Tests I Wish You'd Never Ordered

Endocrinology

No Disclosures

- A 54 yo gentleman presents with palpitations and nervousness

- Prior arrhythmia history in previous treatment with Amiodarone

- Concerned for potential diagnosis of thyrotoxicosis? What next?

Thyrotoxicosis Work-up

- Thyroid panel: No. This is a test I wish you would not order. Consider the individual lab tests. If a thyroid panel is ordered, you must know from each facility what is in each panel. You may get labs that are uncommon such as FTI or T3RU? Which you may not understand/explain?

- Standard lab testing: TSH should give you good information. Usually get, at least a Free T4 as well and consider T3. On estrogen, I wish you would not order total thyroid hormones.

- What results to expect in Thyrotoxicosis? Low TSH, high Free T4, high T3. Keep in mind Low TSH only with normal Free T4 and normal T3 is also thyroxicosis. What next?

Thyrotoxicosis

- What next? Begin medication treatment, No. The diagnosis is not yet clear.

- You need to know if the thyroid is over-producing thyroid hormone endogenously or is the thyroid just inflamed.

- Imaging: Thyroid ultrasound. This may be needed but not yet. It can be considered if there is a palpable abnormality.

Preferred Image

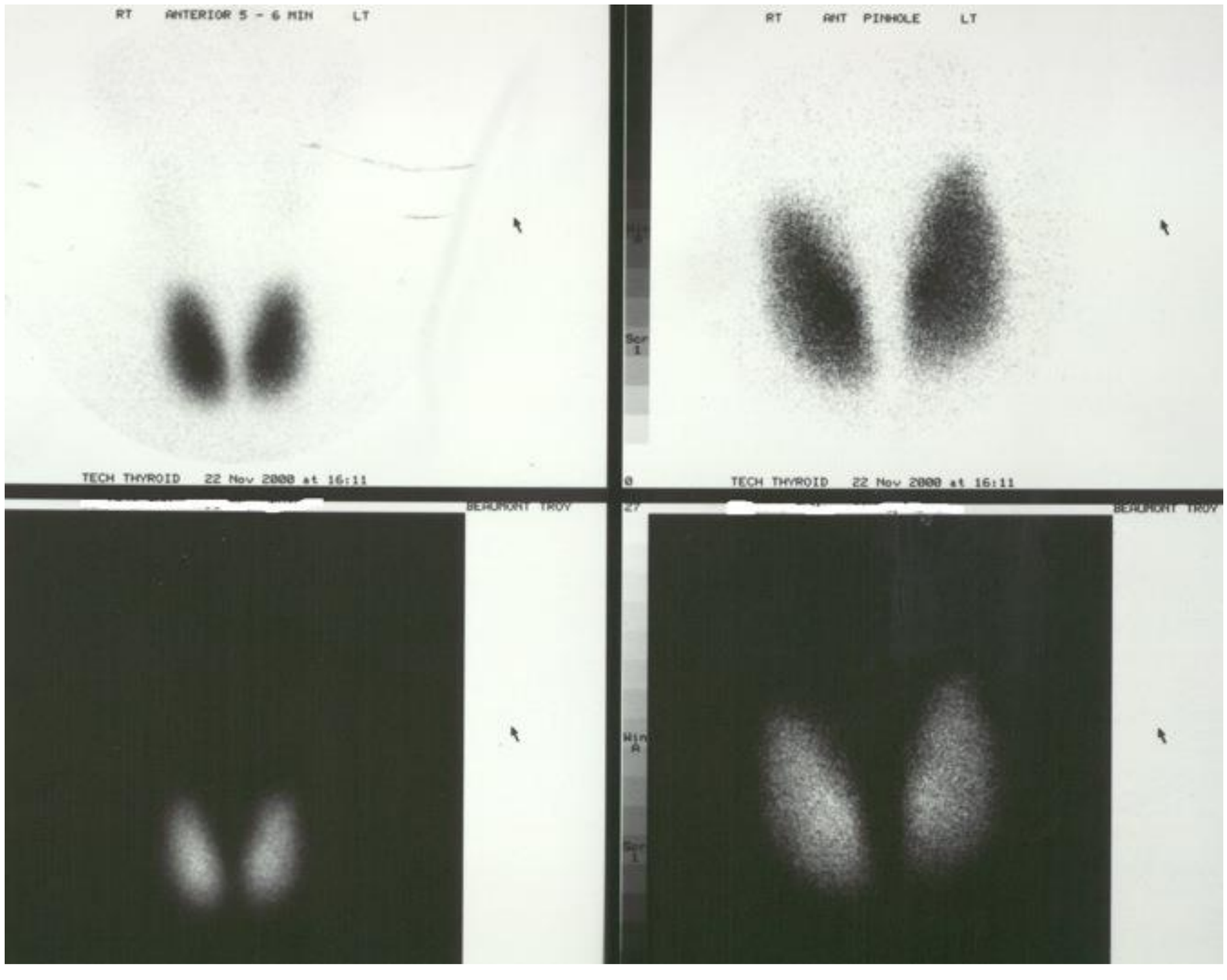
- Nuclear thyroid scan with uptakes. This is may be ordered in different ways at different facilities. I order Iodine-123 thyroid scan with uptakes. My hospital nuclear department obtains 6 and 24 hour uptakes with images with and without pin hole images.

- High uptakes indicate over-production of thyroid hormone and low uptakes suggest inflammation, also know as thyroiditis

Thyroid Scan helps distinguish Graves from Thyroiditis:

- Is the thyroid overproducing? Adding fuel to the fire. Uptake will remain high in Graves, extra thyroid hormone production endogenous
- Is the thyroid inflamed and spilling out all of it's thyroid hormone? Uptake low and poorly visualized thyroid on nuclear scan
- This inflamed thyroid will over time deplete itself of thyroid hormone, like a bag of thyroid hormones with tiny holes leaking hormone

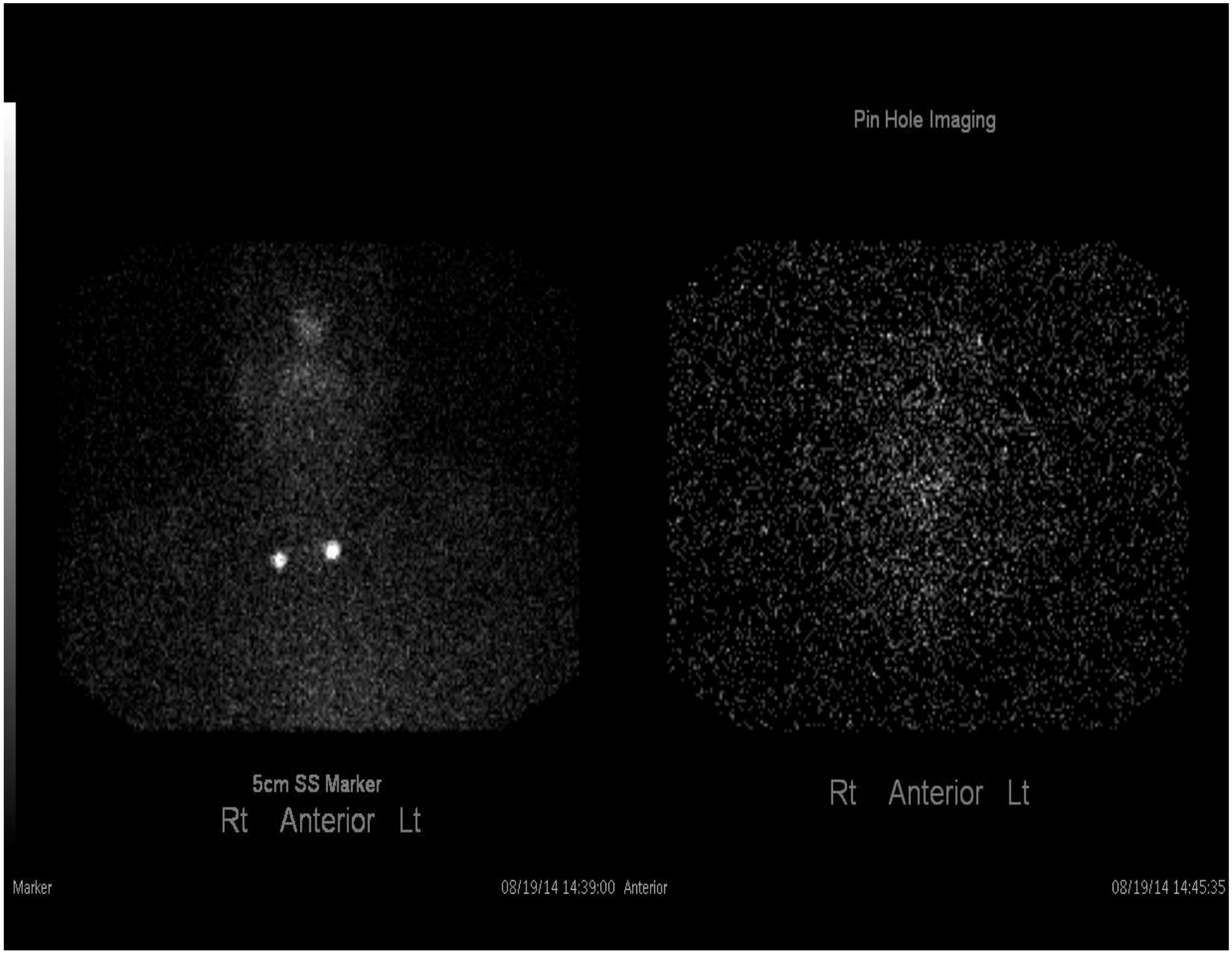
Expected Image



Treatment in Overproduction

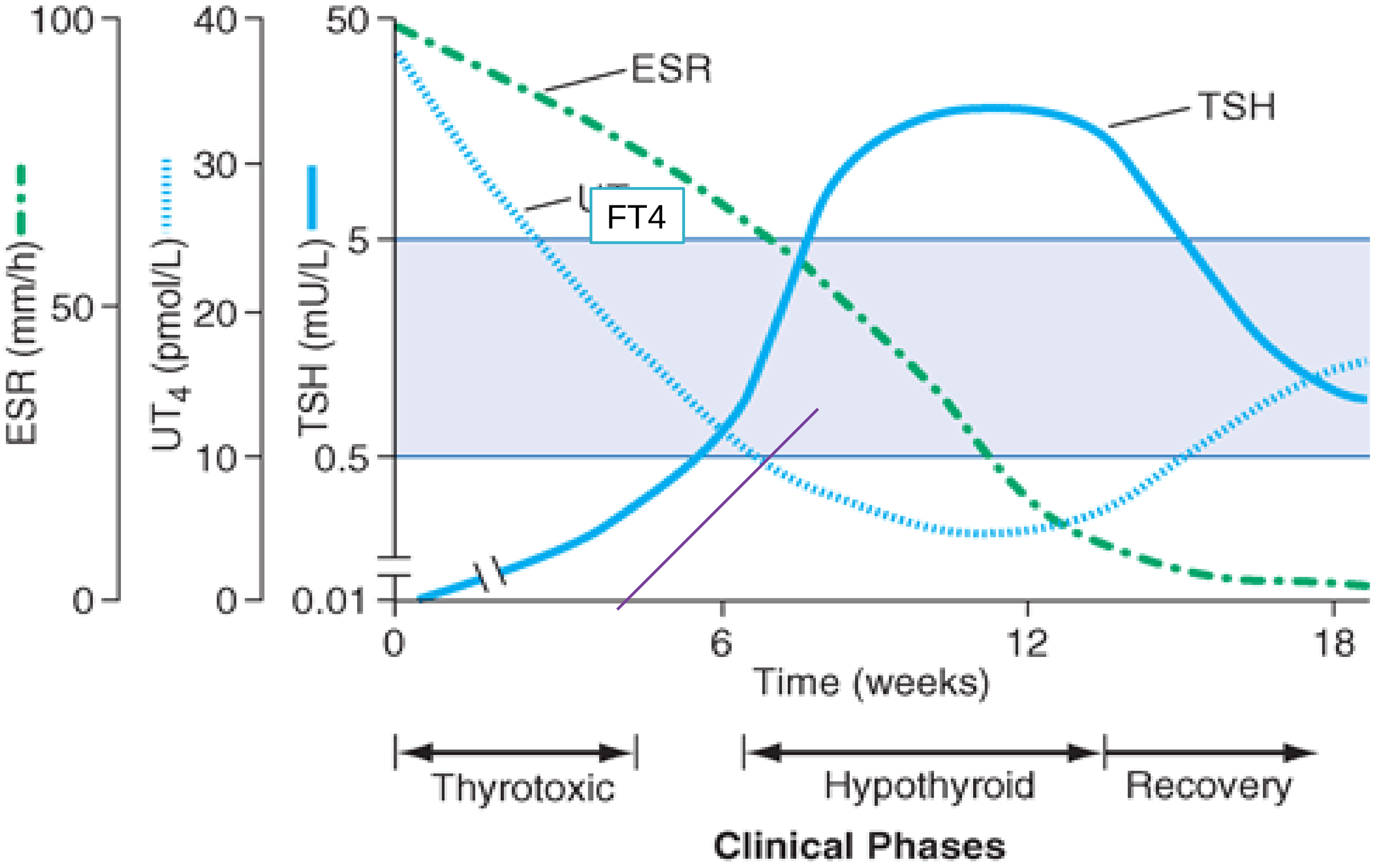
- **Anti-thyroid meds**: CBC, LFT's, Fever/sore throat; less effective with large gland; preferred in children & pregnancy———-consider this chemotherapy; Not definitive in nodular thyroid disease.
- **131-Iodine**: highly effective; aim is hypothyroidism. Higher dose with large or nodular thyroid; Best in diffuse small thyroid without nodule.Avoid in thyroid eye disease provocative
  - **Surgery:** general surgery and anesthetic risk, need pre-treatment with anti-thyroids, Beta blocker treatment; Preferred in nodular thyroid disease, particularly with cold nodule; best tx for large thyroids

Image Obtained



Thyroiditis

- Thyroiditis is a cycle of thyroid function like a sine wave
- At the outset, hyperthyroidism, thyroid hormone leaking out into the serum; treat this with Propranolol
- Returning to normal as thyroid hormone is spent
- After all the thyroid hormone has leaked out, hypothyroidism; treat this stage with thyroxine
- With several months time passed, thyroid heals with recovery of function



Source: Longo DL, Fauci AS, Kasper DL, Hauser SL, Jameson JL, Loscalzo J: *Harrison's Principles of Internal Medicine, 18th Edition*: www.accessmedicine.com

Index Case Treatment Provided

- This was originally managed by primary Internist
- Patient received a few months of treatment with anti-thyroid medication, Methimazole. I stopped it.
- Risks of Methimazole: I tell patients it is like chemotherapy. It can cause agranulocytosis or elevated liver labs/hepatitis/liver failure. In this case, no apparent harm done

Other Low radioactive iodine uptake states:

- Iodine contamination, referring to plain iodine use by the patient as a supplement or iodine contrast use within a few to several weeks before imaging. Drugs containing iodine, Amiodarone. May need urinary iodine testing
- Thyroid hormone use by patient unknown to the doctor, in some cases surreptitious such as by a hospital worker, nurse
- If the patient is on thyroid hormone without the doctor's knowledge and with no known thyroid disease, thyroid function may appear high by lab and clinical exam. Thyroglobulin would be low

Radioactive Iodine Uptake Scenarios

- If the uptake is high in hyperthyroidism, suggests excess production of thyroid hormone.
- Low uptake in hyperthyroidism, suggests inflamed thyroid such as thyroiditis OR this could be iodine contamination such as contrast for CT
- Low uptake can also mean the uptake is somewhere else and the thyroid uptake is suppressed as in the hyperthyroid struma ovarii
- If the hyperthyroidism is due excess thyroid hormone from the thyroid, the thyroglobulin will also be elevated, including thyroiditis.
- If the history is unclear in a patient with low uptake, consider urine iodine testing

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Next Steps after Imaging

- This appears to be a case of Thyroiditis, if other etiologies of low uptake are excluded.

- If this is thyroiditis, Methimazole will not be effective. Radioactive iodine will not be effective. Surgery would not be a good first choice.

- Treatment would be symptomatic. Consider non-selective beta blocker, Propranolol.

Next steps in treatment

- Observe for resolution of thyrotoxicosis over the typical several weeks to a few months. Sometimes this happens before the nuclear image is done.

- Propranolol can be withdrawn as thyroid function normalizes.

- Some patients will progress to hypothyroidism. Treatment is Thyroxine for several months to a year. Thyroxine can later be discontinued to check for persistent hypothyroidism.

What about the Amiodarone?

- Depending on the timing of the Amiodarone, It could be the culprit. Amiodarone is loaded with iodine. Plain Iodine contamination. Sticky iodine holding on for several months or longer.

- Amiodarone can cause low uptakes for months after discontinuation. Thyroid ultrasound with Flow is used to distinguish Graves like thyrotoxicosis from Thyroiditis due to the Amiodarone. The nuclear thyroid scan is often not as helpful in iodine sufficient countries.

Next Case

- A 34 yo female presents with a history of thyrotoxicosis treated with radioactive iodine and thyroidectomy

- She is on thyroid hormone and presents post partum on Thyroxine and birth control pills

- Test I wish you did not order = Thyroid panel. You may not be able to explain all the results. Original physician was in family practice.

PHYSICIAN INFORMATION

Requesting:
Ordering:

PATIENT INFORMATION

Name:
DOB:
Sex:
Tel:

REPORT DETAILS

Name: Thyroid Panel With TSH
Accession ID:
Lab Ref Id:

REPORT DATES

Order: 07/29/2013
Collection: 07/30/2013 16:16:00
Report: 07/31/2013 11:06:03

	NAME	VALUE		REF RANGE
F	TSH	3.860		0.450-4.500 uIU/mL
F	**Thyroxine (T4)**	**17.3**	H	**4.5-12.0 ug/dL**
	- **Verified by repeat analysis**			
F	**T3 Uptake**	**19**	L	**24-39 %**
	- **Verified by repeat analysis**			
F	Free Thyroxine Index	3.3		1.2-4.9

ADDITIONAL NOTES

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Next step for this doctor:

- Endocrine Consult

Thyroid Function Testing

Mathematical relationship:

- T4 is (total T4)=TBG
- T3 is (total T3)=TBG
- T3RU is T3 resin uptake=1/TBG—-Not a T3 value
- TBG is thyroid binding globulin—-do not measure
- TSH is thyroid stimulating hormone
- TRH is thyroid releasing hormone—do not measure

Estrogen affecting TFTs

- TSH = normal
- T4 “Total” = elevated
- Free T4 = normal & FTI would also be normal
- T3RU = low

- The estrogen is causing a higher level of TBG. The higher TBG makes for a greater amount of T4 as the total. Since the patient is otherwise euthyroid, the Free T4 is normal.
- Some families have higher TBG values as a sort of family tradition/trait
- Active liver disease can also cause higher TBG
- T4 and Free T4 could be high if taken close to the lab draw

Back to the most important TFT value is TSH

- If the lab is confusing in some way, the TSH will guide the diagnosis.
- Any random lab can perform TSH lab testing better than any other thyroid lab test.
- TSH in unaffected patient is at or near 1.0 uU/mL

Thyroid Function Testing

Mathematical relationship:

- T4 is (total T4)=TBG
- T3 is (total T3)=TBG
- T3RU is T3 resin uptake=1/TBG—-this is Not a T3 measurement
- Estrogen causes rise in TBG, in contraceptives and in hormone replacement

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Treatment in this Patient

- Increase Thyroxine dose, and recheck TSH in 6 to 8 weeks
- Keep in mind the T4 or Free T4 could be elevated if Thyroxine taken within several hours of lab draw.
- In this case, birth control pill caused a high T4 and low T3RU. These are thyroid labs I wish you had not ordered. But, you need to be able to explain if appearing on lab result.
- Unless the patient is on birth control, HRT or pregnant, there is no routine need for Free T3.

Interpreting Thyroid Function

- Repeat laboratory test (consider laboratory error, wrong patient, etc)
- Clinical correlation/status
- Patient occupation, past medical history, family history
- Medications
- Consider alternate tests
- Consider common etiologies first
- Endocrine consult in hyperthyroidism, thyroid nodule, confusing TFTs