50-year-old woman with thyrotoxicosis

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March 21, 2013
History of Present Illness

- Hospitalized at OSH for dyspnea thought secondary to COPD exacerbation with a component of pulmonary edema (CHF)
- Pt reported worsening and increased frequency of headaches
- Known history of hyperthyroidism, untreated
- CT Head and then CTA revealed large anterior communicating artery aneurysm
- Referred to neurosurgery here and admitted for clipping on 09/20/2012
History of Present Illness

- Operative note reports aneurysm with thin walls and multiple lobulations requiring complex clip reconstruction
- Post-operative complications included
  - Ischemic stroke in the distal anterior cerebral artery territory
  - Tachycardia
  - Fevers
- Thyroid function tests ordered, Endocrine Service consulted
Interview with Sister

- Hyperthyroidism diagnosed 2 years ago, untreated because patient was afraid of treatment
- Pt had previously reported to sister
  - Anxiety
  - Frequent bowel movements
  - Palpitations
  - 100-pound weight loss
History

- **Past Medical History**
  - COPD/Asthma
  - CHF
  - Hypertension
  - Hyperthyroidism diagnosed 2 years ago, untreated
  - Paroxysmal atrial fibrillation
  - Tobacco Use

- **Past Surgical History**
  - None

- **Allergies: NKDA**

- **Prior to admission medications**
  - Albuterol
  - Tiotropium
  - Carvedilol 12.5 mg daily
  - Diltiazem 120 mg daily
History

- **Family History**
  - Sister with history of hyperthyroidism secondary to toxic nodule s/p resection
  - Mother with history of hypothyroidism

- **Social History**
  - Not currently working
  - Previous smoker 0.5 ppd x 20 years, quit after recent hospitalization with diagnosis of COPD
  - Occasional alcohol
  - No illicit drugs
  - Adult son is decision maker
Current Hospital Medications

- carvedilol 25 mg BID
- cefepime 2 g Q8H
- diltiazem 30 mg Q6H
- famotidine 20 mg Q12H
- heparin 5,000 Units Q12H
- levetiracetam 1,000 mg Q12H
- montelukast 10 mg QPM
- sennosides-docusate sodium 1 Tab QHS
- tiotropium 18 mcg DAILY
- vancomycin 1,500 mg Q8H
Physical Exam

- Vitals: BP 131/63 | Pulse 109 | Temp(Src) 38.8 °C (101.8 °F) (Tympanic) | Resp 22 | Ht 162.6 cm (5' 4.02") | Wt 105.23 kg (231 lb 15.8 oz) | BMI 39.80 kg/m2 | SpO2 98% | LMP 09/20/2010
- General: no apparent distress. Appears stated age.
- HEENT: no pharyngeal erythema. PERRL, EOMI.
- Neck: + thyroid bruit, 30 - 45 grams, heterogeneous in texture but no discrete nodules
- Cardiovascular: tachycardic, regular rhythm
- Pulmonary/Chest: clear to auscultation bilaterally.
- Gastrointestinal: soft, non-tender, non-distended abdomen. No rebound or guarding.
- Musculoskeletal: normal range of motion of joints.
- Neurological: alert & oriented x 0.
- Skin: No rash. No alopecia
Initial Post-Operative Laboratory Studies
Thyroid Function Tests

- **POD #2**
  - TSH 0.01 mcU/mL

- **POD #3**
  - TSH <0.01 mcU/mL

- **POD #4 (day of consultation)**
  - Free T4 3.76 ng/dL (0.9 – 1.7)
  - Free T3 1095 pg/dL (230 – 420)
Initial Recommendations

- **Uncontrolled hyperthyroidism: Suspect thyroid storm**
  - Start PTU 200mg PO Q4H
  - SSKI 5 drops diluted in H2O Q6H (give the first dose 2hrs after PTU is given)
  - Hydrocortisone 100mg IV Q8H
  - Propranolol 20mg PO Q6H
  - Obtain daily TSH, free T4 and T3
  - Obtain LFTs with next labs because PTU is known to cause liver dysfunction

- **Paroxysmal Atrial Fibrillation: Currently in sinus rhythm.**
  - As above, please start propranolol 20mg PO Q6H
Saturated Solution of Potassium Iodide

- Uptake and organification of iodine are inhibited in the presence of iodine excess (Wolff-Chaikoff effect)
- The thyrotoxic gland is especially sensitive to this action of iodide
  - Raising the plasma iodide concentration to a level above 5 µg/dl results in a complete temporary inhibition of iodide organification by the thyrotoxic gland
  - When the plasma concentration is above 20 µg/dl, organification is also inhibited in the normal gland
PTU Mechanism of Action

- Prevents thyroid hormone synthesis by inhibiting thyroid peroxidase catalyzed reactions & blocking iodine organification
- Inhibits deiodination of T4 to T3 at the periphery

Alison E.M. Vickers, Jason Heale, John R. Sinclair, Stephen Morris, Josh M. Rowe, Robyn L. Fisher. Thyroid organotypic rat and human cultures used to investigate drug effects on thyroid function, hormone synthesis and release pathways. Toxicology and Applied Pharmacology Volume 260, Issue 1 2012 81 - 88

Methimazole (mw 114.17)  Propylthiouracil (mw 170.23)
T3 and T4 in Hyperthyroidism

- 1974 Study – J. Abuid and P.R. Larsen
- 66 untreated patients with hyperthyroidism
- T4/T3 ratio in hyperthyroid patients lower than that in euthyroid patients
  - Increases in circulating T3 in hyperthyroidism not accompanied by proportionate increases in serum T4
- 28 patients with Graves’ Disease were studied during therapy
PTU 200 mg q4h
SSKI 5 drops q6h
HC 100 q8h

Date

Free T4 (ng/dL)

Free T3 (pg/dL)

PTU 200 mg q4h
SSKI 5 drops BID
HC 100 q8h

PTU 200 mg q8h
HC 100 q8h

To the OR
Why Refractory to Medical Therapy

- If inhibition of the thyroid hormone formation was initially incomplete with the PTU → additional amount of iodide could lead to synthesis of greater amounts of hormone.

- If patient had relative iodine deficiency, administration of iodine could induce autonomous secretion of excess thyroid hormone (Jod-Basedow phenomenon).