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/m² (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
WHAT NEXT?
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
<table>
<thead>
<tr>
<th></th>
<th><strong>ADULTS</strong></th>
<th><strong>CHILDREN</strong></th>
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<tbody>
<tr>
<td><strong>Risk Factors</strong></td>
<td>Head/neck irradiation, female gender, pubertal,</td>
<td>Coexisting thyroid disease, Iodine def.</td>
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<tr>
<td></td>
<td>Coexisting thyroid disease, Iodine def.</td>
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<tr>
<td><strong>Pathogenesis</strong></td>
<td>Mutations in <em>RET</em> gene, <em>BRAF</em>, <em>TRK</em></td>
<td>TRK rearrangements are rare</td>
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<tr>
<td><strong>Prevalence</strong></td>
<td>PTC 70-80% of all thyroid CA</td>
<td>PTC + follicular variant 90% of all thyroid CA</td>
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<td><strong>Presentation</strong></td>
<td>-Asymptomatic or painful w/ obstructive sx</td>
<td>-Asymptomatic</td>
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<tr>
<td></td>
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<td>-70% w/ extensive nodal involvement at diagnosis</td>
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<tr>
<td><strong>Morbidity/ Mortality</strong></td>
<td>Age &gt; 40y have significantly higher mortality from PTC 30 y post-op</td>
<td>-Death infrequent (1-2 per 150-200)</td>
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<td>-usu &gt;25 yrs after dx from non-thyroid malignancies</td>
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<td><strong>Recurrence/ Progression</strong></td>
<td>Mets 6.6% (Mayo 1988) Mets/Recurs in neck, bone, brain, lungs</td>
<td>Met rate 6.9% (Mayo 1988) Mets/Recurs in Met to neck &gt; lungs</td>
</tr>
</tbody>
</table>

Hay et al, 2010
Josefson & Zimmerman, 2008
Pacini & DeGroot 2009
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

Dinauer et al, Grigsby et al, Jarzab et al
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

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**Table 2. TNM Classification System for Differentiated Thyroid Carcinoma**

<table>
<thead>
<tr>
<th>Definition</th>
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<tbody>
<tr>
<td>T1</td>
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<tr>
<td>T2</td>
</tr>
<tr>
<td>T3</td>
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<tr>
<td>T4a</td>
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<td>T4b</td>
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<tr>
<td>TX</td>
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<tr>
<td>NO</td>
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<tr>
<td>N1a</td>
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<tr>
<td>N1b</td>
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<tr>
<td>NX</td>
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<tr>
<td>MO</td>
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<tr>
<td>M1</td>
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<tr>
<td>MX</td>
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**Stages**

<table>
<thead>
<tr>
<th>Stages</th>
<th>Patient age &lt; 45 years</th>
<th>Patient age 45 years or older</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage I</td>
<td>Any T, any N, MO</td>
<td>T1, NO, MO</td>
</tr>
<tr>
<td>Stage II</td>
<td>Any T, any N, M1</td>
<td>T2, NO, MO</td>
</tr>
</tbody>
</table>
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 1st 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

Cooper et al, 2006; Josefson et al 2005)
RAI CONT’D

Pretreatment scan: $^{131}$I (adults 2-5mCi) or $^{123}$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^2; but if based on 70kg adult, use 50-60mCi

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

Cooper et al, 2006; Josefson et al 2005)
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 disposal.

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 _____________.

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

<table>
<thead>
<tr>
<th>Administered Activity in millicuries (mCi)</th>
<th>Number of Days to Follow Instructions</th>
</tr>
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<tbody>
<tr>
<td>☑ Less than 100 mCi</td>
<td>4 days</td>
</tr>
<tr>
<td>☑ 100 to 150 mCi</td>
<td>5 days</td>
</tr>
<tr>
<td>☑ Greater than 150 mCi</td>
<td>6 days</td>
</tr>
</tbody>
</table>


BACK TO OUR PATIENT...

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

- No uptake in the chest
BACK TO OUR PATIENT...

Treatment: $^{131}$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


