THYROID FUNCTION TESTS

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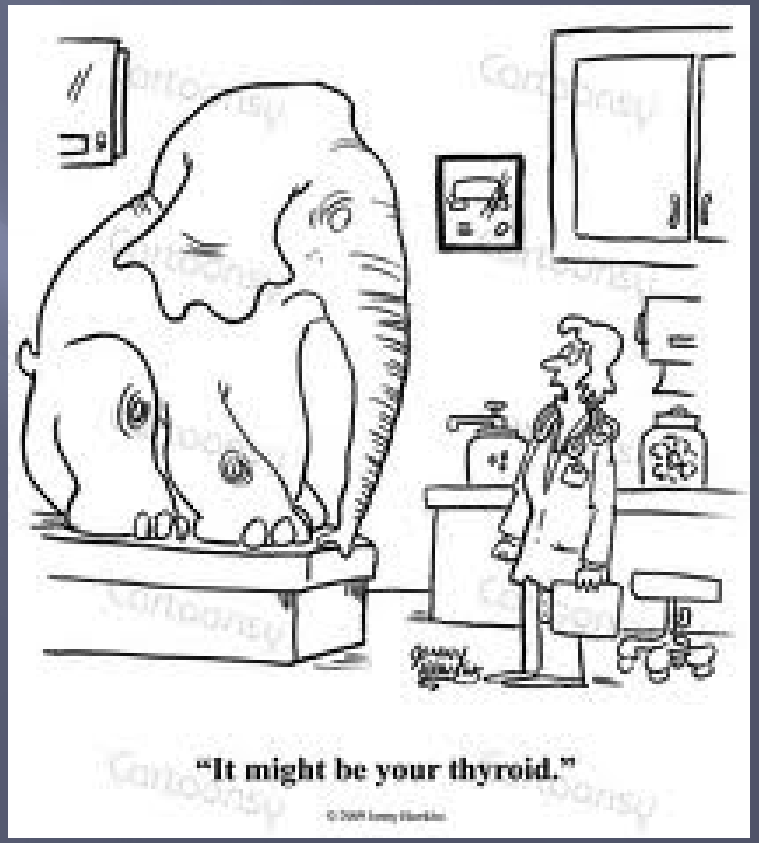


Case one: OB labs

- A 22 yo F who is 10 wks pregnant comes to you because thyroid function tests showed a normal TSH but an elevated T4. She is worried because she was told she might be hyperthyroid.

What do you do?

A) Check a thyroid uptake and scan to further evaluate
B) Repeat thyroid function tests including a FT4 and FT3.
C) Check a thyroid binding globulin.
D) Check thyroid antibodies.
E) Tell the pt that it is normal to be slightly hyperthyroid in the first trimester of pregnancy due to hCG.

Answer B

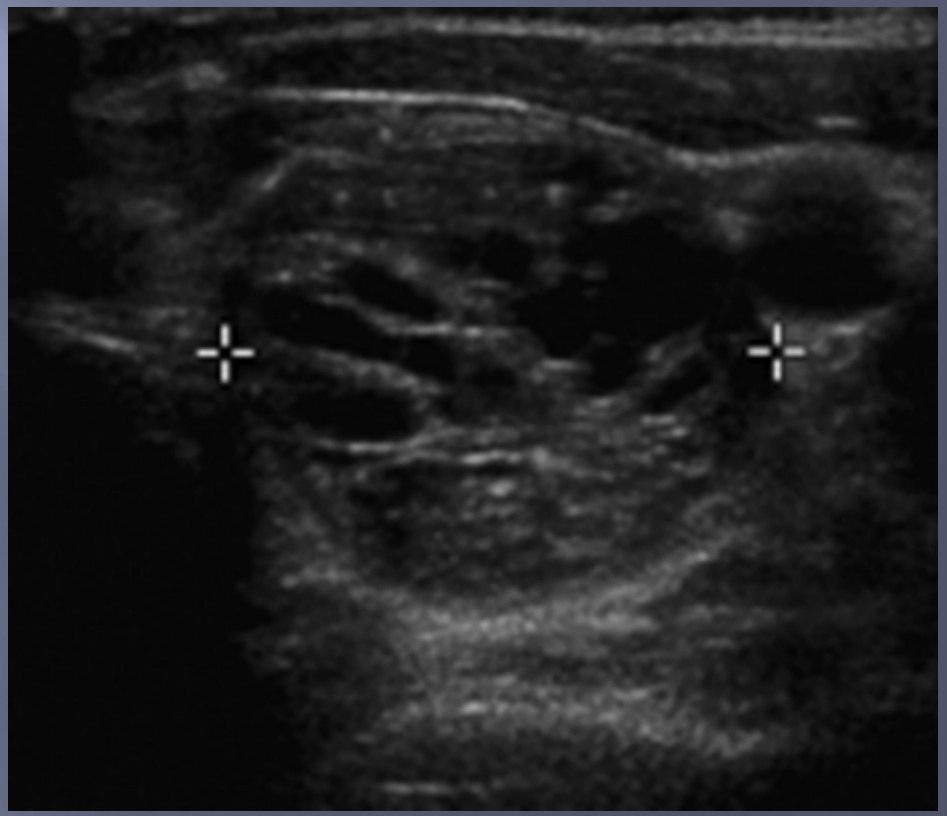
- Radioactive iodine is contraindicated during pregnancy.
- Increases in estrogen due to pregnancy (or OCPs or HRT) result in increased levels of thyroid binding globulin and an elevation in total T4 and total T3 levels.
- Free T4 and free T3 remain normal.
- The alpha subunit of hCG is homologous to the alpha subunit of TSH, so high levels of hCG seen in the first trimester of pregnancy can stimulate the thyroid and suppress TSH. Free thyroid hormones should remain normal.
- A persistently suppressed TSH of <0.1 after the first trimester or elevations of FT4 or FT3 should prompt you to evaluate for toxic nodules or Graves disease.
- High hCG concentrations seen with hyperemesis gravidarum and gestational trophoblastic disease can result in overt hyperthyroidism.

Case two: Nodules

- A 56 yo F is admitted for tachycardia and chest discomfort. She is on tele and is being ruled out for MI. A CT angiogram is negative for PE. A TSH, however, is undetectable with an elevated FT4 of 2.0. You think there might be nodules on thyroid exam.

Imaging

- A thyroid ultrasound confirms the presence of a 2.5cm nodule with mixed echogenicity in the R lobe and a 2cm cystic nodule in the L lobe.



What do you do next?

A) Thyroid uptake and scan.
B) Consult surgery for thyroidectomy.
C) Start beta blockers and methimazole.
D) US guided FNA biopsy of the largest thyroid nodule to rule out malignancy before deciding on treatment of the hyperthyroidism.

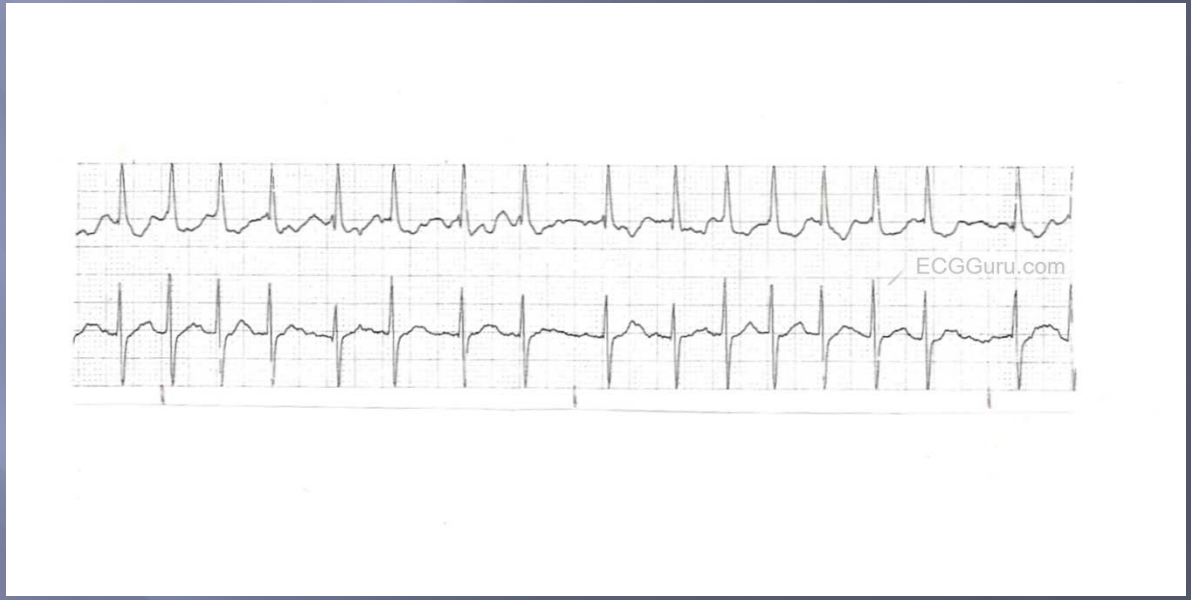
Answer C

- Since the pt received iodinated contrast for the CT angiogram, you cannot perform a radioactive iodine uptake and scan for 6-8 wks.
- While surgery is one choice for management of hyperthyroidism, this is not a mandatory choice simply because nodules are present. These nodules should be further evaluated and the pt should be referred to surgery if there is concern for malignancy. Also, pts should ideally be made euthyroid prior to surgery and cold iodine should be given to reduce vascularity of the gland prior to surgery.
- US guided FNA may eventually be needed, but it is not appropriate yet. If a nodule is hyperfunctioning, you do not want to put a needle in it. She would first need a thyroid uptake and scan, and if a nodule was cold, then it should be biopsied. If it is hyperfunctioning, then RAI ablation would be a good choice for therapy.

Case three: palpitations

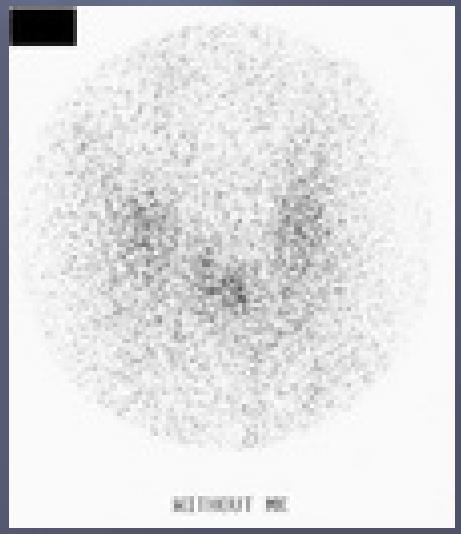
- Your 62 yo pt presented to the hospital with chest discomfort and palpitations.
- PMH: CAD s/p CABG, a fib, HTN, hyperlipidemia
- Meds:
- metoprolol 150mg bid
- Lisinopril 40mg qday
- Simvastatin 40mg qhs
- ASA 81 mg daily
- Amiodarone 200mg qday

EKG



Results

- An EKG reveals that your pt is in a fib with RVR.
- You check a TSH which is low at 0.2, with a FT4 of 1.8.
- A FT3 is high normal.
- A thyroid uptake and scan shows almost undetectable uptake.



What next?

A) The thyrotoxicosis is due to the amiodarone. Cardiology wants to start the pt on an amiodarone drip, but you argue that the treatment is actually stopping the amiodarone.
B) Like all forms of hyperthyroidism, the treatment for this thyrotoxicosis is surgery, radioactive iodine, or anti-thyroid medication.
C) The treatment for this thyrotoxicosis is prednisone and methimazole.
D) You should repeat thyroid function tests in 6wks to determine if treatment is really needed.

Answer C

- This is likely amiodarone induced thyrotoxicosis.
- There are two different types:
  - Type 1: Results from increased synthesis of thyroid hormones with the iodine in the amiodarone as the substrate. It usually occurs in pts with an underlying goiter.
  - Type 2: Usually occurs in pts with no underlying thyroid disease and is due to destruction of the thyroid with release of thyroid hormones, with the amiodarone having a direct toxic effect on the thyroid cells.
- Treatment varies by type. Type 1 is usually treated with anti-thyroid medications, and type 2 is usually treated with corticosteroids, but it is often very difficult to tell which type it is, so we usually use both medications as treatment.
- There is no benefit to stopping the amiodarone. It has a very long half life and will remain in the system for an extended period of time (100 days!).

Case four: The psych consult

- You are asked to see a consult on WT6 for a pt with a low TSH of 0.4, a normal FT4. They are concerned that the pt's anxiety may be worsened by hyperthyroidism. The pt initially presented to the hospital with an overdose of benzodiazepines 1 wk ago, requiring an ICU stay and a couple of days on the medical floor prior to transfer to psych.

- You check a FT3, which is low normal.

What do you recommend?

A) Check a thyroid uptake and scan to further evaluate.
B) Order a reverse T3 level.
C) The low FT3 level means you should be treating with levothyroxine, which may help the pt's depression.
D) You should check TSH receptor antibodies to evaluate for Graves' disease.
E) There is no further treatment or evaluation required at this time, and the pt should have repeat TFTs done 6wks after discharge.

Answer E

- This is probably euthyroid sick syndrome, also called non-thyroidal illness.
- Typically, you will see a low to low normal TSH, a normal FT4, and a low FT3, but this can present with a variety of TFT abnormalities.
- Medications that are given in critically ill patients such as corticosteroids, narcotics, dopamine, etc can all further complicate the picture as they can suppress TSH.
- Psychiatric illnesses themselves can also result in abnormal thyroid function tests.

Case five: Can you refill my synthroid?

- A 49 YO Male comes to you to establish care.
- PMH: HTN, DM2, hypothyroidism, hypogonadism, and obesity
- PSH: Resection of a pituitary macroadenoma many years ago, repair of a detached retina.
- Meds:
- Glyburide 5mg bid
- Metformin 1000mg bid
- Lisinopril 40mg daily
- Simvastatin 40mg qhs
- Levothyroxine 150mcg daily
- Androgel 1pkt daily

- He reports fatigue and difficulty losing weight, but denies hair or skin or nail changes, change in bowel movements, heat or cold intolerance, muscle weakness, palpitations, tremor, sweating.
- You check basic labs and get the following thyroid function tests:
- TSH 0.3
- FT4 1.1

What is your management?

A) Pt is taking too much levothyroxine. Decrease dose to 125mcg daily and recheck TFTs in 6wks.
B) Check a FT3 as you suspect this is elevated.
C) Order a thyroid uptake and scan to further evaluate for hyperthyroidism.
D) Recheck labs in 4-6wks and plan for further workup if TSH is again low.
E) Increase levothyroxine to 175mcg daily.
F) No further workup needed. Continue levothyroxine 150mcg daily.

Answer F

- This pt has central hypothyroidism.
- He has had pituitary surgery and is also requiring testosterone replacement.
- With central hypothyroidism, the TSH is unreliable as it can be normal, low, or even slightly high.
- For pts like this one, you must follow FT4 levels to determine if thyroid medication needs adjustment. Do NOT make adjustments based on TSH.

Case six: mixed up labs

- You are surprised to see that your nonadherent patient actually had his labs done before his visit with you. The lecture you gave him at the last visit must have actually worked! He even brought a blood sugar log to his appointment. Then you see that his HBA1C and cholesterol are still uncontrolled, so you figure that he is still neglecting to take his medication. But you are not sure what is going on with his TFTs:
- TSH 10.3
- FT4 1.9

What is going on?

A) The TSH is elevated, so you need to increase his levothyroxine further.
B) You need to have another discussion with your patient about the importance of taking levothyroxine as directed.
C) The TSH and FT4 do not match up, so he may have a central hyperthyroidism.
D) He needs a pituitary MRI to evaluate for a TSH secreting pituitary adenoma.
E) He has developed a resistance to TSH explaining the high TSH result.

Answer B

- While a TSHoma can explain these results, these are very rare and there are better explanations.
- TSH resistance does occur, but it is rare, would not suddenly develop like this, and FT4 would not likely be elevated.
- These results can occur when the pt has not been taking his levothyroxine as directed, resulting in an elevated TSH. Then, just before he has his labs done, he takes his medication (possibly even extra medication), resulting in the elevated FT4.
- Have the pt take the medication as directed then recheck labs in 6wks.

Case seven: weight loss

- A 32 YO F comes to your office complaining of sweating, palpitations, tremors. She works as a medical assistant in your building and is having difficulty keeping up at work due to fatigue. She has lost about 10 lbs over the past 3 wks, but she states that this is intentional, and she has been dieting and exercising.
- PMH: Mitral valve prolapse
- Family History: Mother with hypothyroidism, daughter with Graves disease, s/p RAI ablation, now on levothyroxine
- Meds: Daily multivitamin, no supplements
- Labs:
- TSH 0.03
- FT4: 1.9

- You perform a FT3 which is normal.
- Next, you perform a thyroid uptake and scan which shows decreased uptake throughout.
- Your pt denies any tenderness to her neck.
- You review old labs, and find that she had a low TSH of 0.2 6 months ago with a normal FT4.

What is going on?

A) The pt probably has thyroiditis causing her low TSH, so no management is needed at this time. You can recheck TFTs in 6-8 wks.

B) The pt has hyperthyroidism and since radioactive iodine uptake is low, her only options for treatment are medications and surgery.

C) Discuss the pt's iodine intake with her because she must be taking in enough to result in decreased RAI uptake. This may also be the reason for her hyperthyroidism.

D) You suspect that the pt is surreptitiously taking thyroid hormone.

E) The pt has a central process resulting in her abnormal TFTs.

Answer E

- The pt is probably taking exogenous T4. (She is an MA, and family members have levothyroxine, so she has access).
- Thyroiditis is also a possibility with the low RAI uptake, but not as likely if she already had a low TSH 6 months ago and still has not recovered.
- Other possibilities include struma ovarii, but this is very rare.
- She could also have functioning thyroid cancer metastases, but this does not fit her presentation.
- She did not have a large iodine load such as iodinated contrast or amiodarone to result in low RAI uptake.

How can you confirm your suspicion?

A) Confront your pt with your conclusions.
B) Call her out of her room and search her purse.
C) Check a thyroglobulin.
D) Check thyroid antibodies.
E) Have your medical student and intern go to her home and perform a thorough search. (Works for House!)
F) Unfortunately, you can't prove it.

Answer C

- Check a thyroglobulin level. If the hyperthyroidism is endogenous (thyroid cancer mets or struma ovarii), then the thyroglobulin will be elevated. If it is exogenous, then the thyroglobulin will be low.

Case eight: "I'm tired. It's gotta be my thyroid."

- Your 40 yr old patient with rheumatoid arthitis complains of fatigue and weight gain. She has no other symptoms of hyper or hypothyroidism, and she admits that she has been less active due to knee pain, and she has been taking her oxycodone on a regular basis as a result. Her rheumatologist has put her on a short course of prednisone to try to control her symptoms while they try to get approval for Enbrel. She has some osteopenia which you suspect is from multiple prior courses of corticosteroids.
- You check a TSH to rule out hypothyroidism, and it returns low at 0.4 with a FT4 of 1.0.
- Physical exam reveals a normal thyroid to palpation.
- She has no family history of thyroid disease.
- You then check a FT3 which is normal. Thyroid antibodies are all negative.

What next?

A) The pt probably has subclinical hyperthyroidism and you should check a thyroid uptake and scan to further evaluate.
B) You plan to repeat thyroid function tests before the next appointment in a few months.
C) You should check a reverse T3 to see if her illness is resulting in an increased production of RT3 and that is why she is tired despite low TSH and normal FT4 and FT3.
D) She could benefit from a low dose of methimazole as subclinical hyperthyroidism can still result in decreased BMD and she already has osteopenia.

Answer B

- The pt is on narcotic pain medications and glucocorticoids which could both suppress TSH.
- Some pts have slightly low TSH values but are actually euthyroid (normal variant).
- It is less likely that she has subclinical hyperthyroidism with a normal thyroid and negative antibodies.
- These patients should have their TFTs followed since they may have true subclinical hyperthyroidism that could convert into overt hyperthyroidism in the future and may need treatment.

Case nine: feeling fine

- A 40 yo F comes in for a follow up visit. She has no history of any thyroid disorders, but her mother had hypothyroidism. She reports no symptoms but brings labs from her naturopath, and she is very worried she has a thyroid problem.
- Meds: only vitamins
- Thyroid exam is normal. She has no eye findings.
- Heart rate is normal. She has no tremor.
- TSH 0.7
- FT4 1.3
- FT3 5.2 (2- 4.8)

What do you think is going on?

A) She probably has hyperthyroidism with a T3 toxicosis only. This is unusual but does occur.
B) You suspect she is taking a supplement from the naturopath such as kelp which contains a lot of iodine, resulting in these lab findings.
C) You suspect that she has an antibody which is interfering with the lab test results.
D) You suspect that her naturopath has given her Nature throid or Armour thyroid.
E) She is recovering from an unnoticed thyroiditis.

Answer D

- This is due to an exogenous source of T3.
- T3 can be given as cytomel, and this is typically used in thyroid cancer pts undergoing thyroid hormone withdrawal or some pts who are still symptomatic on levothyroxine therapy.
- "Natural" thyroid hormone preparations are derived from dessicated animal thyroid and contain both T3 and T4 and may contain large amounts of T3.
- Sometimes treatment with these preparations results in low TSH, low FT4 and high FT3 if given in excess.
- In this case, the doses were not enough to suppress the pt's TSH, but she likely took her medication just before the labs were drawn, resulting in an elevated FT3.

The End!