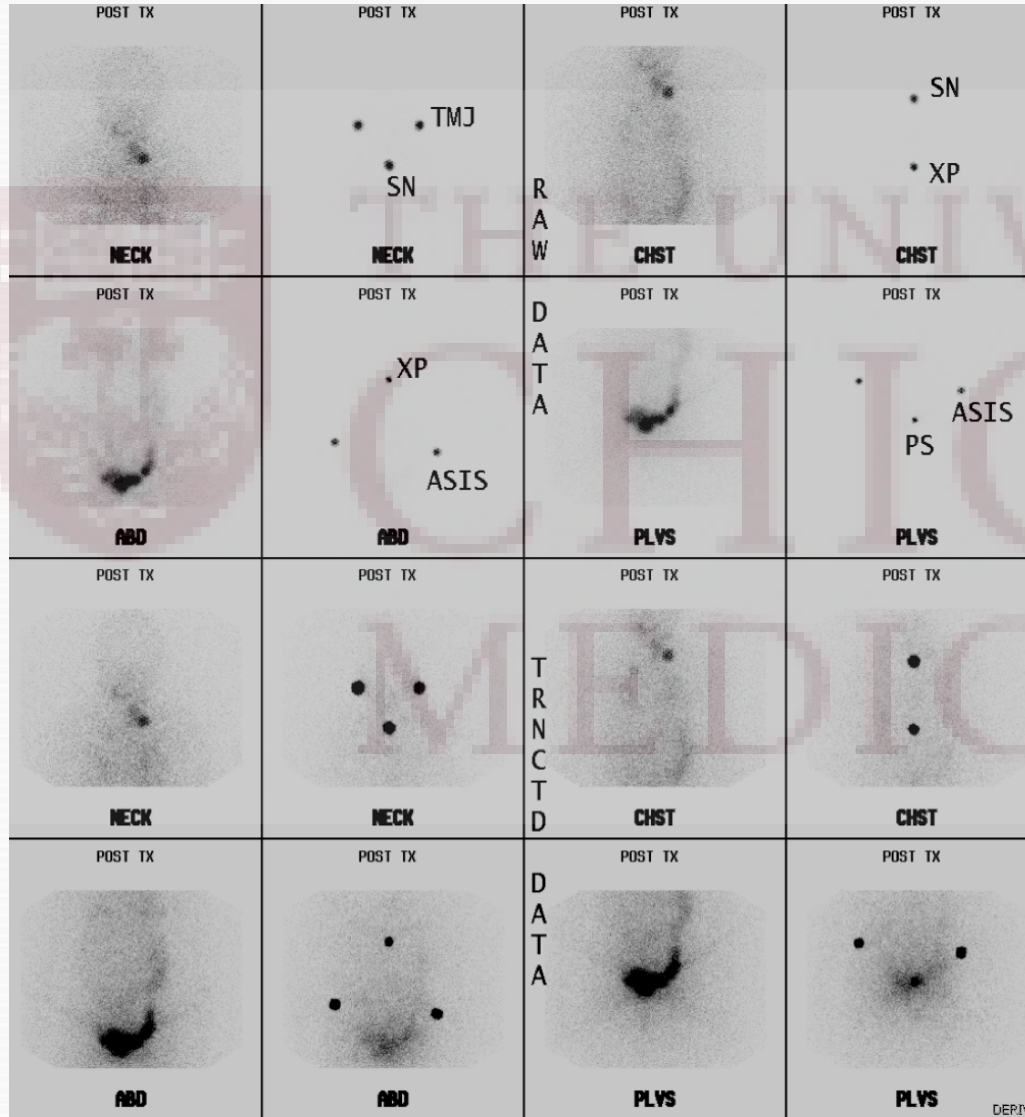
# BACK TO OUR PATIENT...



Pretreatment scan:  $^{131}\text{I}$   
1.5 mCi

- No uptake in the chest

# BACK TO OUR PATIENT...



Treatment:  $^{131}\text{I}$  50 mCi

Post-treatment scan

- Mild, diffuse uptake in chest

# SUMMARY

- **Papillary thyroid carcinoma is rare in children and presents more aggressively than in adults, though prognosis is significantly better**
- **Primary treatment includes total or near-total thyroidectomy; RAI ablation is controversial, mainly reserved for high-risk patients**
- **RAI treatment may be associated with long-term risk of non-thyroid malignancies**
- **Data regarding management is limited by an inability to perform prospective randomized studies**

# REFERENCES

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