Disclosures

No disclosures
Thyroid Clinical Pearls

Objectives: The participant will be able to:

1. Recognize the cause of common and unusual thyroid function tests
Hypothalamus

Pituitary

Thyroid

Normal Physiology

TRH

TSH

T4, T3
Hypothalamus

Pituitary

Thyroid

Graves’ Disease

TRH

TSH

T4

T3

TSI
Primary Hypothyroidism

Hypothalamus

TRH

↑

Pituitary

TSH

↑

Thyroid

T4

↓

↓

T3
JEOPARDY
Thyroid Tests

Low TSH

Low T4

Elevated T4

Low T4

High TSH 1

High TSH 2

High TSH 3

Future Endocrinologist 1

Future Endocrinologist 2

Low TSH

Low TSH

low T4

Low TSH
Case 1

35 y/o woman

- Asymptomatic L thyroid nodule, 3.5 cm
- P 80, negative PE otherwise
- eyes negative

- TSH = 0.04 mIU/L (0.3-5.0)
- fT4 = 1.4 µg/dl (0.8-1.8)
- T3 normal
What would be the most appropriate next step?

A. Ultrasound
B. Fine needle aspiration
C. 24 hour Uptake and Scan
D. CT neck with contrast

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What would be the most appropriate next step?

A. Ultrasound
B. Fine Needle Aspiration
C. 24 hour Uptake and Scan
D. CT neck with contrast
Hyperfunctioning “Hot” Thyroid Nodule, Subclinical Hyperthyroidism
T4 - TSH Relationship

TSH mU/L

T4 µg/dL
Subclinical Hyperthyroidism

Causes (common)

- Graves’ Disease (AITD)
- Toxic Multinodular Goiter
- Hyperfunctioning solitary nodule
St. Mary’s Hospital
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Case 2

54 y/o woman

- mild fatigue, cold intolerance
- negative PE
- thyroid normal size and texture

- TSH = 11.0 mIU/L (0.3-5.0)
- fT4 = 1.1 µg/dl (0.8-1.8)
- TPO antibodies negative
What would be the next best step?

A. Observe
B. Recheck in 3 months
C. Treat with levothyroxine (T4)
D. Treat with liothyronine (T3)
What would be the best next step?

A. Observe
B. Recheck 3 months
C. Treat with levothyroxine (T4)
D. Treat with liothyronine (T3)
Subclinical Hypothyroidism

Causes (common)

- AITD (Hashimoto’s thyroiditis)
- Subacute Thyroiditis (recovery phase)
Subclinical Hypothyroidism

Treatment

- Most agree with T4 therapy if TSH > 10 or fT4 is low
Case 3

54 y/o woman

- asymptomatic
- negative PE
- thyroid normal size and texture

- TSH = 21.0 mIU/L (0.3-5.0)
- fT4 = 1.6 µg/dl (0.8-1.8)
- Negative TPO antibodies

After 3 months of treatment

TSH = 21.0 mIU/L (0.3-5.0)
What would be the next best step?

A. Confront her and say she is not taking the medication
B. Check for celiac disease
C. Ask if she is taking the levothyroxine with other medications in am like MVI and calcium
D. Call the lab and ask them to run TSH assay on a different machine
What is the diagnosis?

A. Confront her and say she is not taking the medication

B. Check for celiac disease

C. Ask if she is taking the levothyroxine with other medications in the am like MVI and calcium

D. Call the lab and ask them to run TSH assay on a different machine
TSH ASSAY

TSH above 20mU/L is usually associated with low T4 or T3.

TSH returns to normal with therapy

Call the lab and ask them to check the assay.
Mayo Building
Mayo Campus
Case 4

54 y/o woman

- aspirin, omeprazole, lisinopril and recently started on amiodarone
- negative PE
- thyroid normal size and texture

- TSH = 12.0 mIU/L (0.3-5.0)
- fT4 = 1.1 µg/dl (0.8-1.8)
- Negative TPO antibodies
What would be the best next step?

A. Stop the amiodarone
B. Treat with levothyroxine
C. Stop the omeprazole
D. Observe and recheck TSH in 3 months
What would be the best next step?

A. Stop the amiodarone
B. Treat with levothyroxine
C. Stop the omeprazole
D. Observe and recheck in 3 months
Case 4

After 3 months of observation

TSH = 2.3 mIU/L (0.3-5.0)
Medication induced elevated TSH

Amiodarone
Sertraline
Lithium
Seizure medications (valproate)
Iodine
Plummer House
Rochester
Case 5

25 y/o woman

- Anxiety and weight loss
- Normal PE at time of annual gyne exam
- No meds except OCP’s

- TSH = 2.2 mIU/L (0.3-5.0)
- TT4 = 14.0 µg/dl (5 - 12.5)
What is the diagnosis?

A. Graves disease
B. Plummer’s disease
C. Hot nodule
D. Elevated TT4 due to OCP
What is the diagnosis?

A. Graves disease
B. Plummer’s disease
C. Hot nodule
D. Elevated TT4 due to OCP
Thyroid Hormone Binding Proteins

- Thyroid hormones are highly lipophilic
- Majority (>99%) circulate bound to proteins with hydrophobic “pockets”
- Rapid changes in hormone concentrations are not possible (long half-life)
- Beware altered binding proteins as a cause for “abnormal” thyroid function

- Thyroid binding globulin (TBG) ~70%
- Transthyretin (TTR) ~10%
- Albumin ~15 - 20%
- Lipoproteins ~2 - 5%
Total vs. free T4

- Normal
- Low TBG (Androgen)
- Hi TBG (Estrogen)
Oral Estrogen & TBG

25 y/o woman

- Anxiety and weight loss
- Normal PE at time of annual gyne exam
- No meds except OCP’s

- TSH = 2.2 mIU/L (0.3-5.0)
- TT4 = 14.0 µg/dl (5 - 12.5)
- fT4 = 1.3 µg/dl (0.8 - 1.8)
- TBG elevated
Binding Protein Abnormalities

**Decreased binding capacity**
- TBG deficiency (inherited)
- Decreased hepatic synthesis of TBG
  - Malnutrition
  - Severe illness
  - Hepatic failure
- Protein wasting states

**Increased binding capacity**
- Increased hepatic synthesis of TBG
  - Estrogens
  - Pregnancy
Case 6

48 y/o man

- fatigue and cold intolerance
- decreased libido and erectile function
- thyroid not enlarged

- TSH = 1.2 mIU/L (0.3-5.0)
- fT4 = 0.6 µg/dl (0.8-1.8)
What is the diagnosis?

A. Primary Hypogonadism
B. Central Hypothyroidism
C. Subclinical Hypothyroidism
D. Euthyroid
What is the diagnosis?

A. Primary Hypogonadism
B. Central Hypothyroidism
C. Subclinical Hypothyroidism
D. Euthyroid
Central Hypothyroidism

48 y/o man

- TSH = 1.2 mIU/L (0.3-5.0)
- fT4 = 0.6 µg/dl (0.8-1.8)
- Testosterone 10 µg/dl (250 - 900)
- LH/FSH = normal
- AM cortisol = 14 µg/dl (7-22)
- Prolactin = 6800 ng/dl (< 20)
Central Hypothyroidism

Giant Prolactinoma
Central Hypothyroidism

Pearls

- TSH can be inappropriately “normal” in hypopituitarism
Case 7

68 y/o man

- Multilobar pneumonia and sepsis

- TSH = 0.8 mIU/L (0.3-5.0)
- fT4 = 0.6 µg/dl (0.8-1.8)
What is the diagnosis?

A. Low albumin
B. Central hypothyroidism
C. Sick euthyroid syndrome
D. Hashimoto’s hypothyroidism
What is the diagnosis?

A. Low albumin
B. Central hypothyroidism
C. Sick euthyroid syndrome
D. Hashimoto’s hypothyroidism
Sick euthyroid syndrome

Combination of low thyroid hormone levels

Serious illness

No treatment is needed

Try not order TFT in the hospital unless there is a strong clinical suspicion of thyroid disease
Sick Euthyroid Syndrome

Six weeks after patient is discharged from hospital
- TSH = 12.0 mIU/L (0.3-5.0)
- fT4 = 1.2 µg/dl (0.8-1.8)

Recovery phase of sick-euthyroid syndrome
Case 8

25 y/o woman

- anxiety and tachycardia
- family history of hyperthyroidism and $^{131}$I Rx
- HR = 100
- 40 gm diffuse goiter
- eyes negative

- fT4 = 3.2 µg/dl (0.8-1.8)
- TSH = 3.5 mIU/L (0.3-5.0)
Inappropriate TSH Secretion

25 y/o woman

- fT4 = 3.2 µg/dl (0.8-1.8)
- TSH = 3.5 mIU/L (0.3-5.0)
- TT3 = 245 ng/dl (80-180)
- TBG, thyroxine binding proteins (TBPE) = normal
- RAIU = 55% @ 24 hrs (12-28%)
- Brother’s labs:
  - fT4 = 2.8 µg/dl (0.8-1.8)
  - TSH = 2.7 mIU/L (0.3-5.0)
What is the diagnosis?

A. Graves disease
B. Plummer’s disease
C. Pituitary Resistance to Thyroid Hormone
D. TSH secreting pituitary tumor
What is the diagnosis?

A. Graves disease
B. Plummer’s disease
C. Pituitary Resistance to Thyroid Hormone
D. TSH secreting pituitary tumor
Generalized or Pituitary Resistance

- Pituitary resistance is always present
- Life-long anomaly (germ line mutation)
- Why do patients develop symptoms?
  - TR-α predominates in heart and brain.
  - Varies with mutation
Siebens Building
Mayo Campus
Finished !