Is it the Thyroid?

When to think about Pediatric Thyroid Disease

Laura C. Page, MD
Duke Pediatric Endocrinology
Objectives

• Recognize features of pediatric hypothyroidism and hyperthyroidism

• Diagnose neonatal thyroid disease

• Describe the effect of illness and obesity on thyroid labs

• Evaluate pediatric thyroid nodules
Outline

• Normal thyroid physiology & the thyroid exam

• Cases

• High risk populations
Disclosures

• Nothing to disclose
Background - Physiology

Hypothalamus

TSH

Pituitary

TRH

Thyroid

T4 \rightarrow T3

T4 & T3

Background – Thyroid Exam

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Background – Thyroid Exam

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Case 1

- 6 yo male with normal energy level, per parents, and chronic, mild constipation controlled with Miralax
Case 1

- Exam notable for small goiter (on visual exam & palpation), nontender

Labs
- TSH: >100 [0.34-5.66]
- fT4: 0.33 [0.52-1.21]
- Anti-microsomal Ab: positive
- Anti-thyroglobulin Ab: positive
Case 1 - Hashimoto’s thyroiditis

• (aka autoimmune hypothyroidism)

• Insidious onset
Hashimoto’s thyroiditis

- (aka autoimmune hypothyroidism)
- Insidious onset
Hashimoto’s thyroiditis

- (aka autoimmune hypothyroidism)

- Insidious onset

- Cobblestone texture
Hashimoto’s thyroiditis

• (aka autoimmune hypothyroidism)

Labs

• ↑ TSH, ↓ fT4
• + Anti-thyroglobulin Ab and/or
  + Anti-microsomal Ab (anti-TPO Ab)
Hashimoto’s thyroiditis

• (aka autoimmune hypothyroidism)

Labs

• TSH, fT4 - normal
• Anti-thyroglobulin Ab, Anti-microsomal Ab (anti-TPO Ab) - positive
Hashimoto’s thyroiditis - Treat

- L-thyroxine (levothyroxine / synthroid)

- Side effects:
Case 2

• 16 yo female, obese, but 12 lb weight loss over last 5 mo. Irregular menses. Decreased energy.

• Vitals: BP 117/70, pulse 130
Case 2

- Exam: fidgety, prominent stare, smooth goiter, tachycardia, fine tremor of outstretched hands, and increased patellar reflexes
Case 2

Labs

- TSH: 0.02 [0.34-5.66]
- fT4: 5.27 [0.52-1.21]
- Total T3: 590 [80-178]
- TSI: 3.9 [<1.3]
Case 2 – Graves’ Disease

• (form of autoimmune hyperthyroidism)
Graves’ Disease

• (form of autoimmune hyperthyroidism)

• Water balloon
Graves’ Disease

• (form of autoimmune hyperthyroidism)
Graves’ Disease

• (form of autoimmune hyperthyroidism)
Graves’ Disease

- (form of autoimmune hyperthyroidism)
Graves’ Disease

Labs

- Down arrow: TSH, up arrow: fT4, up arrow: total T3

- TRAb (thyrotropin receptor Ab)

- TSI (thyroid stimulating immunoglobulin)

- Anti-thyroglobulin Ab, Anti-microsomal Ab (anti-TPO Ab) +/-
Graves’ vs. Hashitoxicosis

Labs

- **↓ TSH, ↑ fT4, ↑ total T3**

- **TRAb & TSI → + in Graves**

- Anti-thyroglobulin Ab, Anti-microsomal Ab (anti-TPO Ab)
Graves’ Disease - Treat

- β-blocker – propranolol

- Methimazole
  - Side effects (rare, serious): hepatitis / jaundice, agranulocytosis

- Radioactive Iodine Ablation

- Surgery (thyroidectomy)
Thyroid Storm – endocrine emergency!
Case 3

- Fullterm male infant with borderline NBS
- TSH: 34.8, T4: 16.2
- Mother reports breastfeeding well (every 2-3 hours). No concerns.
- Exam normal
Case 3

• Repeat labs in clinic
• TSH: 69, fT4: 0.7
Case 3 - Congenital Hypothyroidism

• Endocrine emergency!

• Often asymptomatic

• Start levothyroxine asap & close endocrine follow up
Congenital Hypothyroidism

- fT4 reference range *different* for infants!
- Children / adults: fT4 [0.52-1.21]
- <1 year old: fT4 > 1
Case 4

• Fullterm male infant 16 HOL

• Mom reports she is hypothyroid and on levothyroxine, with normal levels during pregnancy
Case 4

- Mom had Graves’ disease as a teenager and received radioactive iodine ablation 8 yrs ago
Case 4 - at risk for Neonatal Graves’

- Determine Mom’s TRAb/TSI if available
- Mom’s TRAb checked during third trimester and was normal
- Infant without features of neonatal Graves’
Case 4 - at risk for Neonatal Graves’

• Low risk, PCP to follow up NBS, no additional testing
Neonatal Graves

TRAb
Neonatal Graves

*Neonatal hyperthyroidism*

These twins demonstrate clinical features of neonatal hyperthyroidism (thyrotoxicosis), including an anxious-appearing stare and diminished subcutaneous fat.

*Courtesy of Dr. Stephen LaFranchi.*
Neonatal Graves

• Birth surge

• ~ 24 HOL: TSH, fT4, TSI and/or TRAb
Case 5

- 8 yo F with vomiting & 2 wks of diarrhea
- Afebrile, Pulse: 105
- Multiple screening labs: CBCD, CMP, celiac, TSH, ESR, stool culture

- TSH: **0.237** [0.34-5.66]
Case 5

- TSH: 0.237 [0.6-5.1]
- fT4: 1.1 [0.66-1.14]
- Total T3: 76 [87-178]
- Dx w/ GI illness
- TSH: 1.61 after 1 mo
Sick euthyroid / non-thyroidal illness

- During illness:
  - TSH down
  - fT4 down
  - T3 down
  - rT3 up
Sick euthyroid / non-thyroidal illness

- During illness:
  - TSH ↓
  - fT4 ↓
  - T3 ↓
  - rT3 ↑

- During recovery:
  - TSH ↓
  - fT4 ↓
  - T3 ↓
Sick euthyroid / non-thyroidal illness

- During illness:
  - TSH ↓
  - fT4 ↓
  - T3 ↓
  - rT3 ↑

- During recovery:
  - TSH ↑
  - fT4 ↓
  - T3 ↓
Case 6

• 15 yo M w/ obesity, prediabetes, and aunt and MGM w/ hypothyroidism

• Reports low energy, cold intolerance, dry skin, occasional headaches
Case 6

Screening thyroid labs:
• TSH: 6.12 [0.34-5.66]
• fT4: 0.83 [0.52-1.21]

• Anti-thyroglobulin & Anti-microsomal Ab: +
Case 6 - Subclinical Hypothyroidism

- TSH: 6.12 [0.34-5.66]
- fT4: 0.83 [0.52-1.21]
- TSH: 5-10
- fT4: normal
Subclinical Hypothyroidism – Treat???

“Consensus”

- Treat if TSH > 10
- Treat if TSH 5-10 and +Abs, goiter, and/or clinical features
TSH & Obesity

Obesity

↑Leptin

↑TRH

↑TSH

T4 → ↑T3

Leptin

Mason et al. 2014
Case 7

• 14 yo female notes several lumps in neck, all nontender. Otherwise well.

• On exam, cervical LAD and firm ~1.5 cm thyroid nodule.
Case 7

Ultrasound:

- Scattered microcalcifications. Nodule in left thyroid lobe 1.9 x 2 x 1.2 cm. Multiple abnormal appearing carotid chain lymph nodes.
Case 7

FNA:

- Papillary thyroid carcinoma

- Referred for thyroidectomy and bilateral lateral neck dissection

- High risk with metastases to LNs and thymus
Thyroid Nodules / Cancer

- High Risk groups:
  - Hx of head/neck irradiation
  - Genetic syndromes: Familial Adenomatous Polyposis, Cowden syndrome, Carney Complex, MEN2A
Thyroid Nodules / Cancer

- Refer to Pediatric Thyroid Center
- vs. thyroid ultrasound & FNA (>1 cm / concerning features)
Challenge Case

- 6.5 yo F with premature thelarche for several months (no adrenarche), headaches, and poor growth velocity

- Bone age: 5 years
Challenge Case

• LH & FSH: prepubertal
• Estradiol: pubertal
• TSH: > 200
• fT4: 0.2
Challenge Case - Van Wyk-Grumbach syndrome

- **severe primary hypothyroidism**

- TSH binds to FSH receptor

- Breast devo and/or menarche in girls
- Testicular enlargement in boys
Challenge Case - Van Wyk-Grumbach syndrome

• Precocious puberty with *delayed* bone age and *decreased* growth velocity

• +/- galactorrhea
Special Populations

• Type 1 Diabetes

• Celiac disease

• Down Syndrome, Turner Syndrome, Klinefelter Syndrome, Noonan Syndrome
Special Populations

- Vitiligo, alopecia areata, chronic urticaria
Alternative Thyroid Hormone Preparations
Take Home Points

• Check for hypothyroidism in a child with linear growth failure!

• Infants born to women with a history of Graves’ are at risk for neonatal Graves’, regardless of the mother’s current thyroid status

• Illness & Obesity can impact thyroid labs
References


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Questions?